VOLUME CIV NUMBER FOUR

# THE NATIONAL GEOGRAPHIC MAGAZINE

OCTOBER, 1953

**New 10-Color Map of the China Coast and Korea**



**Seventy-two Pages of Illustrations in Color**

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

$6.50 A YEAR 65c THE COPY

VOL. CIV, No. 4 WASHINGTON OCTOBER, 1953

THE NATIONAL GEOGRAPHIC MAGAZINE



# Carlsbad Caverns in Color



## Man-made Light, Outshining the Sun, Reveals a Fairyland Made World-famous by the National Geographic Society

BY MASON SUTHERLAND

Assistant Editor, National Geographic Magazine

*With Illustrations from Photographs by E. "Tex" Helm*

CARLSBAD Caverns, which are usually as dark and quiet as the tomb, have stirred with nocturnal fire of late. For photography's sake, their limestone chandeliers and draperies have been bombarded with light four times as intense as sunshine. The caverns have seen New Mexico's most vivid flash since the firing of the world's first atomic bomb near Alamogordo in 1945.

Tex Helm, a Carlsbad photographer, has just finished shooting the caverns in natural color. His photographs inspired this article, the fourth on the caverns to be published in your Society's Magazine.*

### "King of Its Kind"

The caverns were a relatively obscure national monument in 1924 and 1925 when the National Geographic Society put them "on the map." Backed by a $16,000 grant from The Society, Dr. Willis T. Lee, of the United States Geological Survey (page 449), explored, surveyed, and mapped portions of the caverns and wrote two articles for the NATIONAL GEOGRAPHIC MAGAZINE.

"The most spectacular of underground wonders in America," Lee called them. "For spacious chambers, for variety and beauty, [the cave] is king of its kind."

Dr. Lee became the caverns' first custodian, serving without pay. In his day yearly visitors were counted by the hundreds. In 1952 attendance rose to a record 530,000.

Among the first men to see the caverns were the Basket Maker Indians, who left pictographs on the entrance walls but apparently never explored the pit. Ranchers in the 1880's became aware of the cave because evening's spiraling bat flights darkened the sky above the mouth like the funnel of a tornado.

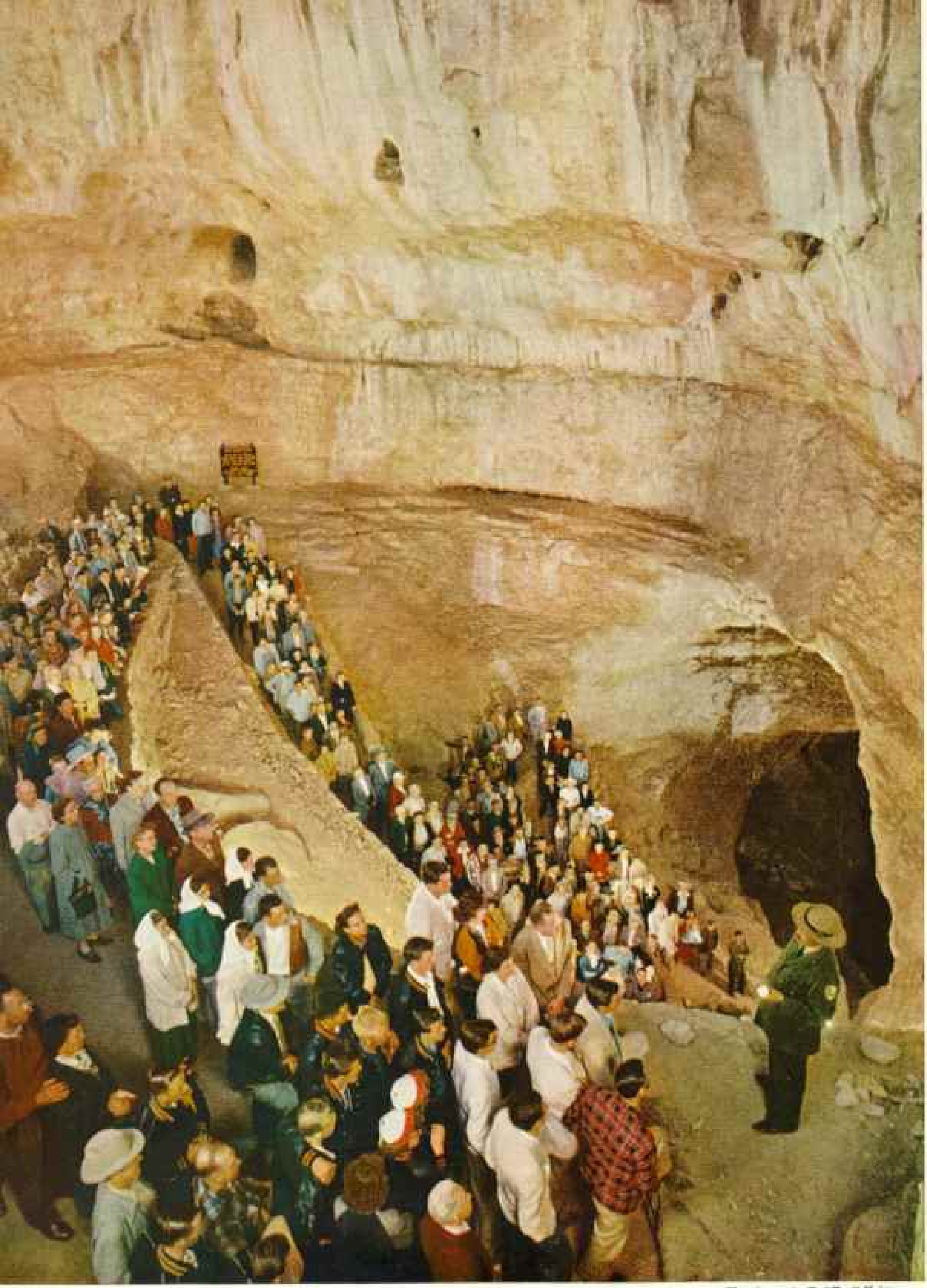
No one explored the deeper recesses until 1901, when James Larkin White, a young cowboy, descended with a kerosene torch and gazed upon hidden wonders.

Though Mr. White's story was greeted with incredulity, he made the caverns his life's work and hobby. Years went by before he saw his faith rewarded. In 1924 he guided the National Geographic exploration party, and in 1930 he saw Carlsbad Caverns established as a national park.

Besides Carlsbad Caverns, The Society has promoted public interest in Katmai National Monument, Alaska, site of the Valley of Ten Thousand Smokes; Sequoia National Park, California, where it helped save the Sierra redwoods; and Shenandoah National Park, in Virginia's Blue Ridge Mountains.

In Chaco Canyon, New Mexico, National Geographic-Smithsonian Institution scientists uncovered Pueblo Bonito, an Indian ruin. A later project dated it by tree-ring analysis. These investigations pushed back the Southwest's historic horizons almost eight centuries before Columbus.

* See "A Visit to Carlsbad Cavern, New Mexico," January, 1924, and "New Discoveries in Carlsbad Cavern," September, 1925, both by Willis T. Lee; and "Bats of the Carlsbad Cavern," by Vernon Bailey, September, 1925.







Photograph by K. "Tex" Hall

**"Ladies and Gentlemen: You Are Entering the World's Most Spectacular Caverns"**

Tour leader Claude Fernandez (right) tells hikers they face a sharp 829-foot descent, and "this is the time to take the elevator if you think you can't make it." Twilight may see 5 million bats streaming out of the entrance.

For my tour of the caverns I had the company of Col. Thomas Boles, superintendent of the park from 1927 to 1946. Colonel Boles, having retired from the National Park Service, lives in Carlsbad, where he serves the United States Potash Company as public-relations counsel. Carlsbad, a city of 26,000 lying 27 miles northeast of the caverns (map, page 450), is the capital of the United States potash industry. Its mines contribute 85 percent of the Nation's potash production.

### Down, Down, Down—829 Feet

"During my 19 years at the caverns," Colonel Boles told me, "I spoke to some 2,188,000 visitors. They included Sir Harry Lauder, who wore his kilt; Robert Ripley, who broadcast from the cave; also Will Rogers, Dr. and Mrs. Gilbert Grosvenor, Burton Holmes, Amelia Earhart, and Ernie Pyle.

"Altogether," Boles continued, "I have made 5,071 complete trips and have enjoyed every one. With every tour I see something I missed before—a fossil in the wall or a natural carving brought out by new lighting."

For a moment we stood in the caverns' mouth, where ages ago a limestone collapse formed a natural entrance 4,350 feet above sea level in the foothills of the Guadalupe Mountains (opposite). Then we started walking down the switchbacks, a series of winding ramps descending 829 feet, the equivalent of an 80-story building. Before long we passed the entrance to the Bat Cave (page 442).

"I recall the time," said Boles, "when a party got caught in the bats' return flight. Women screamed and raised skirts above their heads.

"In those days we had no paved trails down the switchbacks but used staircases. The long, steep slope left unaccustomed leg muscles cramped and aching."

Entering the Main Corridor, a cathedral-like hall a mile long, we saw natural sculptures such as the American Eagle, with a 12-foot wingspread; the Whale's Mouth; the Three Little Monkeys, perched high above the trail; and the Baby Hippo.

My attention was drawn to millions of tons of material which had fallen from the ceiling.

"Don't be alarmed," said Boles. "You couldn't be in a safer place. No collapse has taken place in years."

We arrived at a collapse so spectacular that it has received a name—the Iceberg. Like a berg at sea, it conceals seven-eighths of its bulk. Despite its 100,000 tons, the Iceberg slipped so gently that its pendent stalactites received no injury.

Our trail led to the Green Lake Room, first of the scenic rooms, so named for their wealth of fantastic decoration. Here floodlights threw the Veiled Statue into bold relief (page 436), a frozen waterfall spilled out of a tunnel, and a small enchanted pond turned reflected light an emerald green.

Passing the Bashful Elephant, we entered the King's Palace, which some authorities consider the caverns' most ornate chamber (page 456).

There stalactites by the thousands glitter like icicles or chandeliers. One 7-foot pendant as slender as a soda straw is known as the King's Bellcord. Another downward groping stalactite and upward reaching stalagmite come within a knife's blade of kissing. Doomed never to touch, they are called the Frustrated Lovers.

These two stand guard over a keyhole entrance to the Queen's Chamber (page 459). There we found examples of the famous draperies, masses of stalactites grown together in the form of curtains (page 468). We saw no sign of the Queen herself, but the King's Boots hung in her chamber.

Baby of the royal chambers is the Papoose Room, its low ceiling gleaming with porcupine-quill stalactites. No one has described them better than the little girl who said, "That's just how my foot feels when it goes to sleep."

### Old-timers Drank Drip Water

At times Boles used to halt touring parties in the scenic rooms for lunch, and they drank pure, cold drip water caught on the spot. In those days a certain guide was wont to announce: "All the garbage you don't eat put in this here can."

The colonel recalled that male guests used to carry lunches on their belts, and these wagged like tails. Sometimes when a man slipped and fell, he got up wearing an "apricot-pie sunflower."

Talk about food reminded us that we were hungry. Walking up Appetite Hill, 60 feet of rugged switchbacks, and past the Boneyard, a partly dissolved rock chamber (page 467), we came to the lunchroom (page 460).

Buying coffee and sandwiches, we visited the guides' table. There we met Dave Mitchell, an old-time guano freighter and dean of park employees.

Sight of Mr. Mitchell reminded Colonel Boles of the Rat Hole trip that parties used to take before tours grew too unwieldy.

"That narrow tunnel made an interesting detour from the main passageway," he said. "Everybody got a laugh when fat men got stuck in a tight gap. Dave had the answer—an old starched collar, saved for the occasion. Just as the visitor's trousers grew taut under strain, Dave ripped the collar apart with the explosive sound of rent garments."

"Well," said Mr. Mitchell, "I hate to tell

**Veiled Statue (Left) Stands in the Green Lake Room Like an Art Work in White Shroud**

This guided party walked about a mile through the Main Corridor without seeing many spectacular formations. Having been promised much, some were beginning to wonder. But skepticism turned to awe when they entered the Green Lake Room, first of the scenic rooms, or decorated chambers. Now eyes were dazzled by thousands of delicate stalactites hanging iciclelike from the ceiling.

In contrast to the caverns' original explorers, who clambered over loose rocks and collapsed formations, these visitors follow a paved trail. Over their heads hang examples of the draperies, the curtainlike formations created by water depositing its mineral burden as it evaporated.

Each of the stalactites, the downward hanging stone lances, was formed by water seeping out of the ceiling and leaving a trail of mineral in tubular form, like a soda straw. Where the drip continued, droplets falling to the floor built a stalagmite growing upward.

Sometimes stalactite and stalagmite met and grew together in a pillar or column. Such a formation is the Veiled Statue, to which the National Park Service's uniformed tour leader points. Dripstone created this marvel within the last 100,000 years.

Age of the Carlsbad formations has been determined by the fact that many stand on flowstone laid above silts and fossils whose geologic age is comparatively recent. The caverns themselves are millions of years older.

The Green Lake Room takes its name from a small green pond (lower center) fed by drip water. Most of its formations have stopped growing, reflecting climatic changes overhead in semi-arid New Mexico.



Photochrome by E. "Tex" Hoins

this story—it sounds too fishy for belief—but once when I was resting on a bench in the caverns I saw an eerie light bobbing toward me as if someone were swinging a lantern. It went out just as mysteriously as it appeared. There was no one else in the passage, and in those days we had no electric lights. To the best of my knowledge, the thing was a fireball, a will-o'-the-wisp. I have met it several times since."

Occurring in marshes, will-o'-the-wisp, or ignis fatuus, is supposedly caused by the combustion of methane, or marsh gas. But no one in our party could account for the gas's presence in the caverns, for the air changes naturally every 24 hours. Some, however, recalled having seen cave fog where warm air met cold. Except where cold drafts seep in, the caverns' temperature remains a constant 56° F., winter and summer.

### Rescued from Elevator Shaft

Talk got around to the two elevators, which stand near the lunchroom, and to the adventure of Les Thompson, a park ranger.

"One day in 1939," Boles said, "Les backed into an elevator shaft, assuming the elevator was standing where he had left it a few seconds earlier. Instead, someone had driven it to the 'basement' 754 feet below. Tumbling into darkness in a sitting position, he groped for the greased hoisting cables, caught them in the crook of his arm, wrapped his legs around them, and slid to a stop 150 feet down.

"Les then swung onto a girder, where an elevator crew rescued him. White and shaky, he emerged a few minutes later, much to the surprise of 11 people who had seen him drop. Then he went home and notified his wife. He returned to work two days later despite severely blistered hands. Since his escape Les regards himself as living on borrowed time."

Mrs. Jim White, who sells her late husband's memoirs at a booth close to the elevators, told me how she had cooked for Dr. Lee and other members of the National Geographic exploratory party in 1924.

"When Jim took them out to the Bat Cave and let them down in the iron bucket," she said, "I put a pot of beans on the stove, never knowing when they'd come back. Every day I drove burros with drinking water to the entrance."

Jim's old bucket, in which he let Bat Cave visitors down into 170 feet of darkness, hangs today in a prominent position above his widow's sales booth.

"Jim was my chief ranger, my showpiece," Colonel Boles remarked. "I used to introduce him to the crowd, then let him lead the tour. Long before I came here Jim sensed that millions would follow him, and he did his best to preserve the beauties of the caverns. He'd fight a man who broke a formation. I made some exploratory trips with him. He was catfooted in his cowboy boots, and he was compass minded."

"My oldest visitor," the colonel reminisced, "was Thomas Burns, of Texas, who claimed 100 years. He walked down and then wanted to walk out, but I persuaded him to take the elevator. My youngest, Nelda Marie Davis, a 15-day-old Texan, was carried in on a pillow.

"A year-old baby making the tour still lacked a name, and her parents proposed that I choose one. I suggested Caverna. Nineteen years later a young lady came up to me and said, 'You don't know who I am, but you named me. I'm Caverna Clinch.'

"We used to keep a wheelchair for invalids," Boles said, "but my successors banished it when it ran away down a ramp, fortunately without injury to its occupant. One disabled man toured the caverns in a wheelbarrow, and kindly members of the crowd helped his relatives push it."

Our rest time was up. We hiked to the Big Room, whose mile and a quarter of trail consumes the second half of the tour. This richly ornamented chamber, the largest known anywhere, is shaped like a cross, one arm measuring some 2,000 feet and the crosspiece stretching 1,100. The ceiling at its highest rises 285 feet (page 464).

Passing the Painted Grotto, we caught a distant view of the Rock of Ages, a monumental stalagmite (page 462).

### Texans at the Rock of Ages

At this rock Colonel Boles used to stop tour parties and call the roll of States, the members responding like delegates at a political convention. He saved the Texans until the last, because "cheering the mention of their State, they made further roll call impossible."

We marched past Crystal Spring Dome, fastest growing formation within the caverns (page 454); the Bottomless Pit, whose bottom actually can be seen by flashlight (page 458); Mirror Lake, which correctly reflects its own inverted signpost; the Totem Pole, tallest of several skinny stalagmites resembling their Indian-made namesakes (opposite page); Temple of the Sun (page 444); Fairyland, where stone dolls pour stone tea; and finally the Hall of the Giants, where the Onyx Draperies and three huge domes stage the Big Room's smashing climax (page 466).

These big formations got the floodlights and signposts, but I took equal pleasure in some of the lesser sculptures, most of which had to be picked out with a flashlight. Among them I recall: The stone hen sitting on her





Ektachrome by E. "Tex" Helm

**Totem Pole, a Thin Stalagmite, Soars 35 Feet Toward the Frostwork Ceiling**

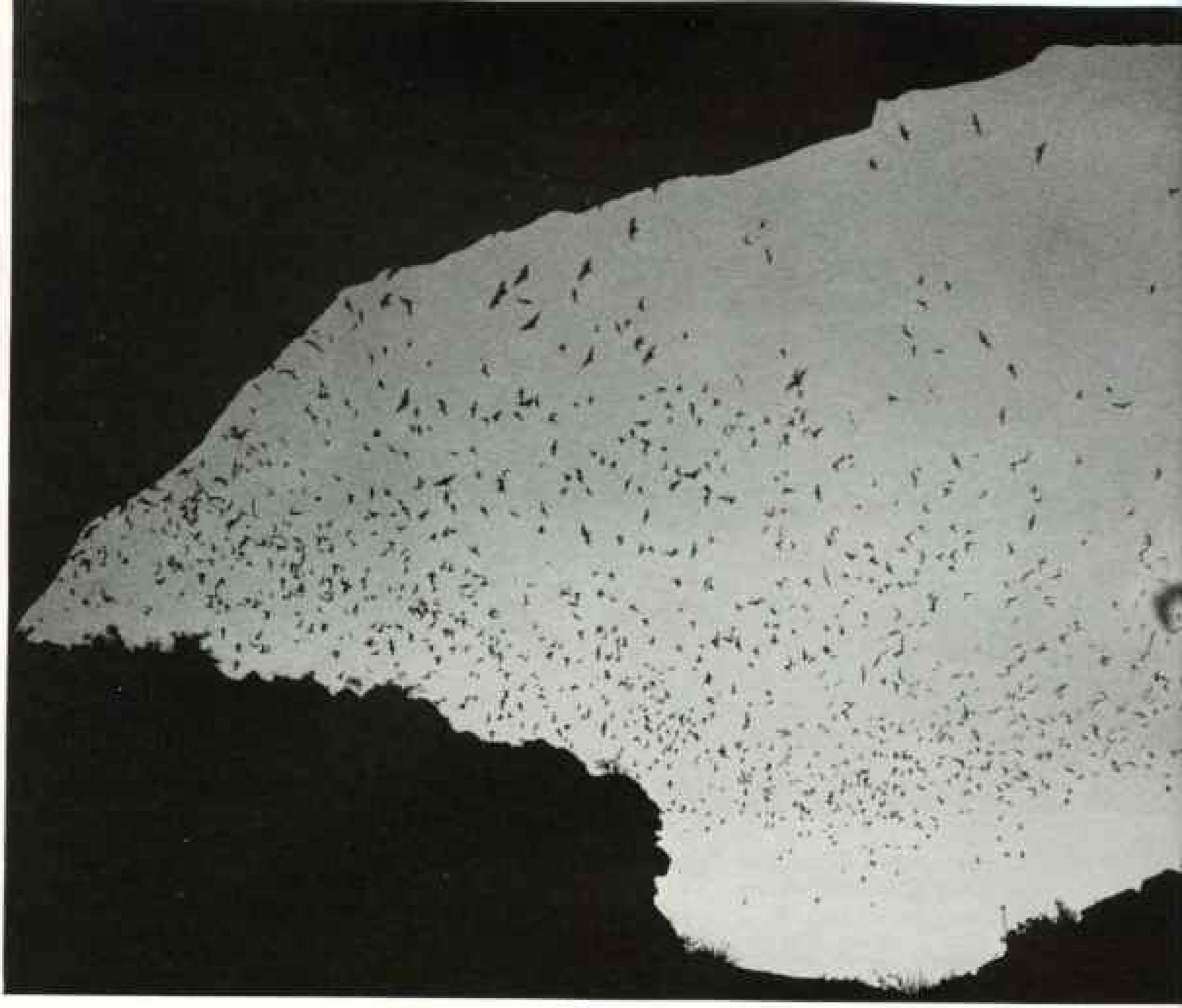
A parental stalactite of equal size is lacking because water dripped too fast to deposit a big evaporative growth overhead. From several angles the Totem Pole shows a tilt from the vertical.

## Tex Helm Mounts His Camera Ladders to Shoot the Cave

For his color pictures of Carlsbad Caverns, Mr. Helm never set up fewer than a dozen cameras, each with a different lens opening to vary the exposure. He opened and closed shutters in total darkness, allowing flashbulbs to make a 1/30-second time exposure (page 448).

"As the caverns' floodlighting is dim," Mr. Helm points out, "visitors are only throwing their money away trying to make movies and color stills. The only effective method is flash."

←Mr. Helm stands behind 2,400 spent bulbs used to illuminate the Big Room (page 464). These and others were provided by Sylvania Electric Products as an experiment in lighting vast sunless areas. Each bulb produced as much light as 1,290 sixty-watt house lamps.



441

**Bats by the Millions Take Four Hours to Clear the Caverns' Mouth**

Pioneer ranchers' attention was directed to the cave by evening's bat flights, which darkened the sky like the funnel of a tornado. By night the bats fly for insects; by day they sleep in a dark chamber (page 443).

nest for thousands of years without laying an egg; Statue of Liberty, a stalagmite, her left hand holding a torch; Abraham Lincoln, with furrowed brow and bearded chin; a life-size Santa Claus, complete to stocking cap, atop a totem pole; the Breast of Venus, a conical stalagmite; and the Mae West Formation, which has been blacked out by a change of lighting.

Also the Sword of Damocles, a bladelike stalactite poised above the trail; an enchanted city with Gothic skyscrapers, cathedrals, and castles standing in miniature atop a stone bluff; long stone faces having the quality of Easter Island sculptures; the stalactite growing from an elevator girder.

And finally the stalagmites that looked like fire hydrants; others that resembled giant candlesticks with melted wax running down their sides; stalagmites that looked like tombstones in a Moslem cemetery; still others coated with cancerous-looking "popcorn."

These and other wonders inspire a million questions, all of which the tour leaders answer as best they can. A few adventurous visitors disappear into side passages, but when the guides switch off the rear lights the "explorers" quickly get back into line. Despite a strict rule against souvenir hunting, one man stole the lock and chain off an iron-barred chamber.

"Remember you can destroy in an instant what Nature took centuries to build," tour leaders point out. "Please don't touch the formations," they counsel. "Stay on the trail at all times and make your trip quietly."

### Visitors Lose Sense of Time

I heard the silence rule broken at the Iceberg. Snapping off the lights to give us a taste of the utter blackness in which the caverns grew, a guide asked us to refrain from speech lest we destroy the illusion. A creepy interval followed. Then some man pinched his wife, she giggled hysterically, and the crowd roared.

In the caverns' dim lighting one loses all sense of time. Once when passing a park ranger I said, "Good night." His answering

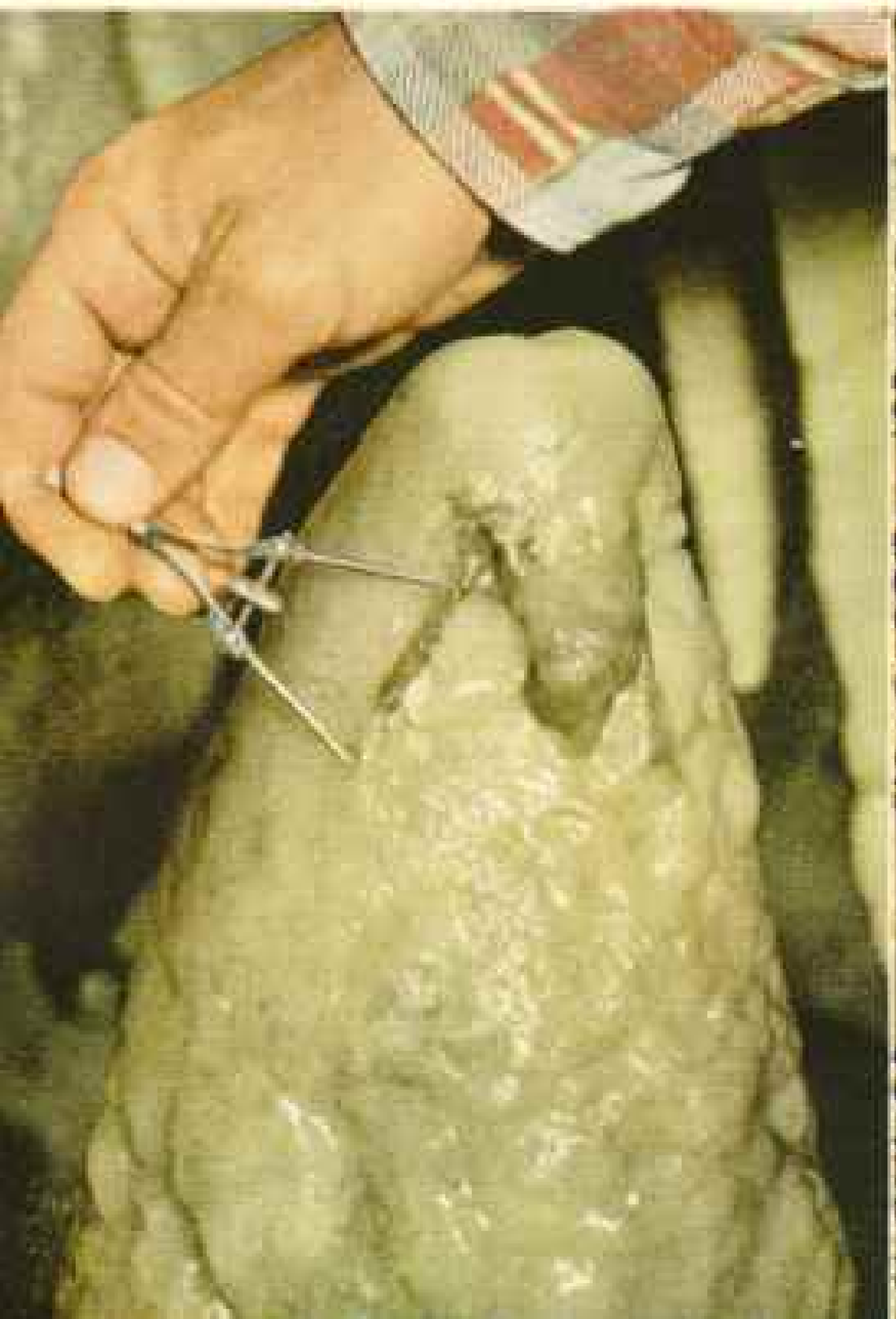
▲ Naturalist Prasil in the Bat Cave Examines Guano for Insect Life

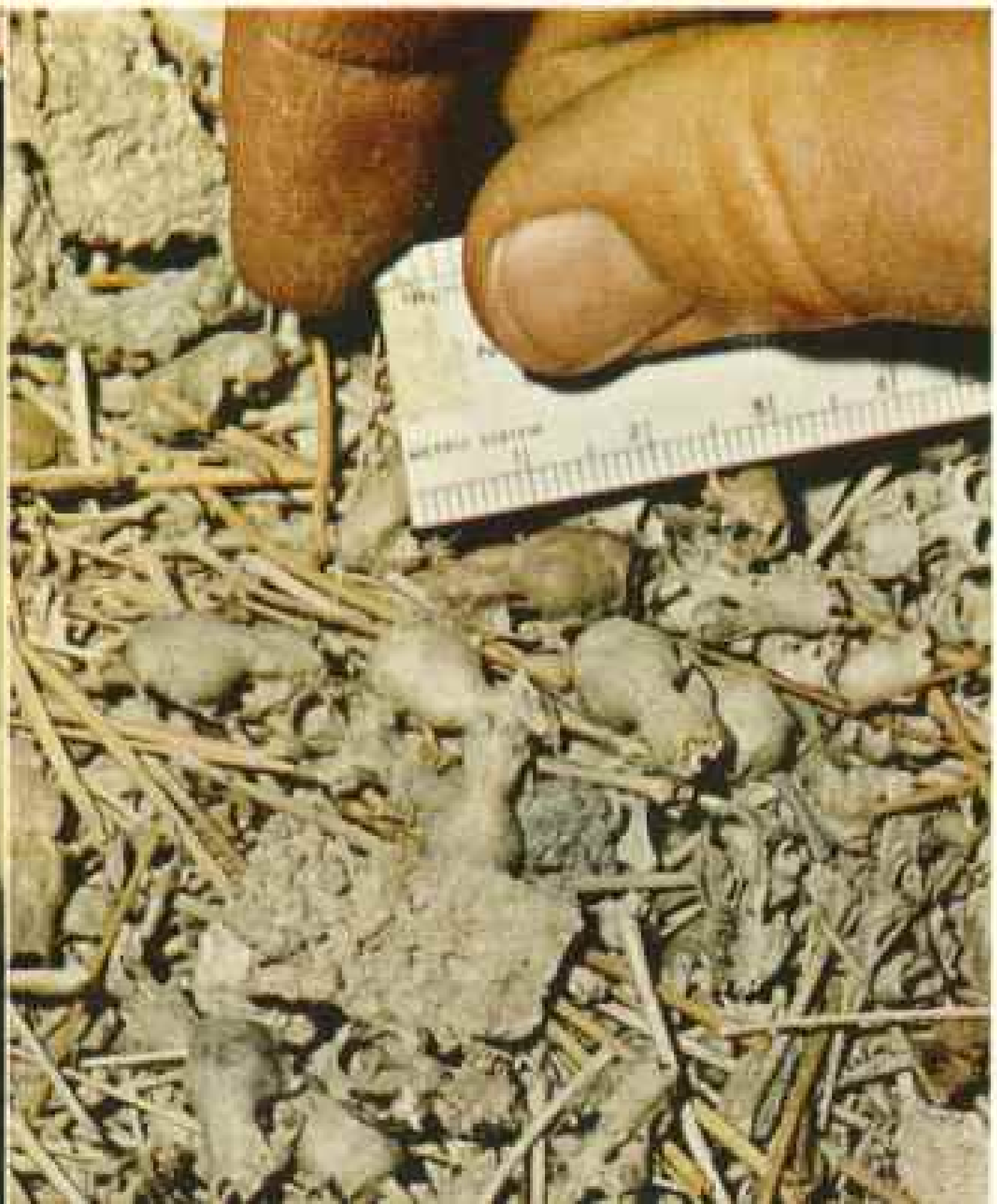
Diggers extracted 100,000 tons of this nitrogen-rich fertilizer for citrus orchards. They left 6-foot seams of centuries-old guano layered between stone laid down by flowing water. This fresh material fell from the ceiling, where the bats sleep head down.

▼ Calipers and Ruler Measure a Fossil and the Skulls of Kindred Bats

Left: This bat, falling on a stalagmite, became firmly cemented as the stone grew. Feet are buried; the head hangs down; wing bones show up darkly.

Right: Fragile skulls and other bones accumulated in this graveyard as bats fell to the floor and died.





laugh directed attention to my watch; it was 2:30 in the afternoon.

No place in the caverns is gloomier than the Bat Cave, an unlighted, off-the-trail passage seldom shown to visitors. The eerie feeling is heightened by an ominous dark giant moving across the walls—your own shadow cast by lantern light!

### Millions of Bats Sleep in Cave

Guided by Richard Prasil, the park's assistant naturalist, I visited the bats' chamber in mid-March, two months ahead of their return from a winter sojourn in Mexico.

We walked across beds of ancient and fresh guano and here and there stumbled upon dusty cables and rusting ore cars abandoned by guano miners. Those old-timers in 20 years removed 100,000 tons of fertilizer once stacked almost to the ceiling.

"In a good season, when insects are plentiful," said Mr. Prasil, "five to eight million bats sleep on the ceiling by day, hanging head down. We can count them because 280 to 300 are known to occupy a square foot, and it is a relatively simple flashlight job to measure their roosting area."

With that word, Prasil directed a beam at a small dark patch 100 feet overhead and calculated that the cave had approximately 2,000 tenants.

"Those 2,000," he said, "are the forerunners of the big migration to come this May. By evening they will stream out of the entrance like a cloud of smoke, and as many as 1,200 people may gather to watch them.

"Leaving at the rate of 300 a second, the bats take four hours to clear the exit (page 441). Water is their first objective. Like locomotives, they scoop it up on the move.

"I have stood among the bats flying out of the cave. Now and then a partial albino with white body and dark wings shone like a snowball in a coal pile. The colony's odor was sweet and musky and overpowering; one could almost judge the intensity of the flight by the smell."

Prasil was in no danger of being hit. Among the surest flyers in the world, bats move accurately in blinding darkness by using echolocation, a sort of natural sonar with which they send out squeaks, catching the echoes as they bounce off obstacles. The human ear can detect the beat of their leathery wings, and also their squeals of pain or rage, but not the guiding squeaks.*

Naturalists have counted 14 species of bats within the park. Of these, only seven roost in the cave. The overwhelming majority are Mexican free-tailed bats, so called because the tail extends about an inch beyond the interleg membrane.

Last year the naturalists banded 3,000 bats to determine where they went during winter migration. Five have been returned, the closest from the cave's mouth, the most distant from Jalisco, Mexico, 800 miles to the south.

"When the bats are here in full force," Prasil said, "few men care to stand below the ceiling, for fleas and bat flies rain down. One authorized visitor, a parasitologist, was searching for those very pests. To collect them, he stood beneath the colony and exposed a bald, shiny head; then wiped it clean with a handkerchief. 'Thirty fine specimens!' he cried, beaming. Stuffing dead bats in one coat pocket and guano samples in another, he departed happily on the bus.

"A former member of the park staff made rattlesnake collecting his hobby. He devoted every spare minute to his snakes. I truly believe he was fond of them. One day he was leading visitors through our cactus garden when an ugly rattler barred the path. Women screamed; men grabbed sticks and stones. Our friend grasped a stick, too, but, instead of clubbing the snake, he defied the crowd. 'Don't you dare hurt that snake,' he warned. Then, using his stick, he removed the reptile from harm's way."

The cave itself, which never harbors snakes, does contain two species of mice. Once in a while the guides sight a coonlike cacomistle, or ringtail, that has wandered in.

One permanent resident is the so-called cave cricket, in reality a long-horned grasshopper, which feeds on the tiny organisms living on guano.

Other tenants are a cave worm, which has been identified as an insect's larva, and a tiny spider. Both spin webs in crevices and slither along them.

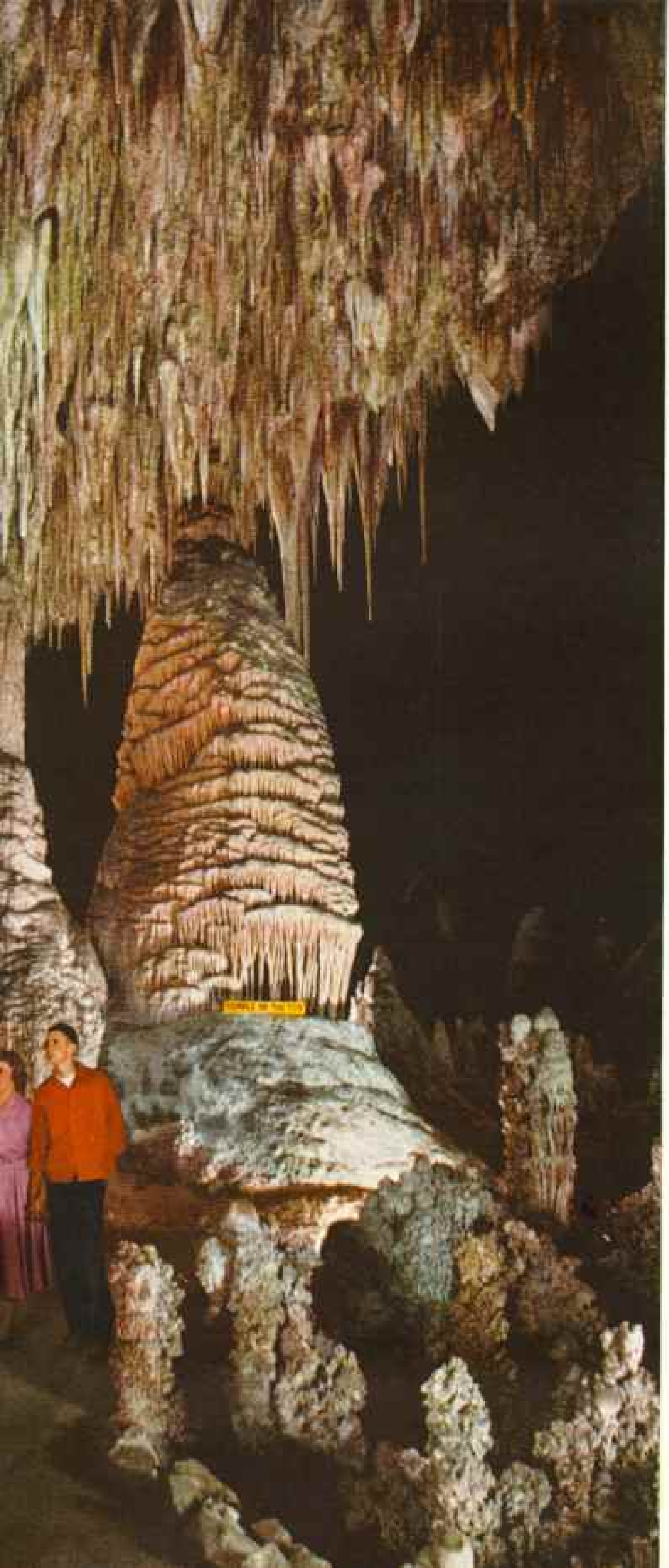
An estimated 1,000 mule deer make the surrounding 49,000-acre park their sanctuary. Many a man has spotted them apparently reading a sign, "U.S. park boundary. No hunting allowed." By night my car's headlights picked up glow from the eyes of deer idling in the park highway. They showed no hurry to give right of way.

### Cave Ice in the New Mexico Room

Guided by tour leader John Good, a geologist, I visited the New Mexico Room, an unlighted section of the caverns closed to the public because its unmarked paths are too steep, slippery, and dangerous.

"Not even experienced guides are allowed to come here alone," Mr. Good told me. "They must enter at least in pairs, so that if one slips and breaks a leg the other may

* See "Mystery Mammals of the Twilight," by Donald R. Griffin, NATIONAL GEOGRAPHIC MAGAZINE, July, 1946.



## Temple of the Sun Has Never Seen the Bright Light of Its Namesake

Like other formations, the Temple of the Sun (right) grew in inky blackness, and its unworldly beauty went unappreciated until men began exploring the Carlsbad recesses half a century ago. On some tours the guides switch off lights and give visitors a chilly taste of the absolute darkness that reigned millions of years.

Just as divers have found beautiful hues in the sea's dark depths, so did the caverns' pioneers discover exquisite coloration where they least expected it. They named the Temple of the Sun not for any fancied solar deity but for its sunlike colors. Impurities within the limestone, particularly iron oxides, tinge the Temple with delicate pastel hues. Since the trail passes close, these high-school boys and girls can examine its splendors to good advantage.

Nature has left not an inch of space undecorated. Stalactites turn the ceiling into an inverted pincushion. Their numbers show that ages ago this section was extremely wet and active. Though taffylike in appearance, the stalactites are capable of gashing anyone blundering off the trail.

A good example of the so-called "popcorn" formations appears in the lower right. This crinkly rock suggests nothing so much as an old-fashioned stick of Crackerjack. Nowadays, in the caverns' dry era, the soft popcorn is beginning to crumble into cave dust. Geologists say it grew on these stubby stalagmites at a time when they were submerged in a pool and coated with the water's excess carbonate of lime. Here and there stalactites subjected to the same kind of mineral bath have emerged with tips studded like war clubs (page 449).



Illustrations by E. "Ted" Hein

summon help." Not relishing the thought of being carried out on a stretcher, I took care as I picked my way up dripping ladders and flowstone.

Good called my attention to the Chocolate Drop, a large mound of dark-brown stone topped with gobs of marshmallow white.

Next, flashlights revealed cave ice, a crust of mineral formed on evaporating water like the curd on boiling milk. When the water drains away, the solidified crust remains like a sheet of ice.

### Lily Pads Grow in Cave Pool

We saw stone lily pads forming in a shallow pool. Each drop of water from the ceiling created a ripple, causing the saturated water to deposit part of its mineral content as a "lily pad" at the surface of the pool.

Baby stalactites one-eighth inch in diameter hung from a rock-candy shrine. Good picked up a fallen specimen and pointed out its cored center, around which the mineral had been deposited. Like a boy at a soda fountain, I blew through the stone straw.

Good and I stood on a limestone balcony and looked down into the green waters of the Emerald Pool. Descending to its rim, we admired stalactites mirrored as stalagmites.

Hot and weary, I was tempted to take off my shoes and wade into the pool, but Good dissuaded me. "See those stony needles on the bottom?" he said. "They'd cut your bare feet to ribbons." So for relief we took a drink of the Emerald's cold, pure water.

Helictites grew in crazy confusion. Masses resembled frozen tumbleweeds; slender pieces looked like worms poking their heads out of apples.

Crystal helictites, unlike normal stalactites, take shape in all directions in seeming defiance of the laws of gravity. One explanation says that the power of crystallization surpasses the tug of gravity, allowing them to build upward and sidewise. Some tour leaders put it this way: "Helictites are female stalactites that can't make up their minds which way to go."

In 1924 Dr. Lee and his aides spent much time exploring and mapping Lower Cave, which actually is no deeper than the scenic rooms. It gets its name from the fact that it may be seen 90 to 100 feet below the main trail. Two abysses look down into it. One is the Jumping-off Place, a walled-in bridge from which no one has jumped yet. The other is the site of two rusting ladders used by the 1924 National Geographic expedition (pages 449 and 455).

Today's guides know five other ways of entering the Lower Cave. Leading me down a series of wooden ladders, they pointed out two phenomena. One was the Rookery, where pisolites, or cave pearls, grow in milky stone nests (page 449). Dripping water tumbles little grains of sand around in these traps, and as the grains roll they acquire concentric accretions not unlike those of oyster pearls. Sometimes they become so large they crowd one another out of the nest.

Close by I watched the formation of splashstone. Lime-laden drip water, splashing into a pool and spreading out in all directions, precipitated a powdery mineral wherever it struck and dried out.

Dripstone, which forms vertical stalactites, stalagmites, and draperies, is deposited in the manner indicated by its name. Flowstone, which paves floors and guano beds, is laid down in horizontal sheets. Frequently drip builds a stalagmite on top of flowstone.

The caverns were hollowed out of a 1,600-foot-thick formation of limestone called the Capitan. Limestone-precipitating algae laid down the stratum some 180 to 200 million years ago in the Permian Sea then covering this part of North America.

At the time the Rockies started growing, about 60 million years ago, the Carlsbad Caverns area was uplifted. Between that era and the Pleistocene, a million years ago, ground water entered fissures and dissolved the less resistant stone. Collapse hastened water's work. Finally the water table fell and air filled the cavities.

At that time the second, or decorative, phase of cavern building set in. Rain water, seeping from the surface, picked up limestone. Wherever drip was slow enough, evaporation squeezed out the water, deposited minerals which, drop by drop, formed stalactites and stalagmites. Nature tried to fill the chambers she took so long to hollow out.

Few of these secondary formations can exceed 100,000 years, for many rest on silt and fossils believed to be of that age.

Today 95 percent of the caverns is dry and dormant. Only a climatic revolution in semiarid New Mexico could bring fresh life to them.

### How Helm Caught the Cave's Colors

For years the caverns defied accurate color photography. The National Park Service's floodlights, artful as they were, did not begin to satisfy the camera's needs. Tex Helm solved the problem with his multiple-flash gear, which fires banks of flashbulbs simultaneously (page 440). His 2,400-bulb shot of the Big Room set a record for flash photography (page 464). These bulbs produced light equal to that of three million 60-watt reading lamps.

Ennis Creed Helm, a native Texan, started

## Park Men Explore the Dome Room

Carlsbad Caverns have 23 miles of explored passages but only three miles of paved trails. Some narrow tunnels, too difficult to reach, have never been entered. In the old days guided parties were encouraged to test their agility and endurance touring keyhole chambers, but increased attendance made such trips impossible.

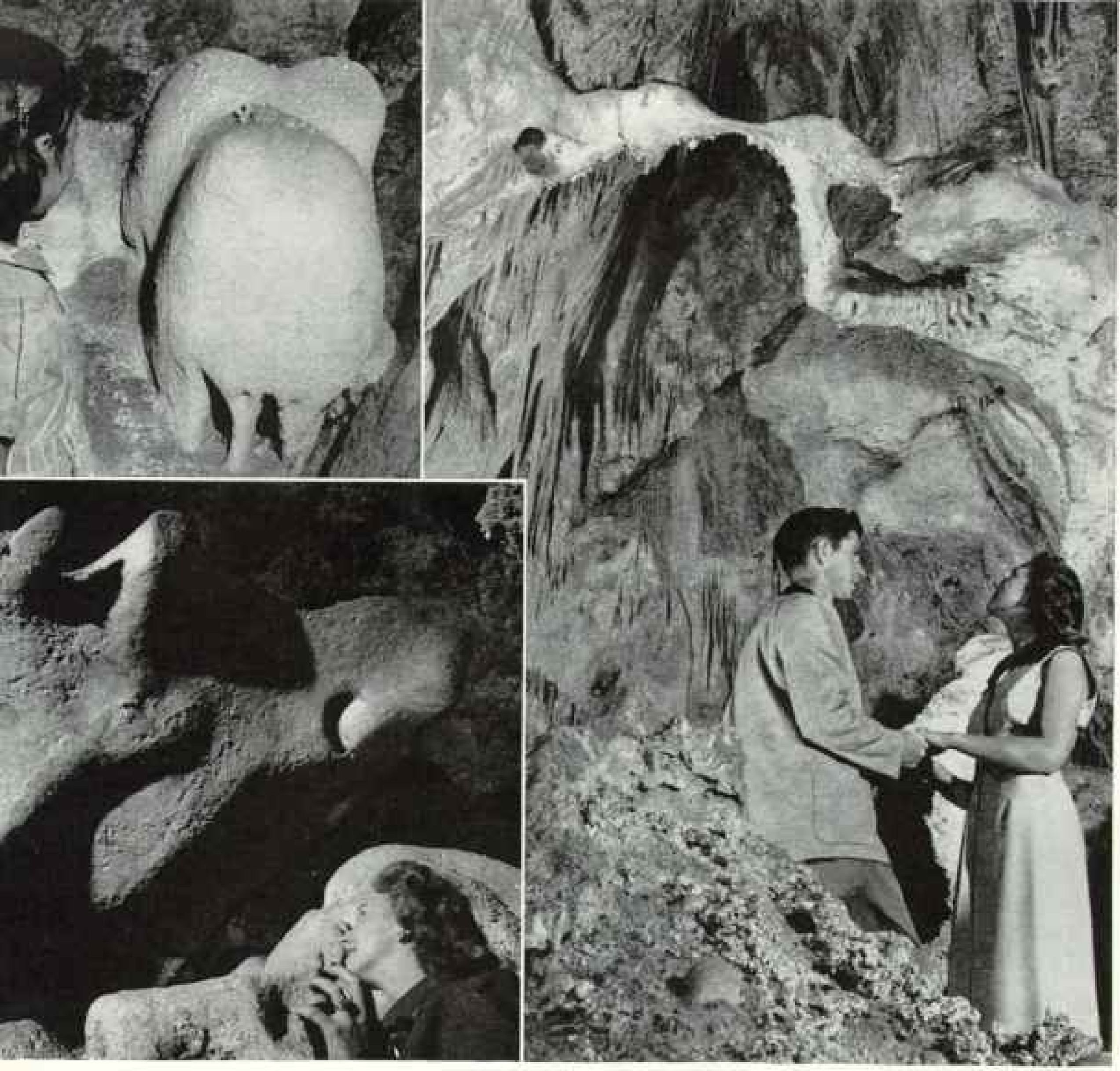
Above: This chamber entrance is decorated with delicate white stalactites, some of which have grown into draperies.

At right a candle-grease effect shows these pillars are still wet and growing. They remain studded with popcorn from a previous immersion in water. Broken stubs in upper right illustrate the brittleness of stalactites. They bear witness to the National Park Service's rule: "Don't touch the formations."

<- Richard Prasil gives Paul McCrary a lift.



Kodachromes by E. "Tex" Helm





his professional career in 1921 as a photographer for the Fort Worth *Star-Telegram*. Turning to newsreel work, he filmed battles in Mexico and covered Admiral Byrd's third Antarctic expedition.

After World War II Helm quit exhausting field work and opened a camera and photoslide shop in Carlsbad, but the caverns presented a challenge he could not resist. He dreamed of capturing their true colors on film.

One day Helm read that Sylvania Electric Products had photographed sprawling Levittown, Long Island, at night by using 1,400 flashbulbs. He asked Sylvania if it would help him on an even bigger project, the Big Room. In reply, Sylvania sent 2,400 bulbs.

Proceeding by trial and error, Helm experimented for a year before working out the light formula. He snapped the history-making shot of the Big Room, 750 feet below the surface, on August 19, 1952.

Other pictures in this series were made exclusively for the NATIONAL GEOGRAPHIC MAGAZINE, which provided technical advice, as did Eastman Kodak, Southwestern Public Service, a power company, and the makers of the Leica camera. Sylvania provided another 14,000 bulbs.

Helm had to work at night so as not to upset the park's scheduled tours, of which there are five a day. Four times a night, twice at the elevators and twice at the scene of operations, he and his helpers loaded gear onto wheelbarrows, which they sometimes pushed up 15-degree grades. Watching them toil along shadowy trails, I was reminded of the Seven Dwarfs in Snow White.

Virtually every color picture in this series cost a night's work. Watching, I saw reflectors mounted behind rocks, with sheets of metal foil beside them to catch the flash and "bend" it into dark crannies. Bulbs were screwed into sockets; wires were tested all along the firing circuit. Thirteen cameras were mounted on tripod heads set on scaffolds between two stepladders. Each camera was

## Out of the Flash-powder Days Comes This Album of Pictures

Photographs on this page are reprinted from the September, 1925, NATIONAL GEOGRAPHIC MAGAZINE.

Dana Lee climbed the Lower Cave's 90-foot ladder before the steel cables rusted (page 455).

"A wire ladder has an erratic nature and an obstinate disposition," Dr. Willis T. Lee wrote. "It has a tendency to be where it does not belong. Those who first descended had an unhappy time swaying and spinning about in the darkness."

Agitated by dripping water, these cave pearls took shape in a milky nest, adding lustrous concentric coats of calcium carbonate as they grew around grains of sand (page 446).

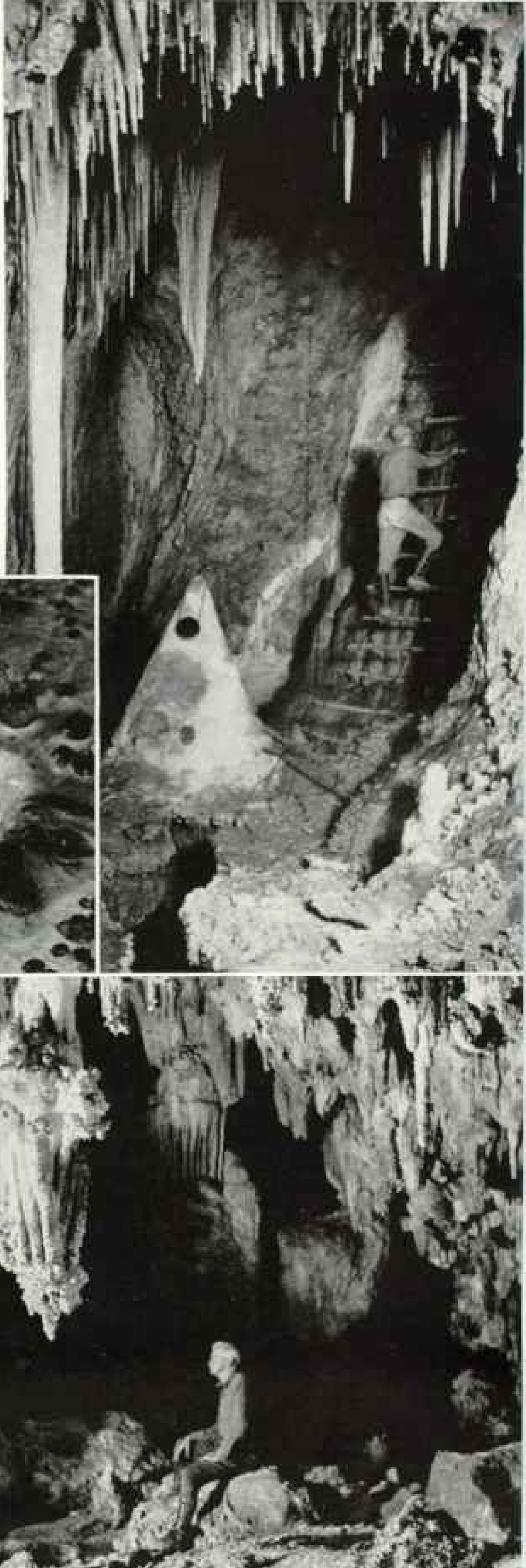
Dr. Lee (bottom picture) examined a popcorn-coated stalactite that reminded him of a cave man's club.

WILLIS T. LEE

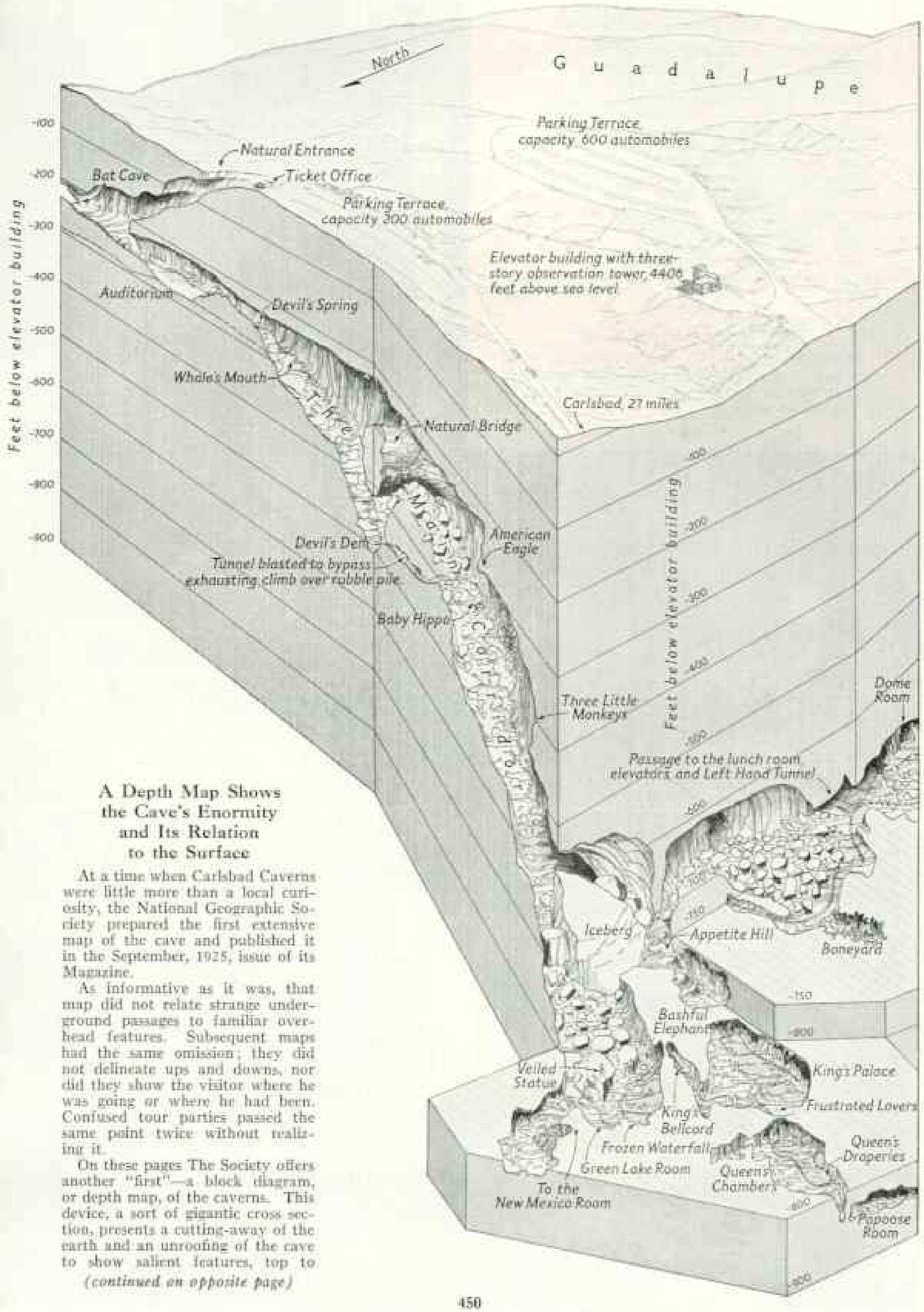
### ← The Caverns' Freak Show

Billing Doves kiss across an arch formed by their own bodies, the Bashful Elephant coyly turns his back to the trail, and the giant Manta Ray appears to leap out of water.









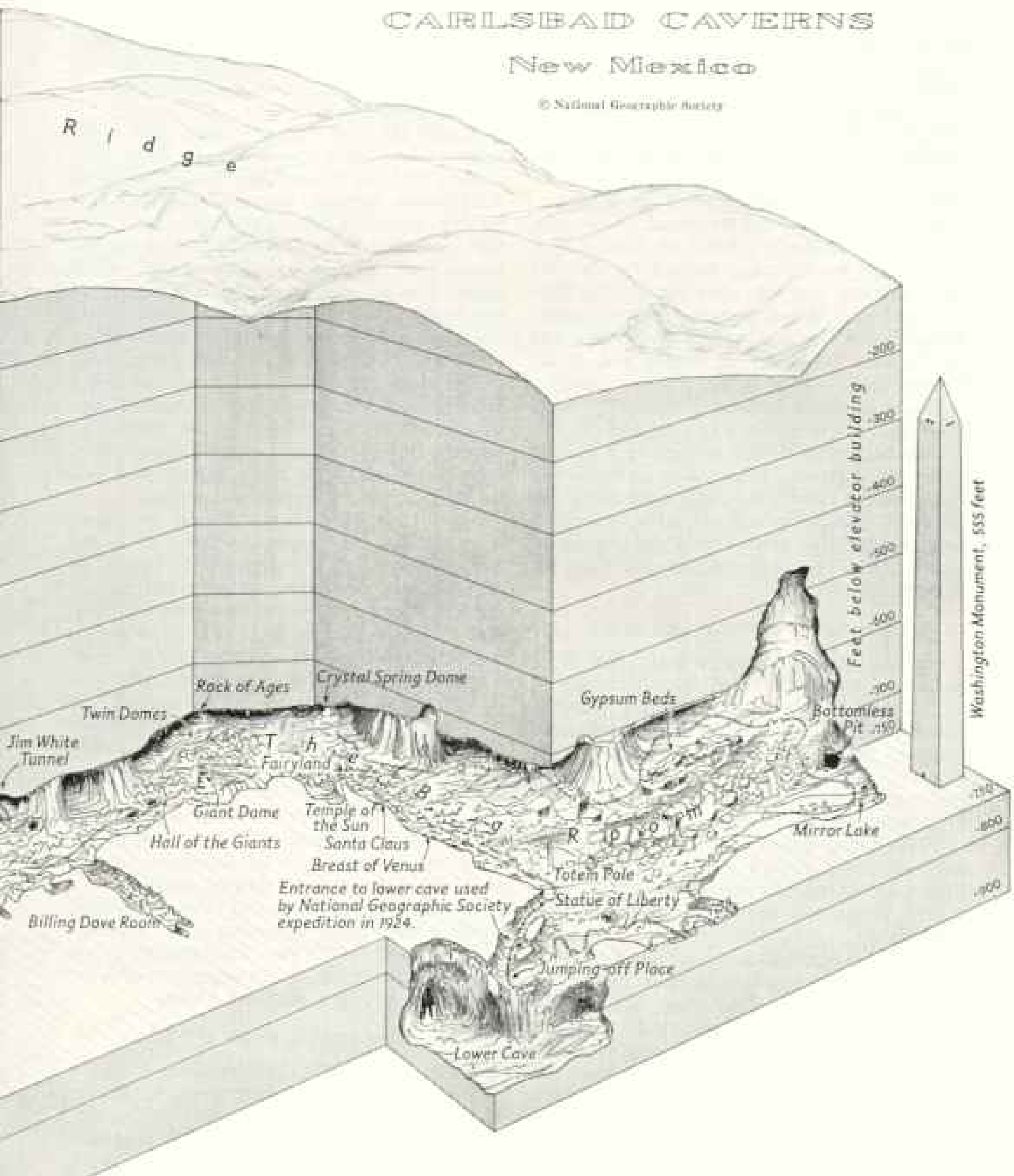

## A Depth Map Shows the Cave's Enormity and Its Relation to the Surface

At a time when Carlsbad Caverns were little more than a local curiosity, the National Geographic Society prepared the first extensive map of the cave and published it in the September, 1925, issue of its Magazine.

As informative as it was, that map did not relate strange underground passages to familiar overhead features. Subsequent maps had the same omission; they did not delineate ups and downs, nor did they show the visitor where he was going or where he had been. Confused tour parties passed the same point twice without realizing it.

On these pages The Society offers another "first"—a block diagram, or depth map, of the caverns. This device, a sort of gigantic cross section, presents a cutting-away of the earth and an unroofing of the cave to show salient features, top to

*(continued on opposite page)*




bottom. With diagram in hand, the visitor can orient himself easily and visualize the enormous rock masses hanging over his head.

Using no exaggeration, the diagram presents an extreme width of 2,400 feet and a depth of 900 feet. It shows three miles of paved trails but omits 20 miles of obscure, seldom visited passages. The 2,000-foot-long Bat Cave is indicated by its entrance (left).

It takes but a glance to see how the subterranean rooms dwarf surface features such as ticket office, three-story elevator building, and 600-car parking lot. The 555-foot Washington Monument, sketched in for comparison, gives an idea of the caverns' depth.

National Geographic cartographer Walter Morrison prepared the diagram. To get accurate figures on elevations, he made his own measurements. Using range finder, hand level, and altimeters, he added depths of cavern floors and heights of ceilings to existing flat maps. At places where he could not sight the ceiling with his range finder, he climbed to high ledges and took readings with two altimeters, checking one against the other. To depict formations accurately, architect Roberts Bujac drew sketches and incorporated them in the diagram.

set at a slightly different lens opening to compensate for error in calculating the amount of light.

As the park's floodlights were turned off, plunging the cave into darkness, Helm mounted a stepladder and opened the shutters. He had to memorize the position of every camera so as not to tip it out of line.

When Helm gave the command, "One, two, three, fire!" hundreds of bulbs crackled. Light, as startling as lightning, bathed the caverns in a blinding, crucible glow for one-thirtieth of a second. When darkness reigned again, Helm closed the shutters. But the job was not ended; every bit of debris had to be cleared from public sight.

"Nothing seems natural down here," Helm told me. "The caverns are another world. Distances are deceiving; so are the angles of light and bounce. Some stones absorb the flash; others reflect it. Just when we think we have things figured out, along comes a new problem like afterglow in some rocks to knock out all our calculations and burn up sections of pictures."

### Cave "Orphans" Coo and Howl

On the surface, gurgles and yells from dozens of assorted infants introduced me to the Cavern Supply Company's day nursery, which takes care of children too young to accompany parents on the four-hour tour underground. Older children were attending an ice-cream party when I walked in; babies in cribs were sucking bottles.

"The young ones cause little trouble outside scores of diaper changes daily," said Mrs. Lila Haney, the matron in charge, "but a few of the four-year-olds try to tear the house down.

"Most of our children cry when parents leave them, but, learning to have fun in one another's company, they weep again when mamma and papa take them away.

"Our youngest charge was just a week old. Our eldest, 92 years, was a grandmother too frail to explore the caverns. Later I got a letter from her. 'That day with the children was the happiest of my life,' she wrote."

Visitors' pets are guarded in kennels close by. They have included dogs, cats, monkeys, a deodorized skunk, and a lion cub.

"Once we kept a hen that had traveled 3,000 miles by car," Mrs. Haney said. "Tongue hanging out in the heat, she arrived wrapped in a wet towel. 'Be careful with her,' said her mistress. 'She is our only baby, and we had no one to leave her with at home.'"

One day tour leader John Patterson borrowed a pickup truck and drove me to New Cave, or Slaughter Cave, one of 30 known caverns within the park. New Cave cannot match the size or beauty of Carlsbad Caverns, but several formations are more spectacular. Wild and exhausting trails to the cave keep it shut to public view.

It was the first day of spring, and a 40-mile wind kicked up clouds of dust from plowed lands in Black River Valley. Passing Rattlesnake Springs, where an artesian flow creates an oasis, Mr. Patterson drove into the foothills of the Guadalupes and parked beneath an abandoned guano hoist. Steel cables ran up a mountain to the mouth of the cave. As the rusting machinery could not give us a lift, we took off on foot. Loose rocks and 30-degree grades left us panting.

Unlocking the steel door, Patterson and I switched on our flashes and descended into the gloom. We stumbled across guano deposits a yard thick and—who knows?—perhaps a million years old. Miners had left cables moored to massive stalagmites.

At a branching of the tunnel we came upon a pillar more enormous than any in the main caverns. We estimated its height as 100 feet, and Patterson, thrice stretching out six feet of arms, demonstrated that its diameter was more than 18 feet. Fluted draperies decorated the column from ceiling to floor. Tapped, they resounded like organ pipes.

A few paces beyond we examined the Chinese Wall, a series of wavy stone levees a few inches high. Wall within wall, they suggested the concentric fortifications of a medieval city.

As we explored farther, each footstep produced a hollow booming sound. Our drumhead was a thin layer of flowstone formed above clay long since washed away.

Another tunnel revealed the Christmas Tree, a stalagmite glittering with crystals.

Using New Cave's awesome settings, movie makers filmed some cavern sequences of *King Solomon's Mines*, a story of Africa.

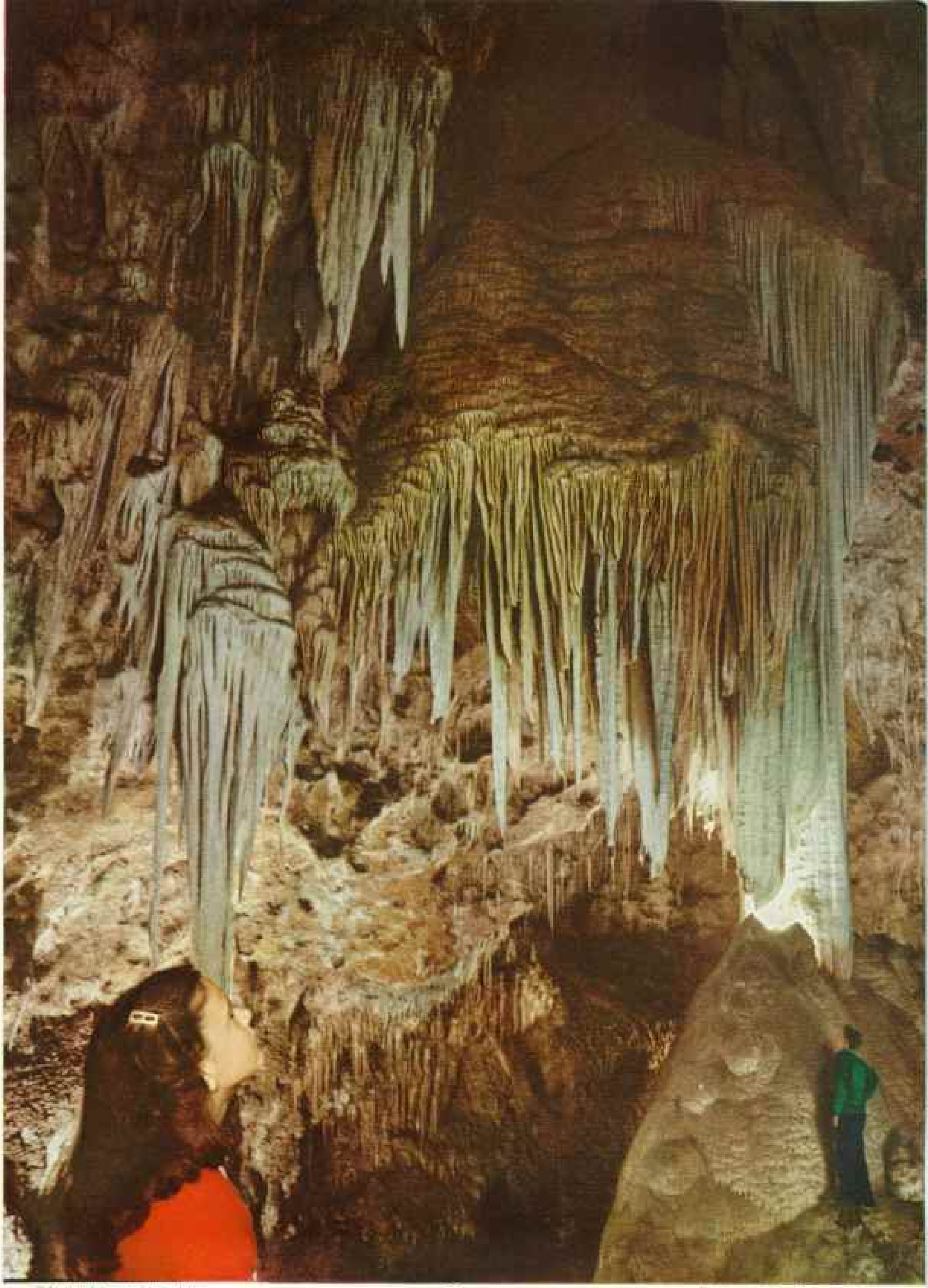
### Caverns Earn a Profit for U. S.

Returning to park headquarters, I had a final talk with the superintendent, R. Taylor Hoskins.

"Making money is not the main objective of a national park," he said, "but it doesn't hurt. In fiscal '53 we received an appropriation of $258,000 and returned about $475,000 to the U. S. Treasury.

"From 1946 to 1953 the park had almost three million paid visitors. I have overheard many of them say, 'It was the best $1.20 I ever spent.'

"If Carlsbad's popularity continues to increase, I visualize the time when we shall have to extend trips into the night. In the future we may open New Cave, making the park a 2-day tour."



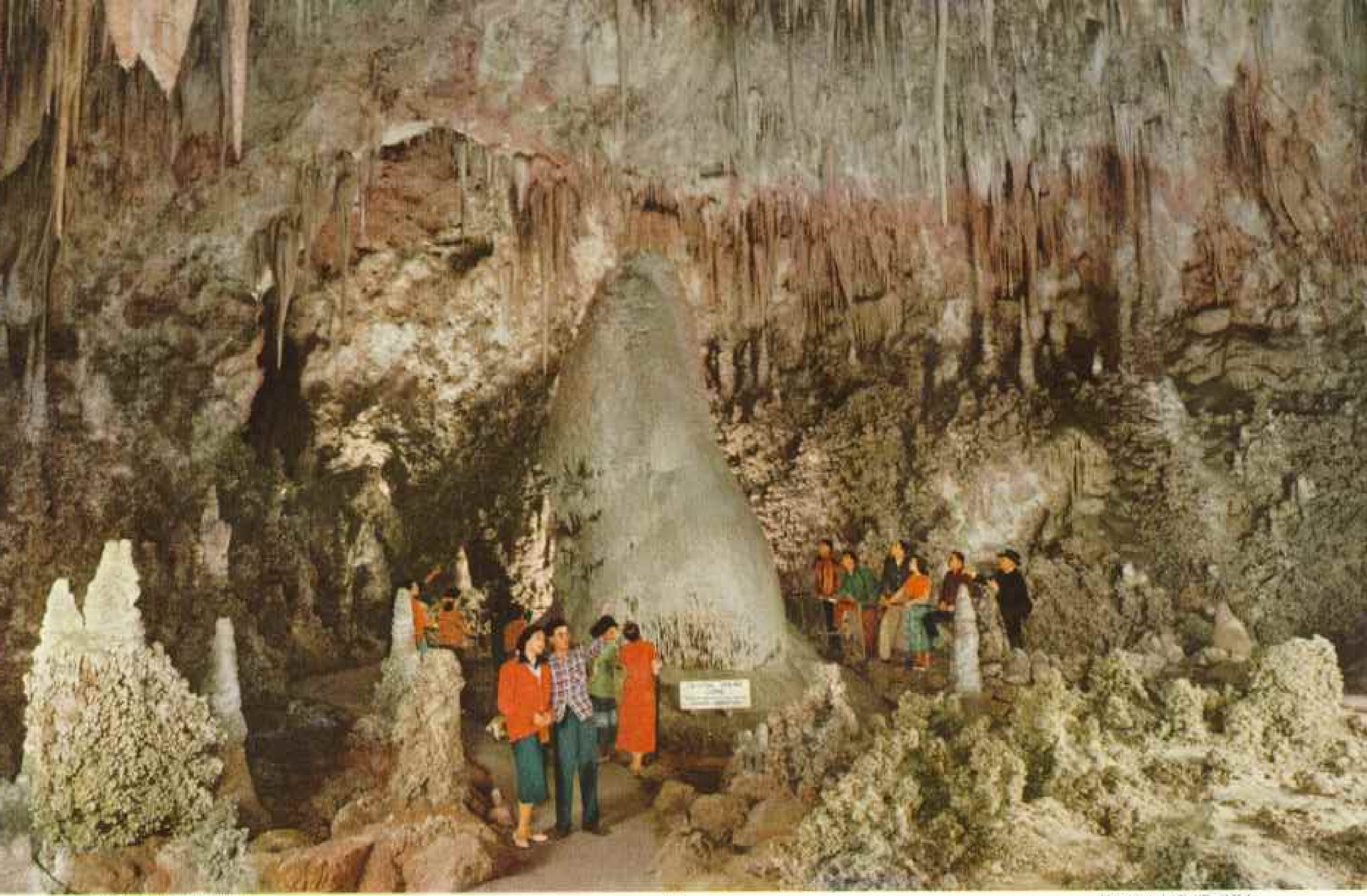




Ektachrome by K. "Tex" Helm

**Limestone Cascades in a Frozen Niagara. Stone Parachutes Hang Motionless in Air**

These Big Room draperies have translucence (page 468) and resonance. If struck, they sound like bells, but, since knuckles may break them and oily thumbprints dim their glowing beauty, the practice is forbidden.




**↑ Moist and Glistening, Crystal Spring Dome Is Still Growing**

Some 95 percent of the caverns is dry and inactive. Decoration continues only where water is dripping.

Most active formation is Crystal Spring Dome. The eye has no difficulty picking out the splashing drops of water that daily spread a thin coat of limestone paint on the dome. One day's measurement showed that the surface was accumulating mineral at 2½ cubic inches a year, but the rate varies.

So much water falls on the dome that a small pool—the Crystal Spring—collects at its foot.

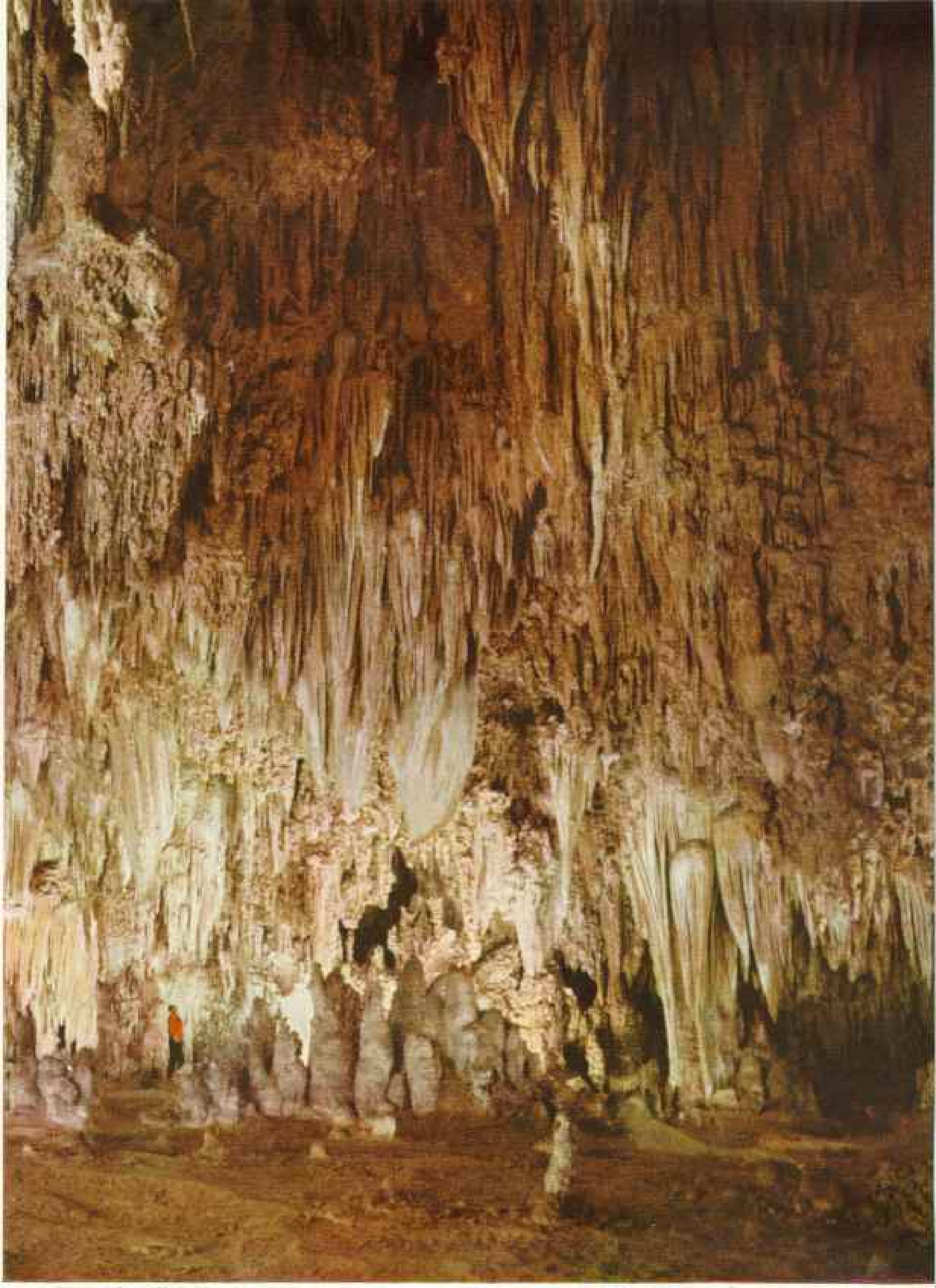
Popcorn deposited halfway up the wall reveals the former waterline.

**← Be Careful! That's a 90-foot Drop**

Tex Helm (with camera) and the author had no rickety ladders to climb. But in 1924 Willis T. Lee and other members of the National Geographic Society's exploration party thought nothing of scaling these cables, which swayed and buckled (page 449).

Today an easier entrance is used to the Lower Cave, and no one dreams of taking the ladders, whose cables have rusted and rungs have rotted. The National Park Service preserves them for historic interest.

Kodachrome by E. "Tex" Helm



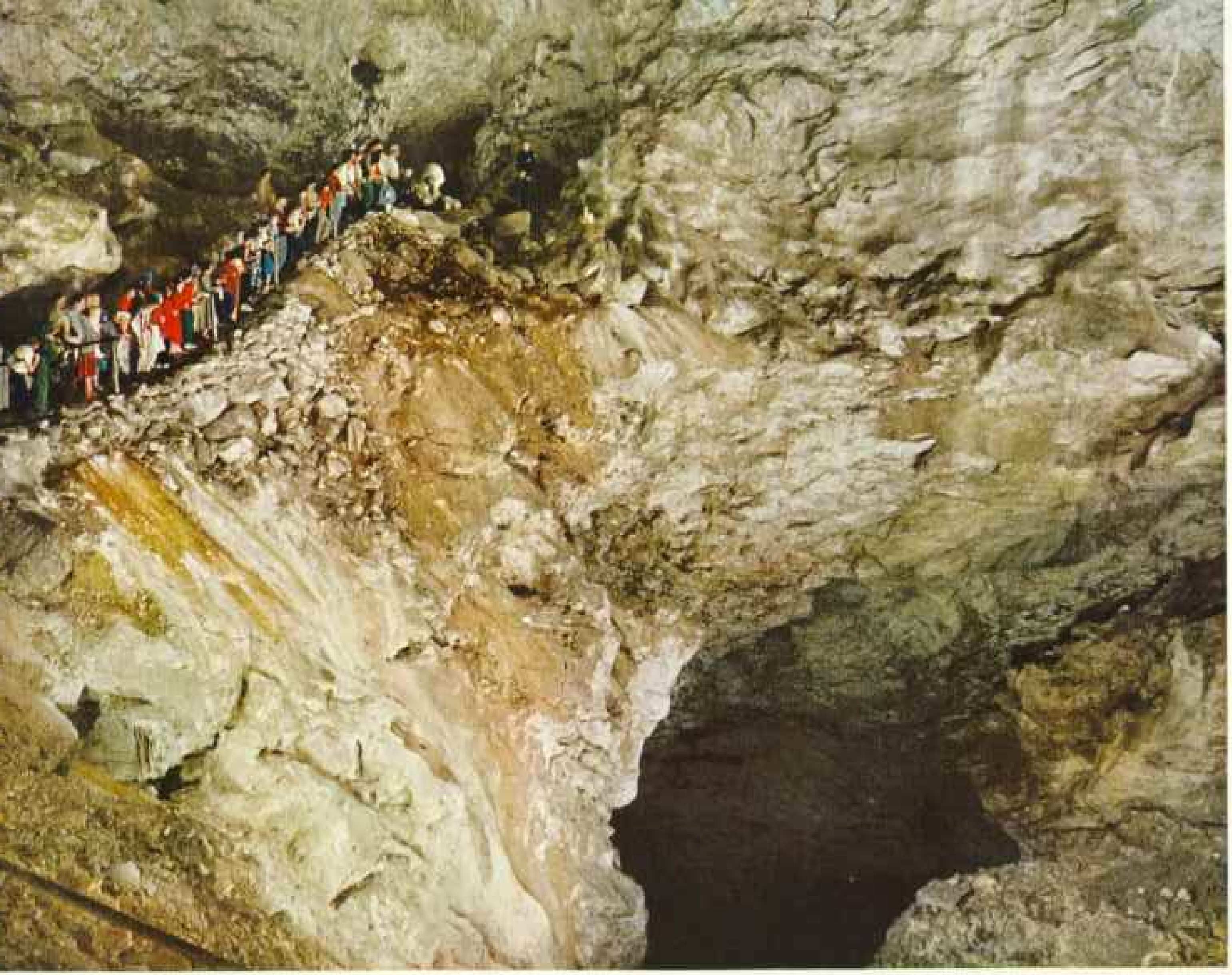




Photograph by E. "Tex" Hahn

**King's Palace Glitters with Stone Chandeliers Like the Ballroom of an Emperor**

Myriad stalactites in this scenic room have formed few corresponding stalagmites, probably because a pool of water inhibited their growth. A solution pocket on the left makes a shadowy gap in the ceiling.



### ‹ The Bottomless Pit, Maw Agape, Yawns Below the Trail

Old-timers named the Bottomless Pit to exaggerate its depth, which they recognized as limited. Today park employees sometimes descend to the bottom with the aid of ropes.

A flashlight easily picks out the floor 138 feet below the trail. Here the ceiling hangs 285 feet above the opening's mouth, making the over-all distance 423 feet, longest vertical drop in the caverns.

On the surface, the pit would be called a sinkhole. Water dissolved the rock, possibly around a vertical fracture. If the abyss had any drain, collapse sealed it off long ago.

This pit is one of many in the caverns. The deepest probes 1,100 feet below the surface.

### ▾ Queen's Chamber Shows Its Wonders

Most of these visitors wear coats or wool shirts, the recommended attire for a four-hour trip in a constant 56° F. A cotton shirt which seems warm enough during a brisk walk may prove insufficient during the stops for lectures and lunch (page 460).

### ↑ Hungry Visitors Get a 40-minute Rest in the Lunchroom

Following their walk through the switchbacks, the Main Corridor, and the scenic rooms, guided parties arrive at the 754-foot-deep lunchroom, a welcome break in their three-mile tour. Quickly they pass through the aisles, pick up box lunch and beverage, and carry them to the picnic tables. Cavern Supply Company, the concessionaire, can feed 2,000 patrons an hour.

← Algae growing under artificial light stain this formation green. Simple plant life exists in the caverns wherever moisture collects and lights remain on long enough to permit photosynthesis. The cluster of stone grapes may have been shaped by mineral-laden water standing on the rock in high humidity. Knife and test tube collect sample algae.

→ This orange seedling aroused the curiosity of all who saw it. Growing out of a seed tossed beside the trail, it existed on its own nutriment and perhaps some bat guano. After attaining five inches, it withered for lack of light.

Cave fungi, which require no light, thrive on dead bats, guano, wood, or any piece of organic material. With their high humidity and even temperature, the caverns would make a good mushroom garden.

Kodachromes by E. "Pat" Helm



## In the Big Room: The Trail Passes Rock of Ages

Occupying a niche in the dark and distant window (left of center), the Rock of Ages is the most celebrated formation in the caverns.

Because of its huge bulk this stalagmite was popularly supposed to be one of the oldest decorations. Actually there is no good way of determining its exact age; no one can tell when it grew or how fast.

The National Park Service used to hold an impressive ceremony at the rock. After the superintendent had delivered an inspirational address, an attendant flipped a switch, plunging the hall into primeval darkness. Then out of the gloom park rangers advanced singing "Rock of Ages," and the lights came on section by section. Finally crowds grew so large that it became impossible to accommodate visitors and carry on the ceremony. Failing to understand the difficulties, people all over the country sent in protests.

On the right another frozen waterfall shows draperies shaped like atomic clouds. Draperies to the left are so thin and delicate that they are called ribbons.

Carlsbad is not a highly colored cavern; many others are more vivid, but none can match the immensity of its spectacle. The National Park Service, forbidding colored floodlights, insists on showing the formations in their natural state.

The next two pages disclose the marvels on the far side of the distant passage.



Kodachrome by E. "Tex" Bello

**Photography's Biggest Flash Shot: It Took 2,400 Bulbs to Light the Big Room**

The picture covers an estimated 550,000 square feet; it shows visitors a fifth of a mile away at the right. This single exposure cost Heim and his crew 16 hours of work setting up and taking down cameras and lights.



Kodachrome by E. "Ted" Hale

**Distant Rock of Ages and Other Stalagmites Stand Out Like Icebergs in a Colored Sea**

So vast is the Big Room and so twisting the trail that most visitors fail to recognize it as a single chamber. Chief Sunny Skies Hunt, a Carlsbad curio dealer, stands in center in his Indian headdress.

### ↑ Three Massive Domes Stretch Ceilingward in the Hall of Giants

Giant Dome (center), largest stalagmitic growth in the caverns, towers 62 feet above the trail. A thin band of stone attached to the ceiling turns it into a column. Twin Domes (right) are not identical, and they were not necessarily born at the same time.

Onyx Draperies hang above the trail. Composed of calcium carbonate, they are not true onyx, which is a form of quartz.

### ← The Boneyard: a Stony Bit of Swiss Cheese

Many visitors pass this rather barren section without a second look, but geologists find the Boneyard the most exciting feature, for it illustrates the nature of the caverns' beginnings. Long ago, when the limestone lay beneath the water table, the least resistant parts dissolved, leaving these "bleached bones." Before complete solution took place, water drained away and air filled the cavity. Decoration failed because dripping water was lacking.

Geologists used to believe that underground streams carved caverns; lately they have advanced the theory of two-cycle development. In the first phase, ground water eats away the more soluble portions. In the second, deposition of stone tends to fill the cave.

Here the four human figures interfere with an illusion. Turn the picture upside down; the honeycomb looks the same.

Illustrations by E. "Tex" Hoffa

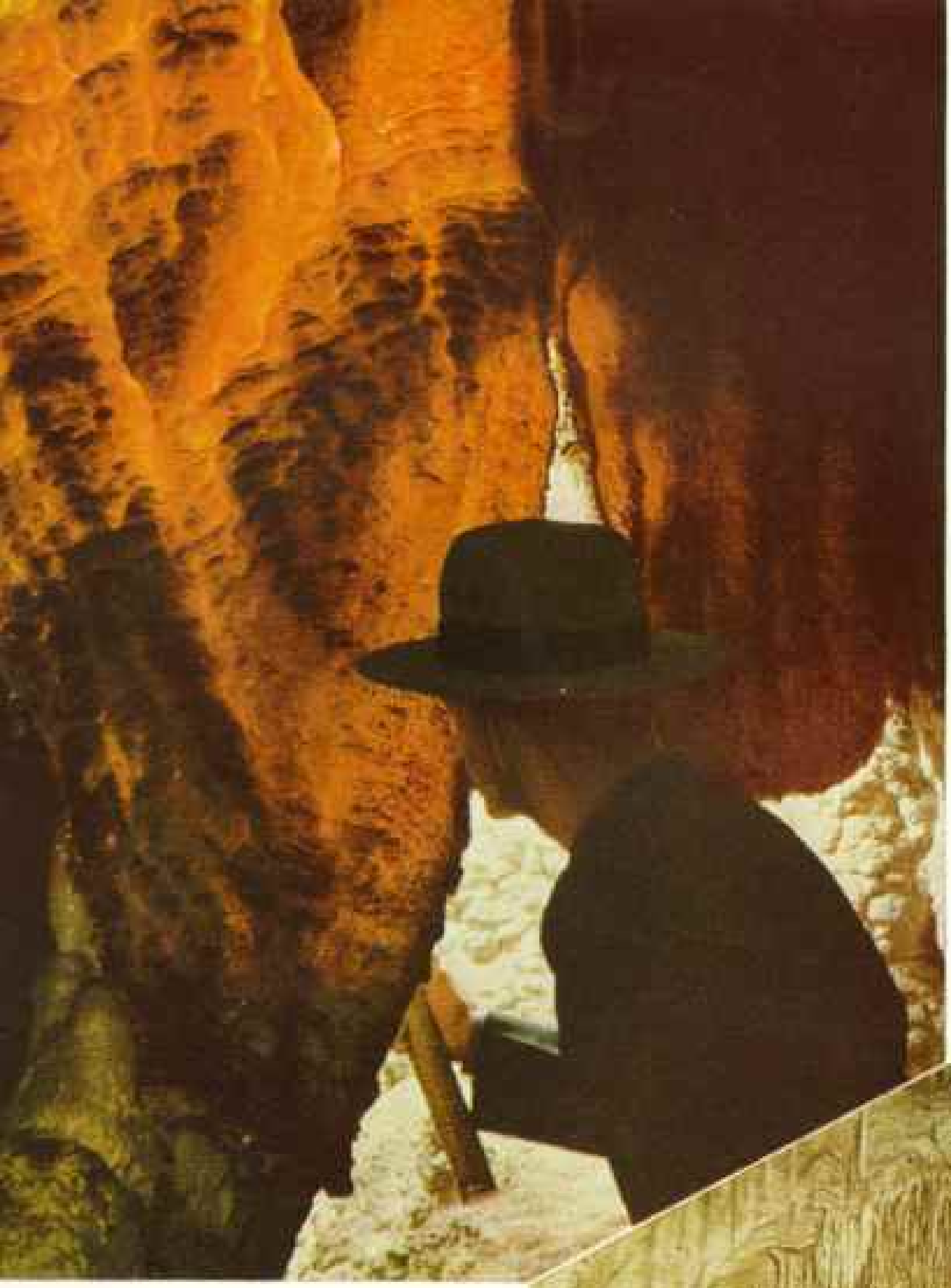
## Queen's Draperies Glow in Torchlight

These formations absorb light and continue to emit it for seconds after the source has been doused.

In certain chambers the photographer wasted a night's work by having all his shots burned out despite painstaking calculations on the amount of light required. He found the cause in afterglow, which held the light and fed it into the open cameras.

Draperies, a form of stalactite, produce eerie effects. Some remind one of elephant ears; others suggest the wings of fallen angels or monstrous bat-men.

Forty-two feet high, these portieres are the largest in the caverns.



## Dolls' Theater Fascinates Children

This small and exquisite formation is one of the most beautiful in the caverns. Every passer-by stops to observe its resemblance to a brilliantly lighted stage. The effect is even more striking with just the usual bulbs concealed deep in the theater. The photographer had to sacrifice some of the formation's incandescent quality by directing his lights from the front—only one of the many difficulties he faced.

This small forest of stalactites and stalagmites shows how the decorative phase of cavern building tends to reverse the dissolving process by filling passages with secondary growths.



Kodachromes by E. "Tex" Deitz

# We Followed Peary to the Pole

By Gilbert Grosvenor and Thomas W. McKnew

*President and Secretary of the National Geographic Society*

ACROSS the blinding white stretches of Arctic space the six men and their sledges crawled, dark specks on the world's icy crown. The air they breathed was bitter, with an edge of frozen steel. They climbed each pressure ridge fearful of finding on the other side the open lead of inky-black water that would spell, at the least, a costly detour; at worst, defeat (page 484).

They were lucky. Only one great lead caused much delay; no blizzards pinned them down; with temperatures rising to 15° below, their dog teams reeled off marches of 25 to 40 miles a day over the slick sea ice. On April 6, 1909, after 37 days of continuous sledging from Cape Columbia, Comdr. Robert E. Peary, U. S. Navy, and his men reached their long-sought goal. For the first time in history men stood at the earth's apex, the North Pole.

Inevitably we thought often of this gallant band when, last May, we retraced by plane Commander Peary's route to immortality. We had been invited by the United States Air Force to accompany a routine staff visit to northern bases. The Air Force periodically performs such missions to acquaint high-ranking officers with problems of supply and operations. Many airmen have flown across the Pole since Lt. Comdr. Richard Evelyn Byrd and Floyd Bennett in their little monoplane blazed the first sky path in 1926.* But for us the journey had peculiar significance.

### Society Long Interested in Pole

The National Geographic Society, since its founding in 1888, has followed actively the successive assaults against this grim objective. It has supported many expeditions, placed all its cartographic and technical resources at the service of Arctic explorers, and cooperated fully with the United States Government's polar research. Its staff has developed special apparatus (such as the Bumstead sun compass, forerunner of the astrocompass) for high-altitude navigation. Some ninety articles about life at the top of the world have been published in The Society's official journal, the National Geographic Magazine.†

Moreover, one of us [Grosvenor] had enjoyed the inspiring friendship of all the great Arctic heroes, from Admiral George W. Melville, U. S. Navy, and General A. W. Greely, U. S. Army, to Nansen, Peary, Amundsen, Byrd, Ellsworth, Nobile, Donald MacMillan, Rasmussen, Sir Hubert Wilkins, and James Mann Wordie, as well as Amos Bonsall, master's mate and last survivor of Elisha Kent Kane's Expedition of 1853-1855 (page 474).

On that May morning, as our huge four-engined C-54 flew poleward, we looked down upon the glassy pack ice with profound respect and humility. We knew well the lives, the agony, the treasure, the bone-weary efforts which, for more than 300 years of exploration, had been poured into the campaign to reach latitude 90°N.

### Much Planning Behind Flight

Yet here we were, cruising at 9,800 feet in a warm cabin, leaping in a matter of minutes huge expanses of ice which had cost Peary and his followers many a long day's painful trek (page 471). But it was not that simple, for behind our flight were many months of planning and the efforts of a fine crew carefully selected for experience in Arctic flight.

At 12.28 a.m. on May 18 we took off from Andrews Air Force Base near Washington, D. C. Our objectives were multiple: we wanted to see with our own eyes the bewitching white world about which explorers and artists have raved; to study the colorful rocks and cliffs rising above the snow; and to see the ice field at the Pole itself.

Our plane was outfitted with bunks, galley, refrigerator, and other amenities. The personnel were from Headquarters, USAF, and from the Air Force's far-flung Military Air Transport Service.‡

Just before take-off our flight steward, Sergeant Householder, briefed us on emergency ditching procedures and gave us a short parachute drill.

"If we get in trouble up north," he said, "we'll try to bring the plane down. Bail outs are risky, you're likely to get pretty widely separated, and we can't carry down a tenth as much equipment as we have on board.

* See "First Flight to the North Pole," by Lt. Comdr. Richard Evelyn Byrd, National Geographic Magazine, September, 1926.

† For other articles on the Arctic, see the two-volume National Geographic Magazine Cumulative Index, 1899-1952.

‡ Participants in the Top of the World Flight, in addition to the authors, were: Col. John T. Shields (HQ, USAF), commander of the flight; Col. Paul Jones (HQ, USAF); Col. M. A. Richer (USAF); Lt. Col. C. R. Meyer (HQ, USAF); Capt. William Campbell (USAF), aircraft commander; Capt. Donald E. Simmons (HQ, USAF), copilot; Capt. E. W. Black (USAF), navigator; Capt. David A. Beach (USAF), Polar navigator on North Pole leg; T/Sgt. E. G. Todd, engineer; T/Sgt. E. E. Sutphin, engineer; S/Sgt. J. E. Giblin, radio operator; A/2c Richard I. Fickett, radio operator on North Pole leg; S/Sgt. L. H. Householder, flight steward.


470 David T. Hatcher

**A Lonely Shaft Overlooks Baffin Bay; P Stands for Peary and the Pole**

Financed by Admiral Peary's family, the 60-foot pylon was erected on Cape York, Greenland, by a 1932 expedition led by Capt. Robert A. Bartlett, one of Peary's aides on the 1909 expedition that reached the North Pole. The authors' plane passed over the memorial en route from Newfoundland to the United States Air Force Base at Thule, 60 miles to the north (map, page 472).

Besides, the plane makes a good rescue marker in itself. On the other hand, if the ice is too hummocky to risk crash landing, we'll just have to abandon ship. Then you'll each strap your individual survival kit to your chute and hit the silk."

We soon turned in and, with only a few minutes of turbulence as we flew through rain squalls over Long Island, New York, slept placidly till dawn.

### Newfoundland Base First Stop

We breakfasted high above cloud-covered Nova Scotia.* Not till we soared over Cabot Strait did the undercast yield, disclosing the French islands of Miquelon and St. Pierre, last North American fragments of a once broad empire, and Placentia Bay, where President Franklin D. Roosevelt and Prime Minister Winston Churchill met to draft the Atlantic Charter aboard the ill-fated British battleship *Prince of Wales*.

In Newfoundland we touched down at the Royal Canadian Air Force Base of Torbay, just north of St. John's, and motored to the USAF's Pepperrell Base headquarters, where our hosts had official business.

Soon Mr. R. B. Herder, president of the St. John's *Evening Telegram*, appeared with a car and a friendly invitation to visit Brigus, some 40 miles distant, home town of the late Capt. Robert A. Bartlett, Peary's second-in-command and Hubbard Gold Medalist of the National Geographic Society.†

More interesting than Brigus's stone monument to the great skipper proved to be the surviving Bartletts. Within the house Bob built for his mother she had set aside a room especially to display mementos of his remarkable career. Here Bob's brother, Bill (hardy as a pine knot) regaled the company with reminiscences of Captain Bob's salty adventures.

Back at the air base plans were made for an early take-off. At 6:30 a.m. we zoomed off the runway. Our goal: Thule, 2,041 miles away. A dog-leg took us over Gander; then we headed for a radio beacon on the Greenland coast—BW8, an Air Force installation near Holsteinsborg, better known to World War II ferry pilots as Blue West 8.

Persistent undercast blanked out our gaze all the way to Thule, except for a few miles down Davis Strait. But on our maps we could check off landmarks of polar exploration as we flew invisibly at 9,500 to 10,000 feet.

* See "Salty Nova Scotia," by Andrew H. Brown, NATIONAL GEOGRAPHIC MAGAZINE, May, 1940.

† See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Servicing Arctic Airbases," May, 1946, and "Greenland from 1898 to Now," July, 1940, both by Capt. Robert A. Bartlett.

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**Bunks, Hot Food, and Warm Cabin Made C-54 a Snug Contrast to Peary's Dog Sleds**

Last May the National Geographic Society's president and secretary flew from Washington, D. C., to the North Pole and back, with stops at Torbay and Stephenville, Newfoundland, and Thule, Greenland. Here Gilbert Grosvenor (right) and Thomas W. McKnew unfurl The Society's flag, later dropped on the Pole. A similar flag was left there by Lt. Comdr. Richard E. Byrd on his 1926 flight.

Off to our left lay Indian Harbour, where Peary, returning in triumph, sent his first wireless message from Labrador to the world: "Stars and Stripes nailed to the Pole".

The capital of Greenland, Godthaab, on the southwest coast, reminded us of Count Gaston Micard and Willie Knutsen who embarked there to shoot walruses. The count carried his silk umbrella and rode on a sled fitted with two armchairs, back to back, so he could keep the sun out of his eyes.

Ahead lay Melville Bay, where Peary met and recruited his Greenland Eskimos year after year, and Cape York, where a stark shaft unveiled by his daughter, Mrs. Marie Peary Stafford, now commemorates Peary himself.

As the plane droned northward, we occupied ourselves in checking our cameras and other gear and in talking with the crew. We gave Colonel Shields, the senior officer present, Peary's book, *The North Pole*. Shields took it off to a corner of the cabin and couldn't be pried loose from it. Before our flight was up, half the officers aboard had made their first enthralled acquaintance with this "guidebook" to the Pole.

Shortly before five in the afternoon we picked up the radio beam at Thule. For nearly 25 minutes we circled downward, guided at each step by radar operators for Ground Control Approach. Clouds still shrouded the land, but as we let down we sighted the table-top mountain which marks North Star Harbor, Thule's port. Then at last we broke into the clear just above the runway and glided smoothly in.

### America's Northernmost Air Base

Snow still lay thickly about, and the harbor was frozen over; though midsummer was almost upon Thule, it would be perhaps a month before icebreakers could clear the way for the fleet which resupplies the base in its two months of open water.*

Some 935 miles from the Pole, Thule was first spotted as a potential base by Knud Rasmussen in 1910. But it was Col. Bernt Balchen who recommended in 1950 that the USAF convert it from a small Danish-American weather station into a great operating field. Certainly Thule, because of its sheltered position at the foot of Greenland's icecap, its deep bay, and its generally open weather, is an obvious choice for a bastion athwart the circumpolar air routes linking the world's great capitals.

* See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Far North with 'Captain Mac,'" by Miriam MacMillan, October, 1951, and "Americans Stand Guard in Greenland," by Andrew H. Brown, October, 1946.

UNION OF SOVIET SOCIALIST REPUBLICS

Arctic Ocean

North Pole

Possible drift of Jeannette wreckage

Jeannette Sunk 1881

Drift of Fram

Possible drift of Melville-Bryant Cairn

Franz Josef Land (U.S.S.R.)

Take-off point of Byrd's Polar flight, May 9, 1926

West Spitsbergen

Fletcher's Ice Island

Cape Columbia

Cape Calon

Cape Sheridan

Cape Constitution

Fr. Conger

Alert

Independence Fjord

Nord

Greenland Sea

Greenwich Meridian

Point Barrow

ALASKA

Beaufort Sea

Peary Land

Ellesmere Island

Kane Basin

Lincoln Sea

Kennedy Channel

Lambert's Land

Hazen Camp

Cape Sabine

Thule

Humboldt Glacier

Britannia Lake

Victoria Island

North Magnetic Pole

Cape York

Melville Bay

Prince of Wales Island

Baffin Bay

GREENLAND (Denmark)

Baffin Island

Davis Strait

Foxe Basin

Arctic Circle

Holsteinsborg

BWS ("Blue West 8")

Godthaab

Hudson Strait

Frobisher Bay

Chubb Crater (Ungava Crater)

Hudson Bay

Narssarssuaq

Julianehaab

Cape Farewell

Hebron

Cape Mugford

Nain

Davis Inlet

Burnt Creek

Indian Harbour

LABRADOR

Goose Bay

CANADA

Seven Islands

Atlantic Ocean

Gulf of St. Lawrence

Gander

NEWFOUNDLAND

Stephenville

Torbay Aerodrome

Pepperrell Air Force Base

St. John's

Cabot Strait

"Beinn Bhreagh"

Baddeck

Sydney

Placentia Bay

St. Pierre and Miquelon Is.

Montreal

Ottawa

St. Lawrence R.

Halifax

Bras d'Or Lakes

NOVA SCOTIA

UNITED STATES

Boston

Cape Cod

New York

Long Island

Washington

Andrews Air Force Base

75°

70°

65°

60°

55°

50°

45°

## Top-of-world Flight Covered 8,800 Miles

Thule Air Force Base's strategic position guarding polar approaches to Canada and the United States is clearly shown. Greenland, the world's largest island, is 1,660 miles long and 800 miles wide. The North Magnetic Pole, which distracts the compass needle from true north in high latitudes, is on Prince of Wales Island, 1,480 miles from the North Pole and 600 miles west of Thule.

*A National Geographic Map*
*Drawn by William T. Peele*

Under the North Atlantic Treaty a pact was signed by Denmark and the United States concerning the defense of Greenland—a model of international cooperation.

To put muscle into that pact, the United States in the spring of 1951 sent a small army of skilled workmen north to Thule. Army engineers and transportation units, teamed with civilian tractor drivers, contractors, stevedores, carpenters, and architects, invaded North Star Harbor in what was called Operation Blue Jay, or "Normandy-on-ice." All manner of equipment came with them—a 29,000-pound power shovel, 100-ton earth compacters, bulldozers by the score, and a mammoth sea-water distillation unit.

Working around the clock in eight-hour shifts through the continuous daylight of two summers, these men laid out a 10,000-foot airstrip and a 480-acre town chockablock with fuel tanks, hangars, barracks, offices, warehouses, radio installations, a huge gym.

Weather was the main enemy.

Temperatures sink so low in Thule that steel and rubber get brittle. Cold-storage lockers have to be *heated*, and engines kept running continuously; water must be delivered by truck, not pipe.

All buildings except the hangars are constructed with a three-foot air space beneath them, both to let the snow blow through without piling up and to prevent the floor's warmth from melting the ground's top layer of permafrost. Light structures, mounted on stilts, must be anchored with concrete weights to keep them from blowing away.

### Baseball in the Icebox League

Construction still goes on at Thule, but life is less strenuous than in the first frantic years. Ball teams such as the Frigid Digits, the Little Siberians, the Pie-eyed Pipers, and the laundry unit's Wet Sox compete in summer games which may be called on account of exhaustion but never on account of darkness. Bowling teams were in full action while we were there.

Other workmen off duty read the *Glacier Gazette*, dribble a basketball in the gym, try out for the glee club, or listen to Thule's radio station KOLD.

A base reporter, waxing enthusiastic over the number of arctic flowers which employees had grown, asked editorially: "What's Hawaii got that Thule hasn't?" One answer might be: women. We saw only two on the whole post—the wife of the Danish Liaison Officer and an American Red Cross Gray Lady.

While Colonel Shields and the others attended to their official duties, we dined in the officers' club on roast Long Island duckling and a delicious pastry and took to our beds. We slept well, but only after darkening all the windows against the circling sun. In a few hours we roused ourselves and, at 5:38 a. m., took off for the North Pole. Clouds gave way to brilliant sunshine, and, as we crossed Kane Basin to Washington Land, we could see clearly for a good 25 miles in any direction.

Our route passed directly over Fort Conger, where Lt. A. W. Greely had passed two most successful years directing the United States Government magnetic and meteorological station. This was one of 13 circumpolar stations that 11 nations had established to make synchronous observations in 1882—the first instance of international cooperation in scientific field research that we know.

### Only Seven Men Survived

His work completed and no relief supply ships having arrived by the appointed time, Greely took his party to Cape Sabine as per instructions previously given him, and wintered there 1883-1884. Contrary to government promises no supplies had been placed there.

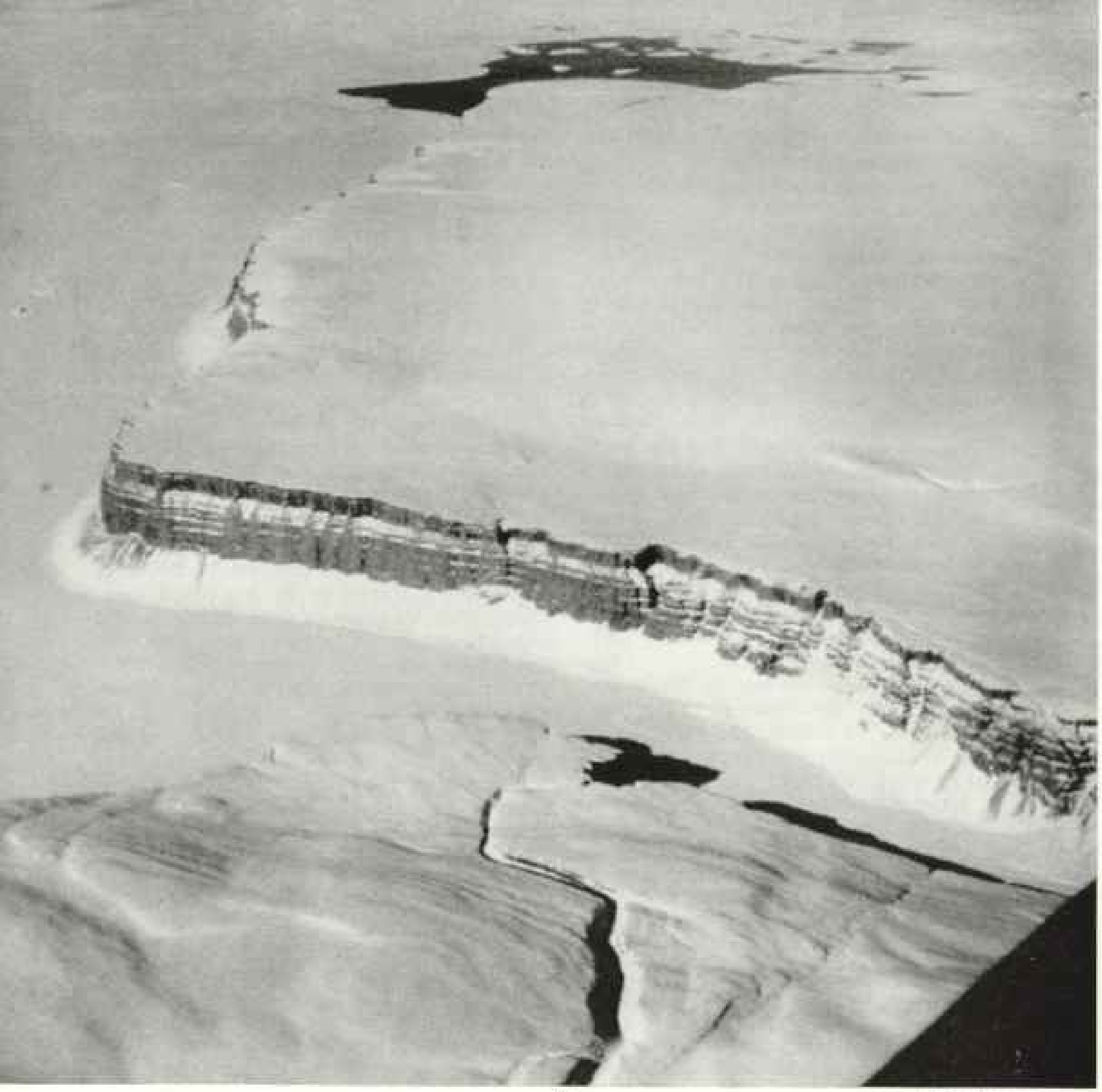
Of 26 men, 19 died. When relief steamers arrived June 22, 1884, Greely and six others were barely alive. By heroic devotion to duty they had kept their records, instruments, and collections in good condition. Greely was awarded the Congressional Medal of Honor, and was the first volunteer private soldier of the Civil War to obtain the rank of brigadier general, U. S. Army.

In 1888 he was one of 15 scientists to organize the National Geographic Society which he served as devoted trustee for 47 years continuously until his death in 1935.

North of the fort we passed over Lincoln Bay where Peary had set up the first of four main caches to support his dash to the Pole. Not far away we made out the snow-scraped runway of the tiny Canadian-American weather station at Alert.

Our plane let down to 5,000 feet, and the air waves sang with exchanges between our pilots and the communications personnel on the ground. No other sign of life, however, could be detected; in a white waste, Alert's few lonely buildings sat numb and frozen, buried to the eaves in drifted snow.

Past Alert we cruised to Cape Colan, the third cache point, near 83° N, 67° W, and thence to the fourth and final base, Cape Columbia, Peary's last landfall between the North American Continent and the Pole (page 477). Here at 5,000 feet we circled, trying to spot the cairn of stones and sledge planks which Peary erected here. In the featureless mantle of snow we could discern nothing—though several days before, as it turned out, a pair of Canadian scientists



474 Gilbert Grosvenor

**Troedsson Cliffs of Cape Calhoun Advertise Entrance to Narrow Channel Splitting Danish Greenland and Canadian Ellesmere. Crimson Walls Rise 1,385 Feet**

Charles Francis Hall, Sir George Nares, A. W. Greely, and Peary drove their ships past this striking promontory to safe anchorages close to the Arctic Ocean, 200 miles beyond. The photograph was made at 9,000 feet after the plane passed Humboldt Glacier, the world's largest known river of ice, which fronts Kane Basin for 50 miles. Amos Bonsall of the Elisha Kent Kane Expedition discovered it a century ago.

trekking overland from Alert had located the cairn and recovered some of Peary's original records and a piece of the Flag of the United States that he had left on his unsuccessful dash to the Pole in 1906.

North of Cape Columbia the pack ice spread over the Arctic Ocean. Pressure ridges raised zigzag lines across its flat, glistening surface, and thinly frozen or open leads of blue-black water scarred it with dark gashes. For the most part, however, we thought the going looked easier than the rough, tortured routes over Ellesmere Island which Peary had followed to get here.

The central section of this Arctic Ocean forms a bumpy basin, which averages about 12,000 feet in depth but has quite a few sea mounts and valleys. Its lowest known point is slightly more than 16,000 feet; at the Pole it is 14,150. Tidal range is low.

Currents sweeping through the Arctic Ocean have long intrigued explorers. After Lt. Comdr. G. W. De Long's ship, *Jeannette*, sank north of Siberia (77° 15'N, 155° E) in 1881, boxes and stores thought to be part of its wreckage were washed up three years later on Greenland's southern coast, at the other side of the Arctic (map, page 472).

Fridtjof Nansen concluded that this debris had drifted either across or very close to the

Pole. Allowing his ship *Fram* to be frozen in the pack ice at about the point where *Jeannette* went down, he stayed aboard until it was carried 314 miles closer to the Pole. Then he struck out with Johansen on their nearly disastrous march to 86° 14′ in 1895. The *Fram* drifted as far as 85° 57′ and reached Norway safely under the guidance of Sverdrup.

Later, casks specially designed by Adm. George W. Melville and Henry G. Bryant were released in 1899 at Point Barrow, Alaska, and the Bering Strait and drifted west of Spitsbergen, presumably having passed within a few degrees of the Pole. One was found in Iceland in 1905, and another in Norway in 1908. More recently, discovery of fresh-water ice islands floating in the Arctic ice pack has given scientists an excellent opportunity to plot the general movement of polar currents.

It is now known that the main circulation of Arctic water is northward from Bering Strait to a little beyond the Pole. Here part of the current flows south through the Greenland Sea. The rest curves abruptly right and sweeps the northern coast of Greenland and the Canadian archipelago. Reaching the Beaufort Sea north of Alaska, it turns right and rejoins the flow out of Bering Strait.

The ice islands thus far located have been rotating around the Pole in this roughly circular current at about one mile per day; a complete circuit takes from five to six years.

### A View of Ice Island T-3

It was thrilling to look down on the most famous of these islands, T-3, about one hour's flight from Cape Columbia. Only a few months earlier we had had the pleasure of working with Lt. Col. Joseph O. Fletcher, USAF, on his article, "Three Months on an Arctic Ice Island," published in the NATIONAL GEOGRAPHIC MAGAZINE for April, 1953.

Darker, thicker, and tougher than the soft, surrounding pack ice, T-3's great frozen platform showed up sharp and clear. Four by nine miles in size and weighing some four billion tons, it is a monstrous fragment of shelf ice torn from the primordial cap which once covered Ellesmere. Two other huge chunks that broke off from the same ice foot have become polar islands, too, floating across the northern seas. T-1 has drifted back to Ellesmere; T-2 crossed the Pole and at last report was somewhere off Greenland.

The U. S. Air Force, which discovered these vast ice rafts, maintains a post on T-3 for weather and geophysical research. Circling the ice island at 5,000 feet, we watched a plane take off from its resupply mission from Thule, chatted over the radio with the men below (who volunteer for four-month hitches on this barren but meteorologically important outpost), and gazed respectfully at their little huddle of Quonset huts, oil drums, tracked weasels, and radio masts.

Pools of melted water make landings on T-3 hazardous during much of the Arctic summer; so aerial missions must be crammed into a few short weeks. We said good-bye over the radio to our lonely friends on T-3 and pushed on toward the Pole, 300 miles distant.

Colonel Meyer, sitting near us, glanced at the pack ice. "When you've seen one pressure ridge, you've seen 'em all," said this veteran of 32 Polar flights. "From a hundred miles offshore to the Pole it doesn't change a whisker. And what's the Pole itself? Just a moment in time and space."

### Last Lap to the Pole

As mile after frozen mile unreeled beneath us, however, excitement in the plane mounted. Noses pressed against the wind-chilled Plexiglas windows, we craned our necks to scan the dazzling white expanse of ice and water below. The sun stood at 20° above the horizon; not a cloud showed against the blue. It brought to mind Peary's entry in his diary when he was struggling south along the Greenland shore in 1901 with frostbitten face and food all but gone: "Man was not born to die beneath such a sky!"

Our radio operator continued to relay our position to Thule and to T-3. From our seats in the cabin we could hear the pleasant buzz of conversation, punctuated occasionally with a spurt of laughter.

"All seems pretty cozy compared to our early flights up here," sighed Colonel Meyer. "We used to barrel along at 18,000 feet in complete radio silence for hours, just tapping a key to maintain contact with Point Barrow over in Alaska. Wasn't anybody up here to talk with. And cold! We always kept the cabin temperature near freezing, so the men would have all their arctic clothing on if we ever had to come down quick. Never saw another plane, or any sign of life at all."

Five minutes from the Pole the pilots told us to get ready. We checked our cameras again, and Grosvenor went forward to the radio operator's seat in the cockpit, which had access to a small chute ordinarily used for releasing smoke bombs to check drift. Charles Althoff at The Society's headquarters had attached a steel spike to the webbing of a big National Geographic flag and rolled it so that it formed a sort of padded spear (page 471). Now, quickly confirming our position, the navigator cried:

"Flag away!"

Down through the chute plummeted The Society's banner. It was the second time it had

been planted by air on the earth's geographical North Pole; Byrd had dropped it first from the *Josephine Ford* on his flight of May 9, 1926. Now a new one surmounted the globe.

To celebrate the exact moment of passing the Pole, our plane commander rang the emergency bell for a bail out. Duly warned, we did not reach for our parachutes but simply for each other's hands. And we had reason to congratulate ourselves: we were assured that never had weather conditions been so favorable for obtaining a precise pinpoint of the Pole (pages 478, 479).

### Flying into Tomorrow

"We are there," the navigators stated firmly. "No possible question about it."

It was a curious feeling. For a second we had lived at the one point in the world where there is no north or east or west, but only south; where in summer the sun neither rises nor sets.

At the time we flew over the Pole the temperature at our elevation was 0° F.; on the surface of the polar ice, an estimated 5° F., with a wind velocity of five miles per hour.

Turning left a mile farther on, we made at 7,500 feet a complete circumnavigation of the Pole at latitude 89° 59′ N. In this short counterclockwise swing we passed through every time zone in the world and every degree of longitude. In five minutes, we had flown from Wednesday, May 20, into Thursday, May 21, and then returned to Wednesday when we crossed the imaginary date line a second time.

The Roman writer Tacitus felt quite certain that anyone standing near the Pole could look eastward and see Phoebus, the sun's charioteer, rise from the other side of the world. "The sound he makes on emerging from the waters can be heard," declared Tacitus, "and the form of his steeds is visible."

Alas for the classical view! We looked in vain. The sun, poised placidly in the sky, shone with a pedestrian light; no Olympian horses urged it along its Arctic orbit.

We had been interested in the positiveness with which our navigators had announced our crossing of the Pole. How could they have been so sure we hadn't passed to one side or the other? Our magnetic compass would have been of little use, for we were well within that area around the North Magnetic Pole (which lies at about 73°N, 100°W) in which the directive force is almost straight down and therefore not much help in controlling a horizontal needle.

Modern polar navigators use instead a directional gyro which maintains with reasonable accuracy whatever bearing it is set for. Our navigators adjusted their gyro at Thule for the correct bearing, and then checked it every half hour by taking bearings on the sun. If we had been flying in the polar night, they would have taken fixes on the stars.

The reader may ask how our pilots could plot a true course in this northern area. For here all meridians (which run north to south) converge at the Pole, packed so closely together that an airman may scarcely have noted his crossing of one meridian before his plane has roared across another.

Again, suppose his plane is at the Pole itself and he wants to take a heading for New York. What compass bearing should he choose? You might say: due south, or 180°. But *all* meridians from the Pole are due south, and a 180° course could land you as easily in San Francisco or Helsinki as New York.

"How do you overcome this confusion?" we asked Colonel Meyer.

"Well, for one thing," he said, "we draw a grid across our polar chart. All meridians point equally north and south, but we choose one of them—say, the Greenwich meridian—and let that stand for grid north. Then we draw lines parallel to the Greenwich meridian three inches apart, and measure our direction from these lines. This gives us a simple chart on which to plot our course."

"But it doesn't solve your basic problems of direction and position, does it?"

"No, though it makes it simpler to navigate on dead reckoning. To get accurate headings and accurate fixes along the course, we have to depend on the sun and the stars. Radar gives us our ground speed and our drift, but it isn't much use over the pack ice in determining our position, because there aren't any stable, recognizable landmarks."

"What do you do in the twilight weeks when the sun is below the horizon and the stars are pretty faint?"

### Sky Compass Explained

"It isn't easy," said Meyer. "But by means of a Pfund sky compass we are able to determine the aircraft's heading even when the sun is 6° below the horizon. This instrument operates under a principle utilizing two polarized lenses from which the direction of the source of light may be determined. Then we just keep a close check on our ground speed, elapsed time, drift, and so forth."

"How were you able to pinpoint the Pole on this flight so precisely?"

"Because we started the last lap from an exact fix—the Ice Island T-3—with a run of 300 miles to the Pole. What's more, we had the sun in sight all the way, to give us frequent position lines and heading checks, and we had the pack ice clearly in view below

Gilbert Grosvenor

**Cape Columbia's Bleak Headland (Foreground) Offered Peary a Final Glimpse of Land**

Sledging from Ellesmere's north coast, the Commander began his journey to the Pole March 1, 1909, a 37-day trip. Flying in a USAF plane on a routine mission, the authors retraced Peary's route in 3½ hours.

us, to check our drift and ground speed by timing. Conditions, in short, just couldn't have been better."

Our plane wheeled southward, headed toward Greenland. We busied ourselves writing letters to trustees and staff men and women of The Society, to Admiral Byrd, Commander MacMillan, and to various officers in the armed services long interested in Arctic exploration. These messages were later flown from Thule to Ice Island T-3 and individually postmarked "North Pole."

### Greetings to the White House

One note we addressed to the White House. It read:

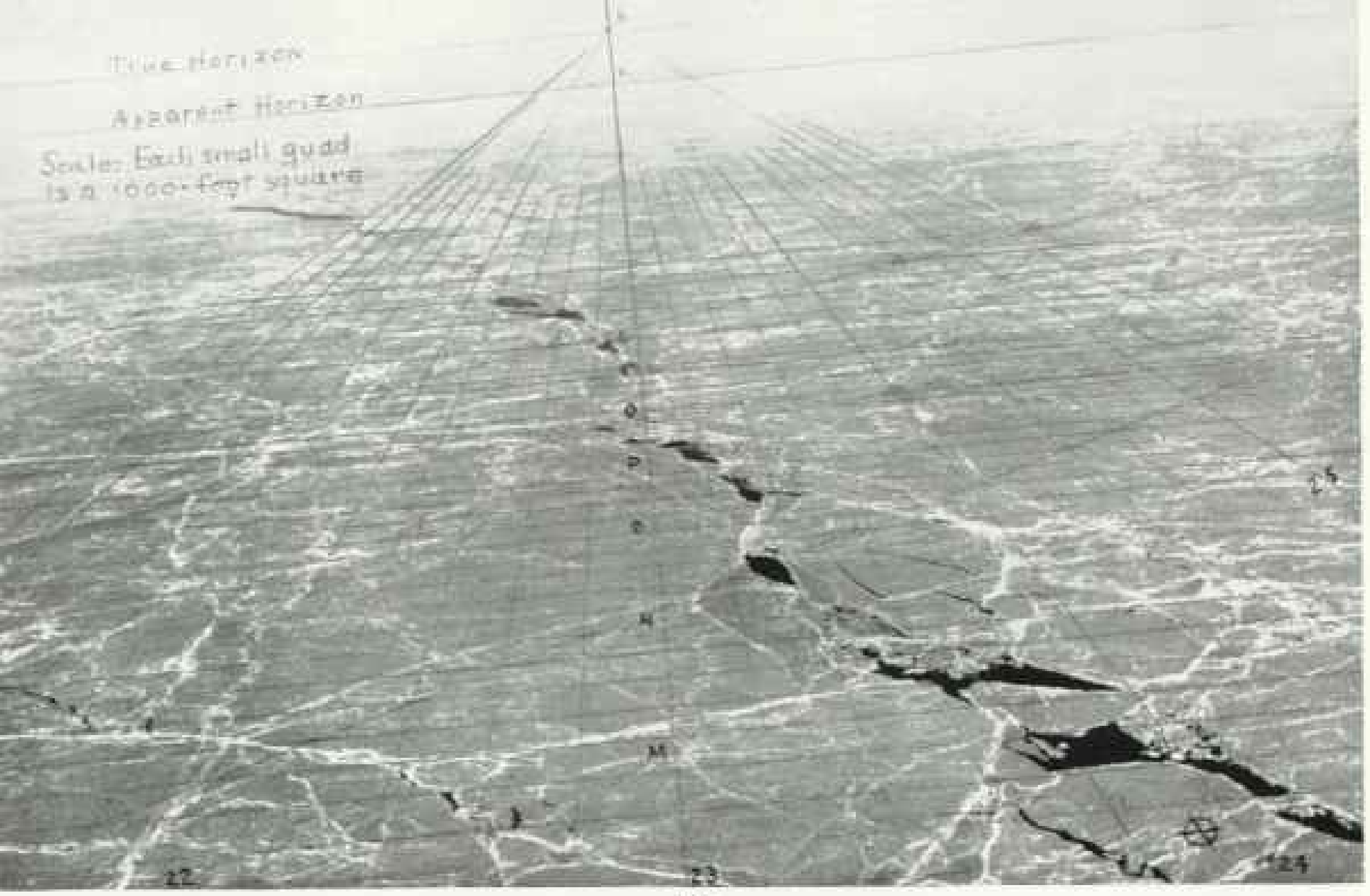
"To President and Mrs. Eisenhower. We send respectful greetings and best wishes from the North Pole and Island T-3. The air base at Thule is superb and, as you know well, your Air Force operating here and to it from U. S. A. superlative. (signed) Gilbert Grosvenor and Thomas W. McKnew."

Another message we were delighted to send went to Mrs. Robert E. Peary, widow of the Admiral, and to her daughter. It arrived, as it turned out, on Mrs. Peary's 90th birthday. Mrs. Peary was the first white woman to brave the rigors of an Arctic winter. She wintered with her husband in 1891-1892 and 1893-1894 at 70 miles north of Thule. Their daughter Marie Ahnighito Peary (Stafford) was the first white child to be born (September 12, 1893) at such a high latitude.

The 576-mile dog-leg we were now following was taking us a good deal nearer the so-called "European route" to the Pole than we had been on our northward course. To our left, far out of sight, lay Franz Josef Land, where Nansen had wintered after his unsuccessful attempt to drift across the Pole in *Fram*.

Still to our left, but nearer, rode the island of West Spitsbergen. From its frozen surface Byrd and Bennett took off on May 9, 1926, on their great mission. Three days later Lincoln Ellsworth, Roald Amundsen, and Umberto Nobile in the Italian dirigible *Norge* soared off on the last leg of their flight over the Pole to Alaska.

It required more than four hours to make our first landfall in east Greenland, a grim little weather station called appropriately and simply "Nord." It had an airstrip, we were told, but four feet of snow still covered it when we passed overhead. Nord is accessible during four and a half months of the year. For

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**Grosvenor's Photographs Enabled National Geographic Cartographers to Pinpoint the Pole**

What does the North Pole look like? To children it is a candy-striped signpost planted outside Santa Claus's workshop. To cartographers it is a point on the globe, latitude 90° N. To polar navigators it is a position in time and space determined by complex calculations of ground speed, drift, compass errors, elapsed time, and celestial fixes. But to the authors, flying over the Pole at 11:29 a. m. eastern standard time (1629 Greenwich time) on May 20, 1953, it was a particular floe of crystal ice in the vast, ever-shifting pack.

Mr. Grosvenor took 15 photographs from the window of the Air Force C-54 as it twice circled the Pole counterclockwise at an average altitude of 7,500 feet (page 476). Painstakingly relating one picture to another by minute comparison of ice floes and open water, he plotted the position and angle from which he had taken each photograph. He was the first to locate the Pole from the air by making photographs from all sides; later, plotting the lines of focus, he found they met at the Pole like spokes of a wheel at its hub. Having thus centered his flight, he concluded that the Pole was at the floe (roughly 2,000 feet wide by 4,000 long) here shown by a circled cross (lower right).

Photogrammetric engineer G. C. Tewinkel of the U. S. Coast and Geodetic Survey, asked to check the computations, laid down a perspective grid on the photographs and embarked upon involved mathematical formulae. His conclusion: Mr. Grosvenor was correct.

Illustration above shows long line of leads stretching south from the Pole. Low as they appear here, the pressure ridges (white lines) on ice pack are 10 to 30 feet high. They have been thrust up by grinding floes (page 484). Each grid square in overlay measures 1,000 feet along the side.

the other seven and one half, the volunteers who man its three tiny buildings must shift for themselves. They can receive supplies by airdrop, but only in dire emergencies do ski-equipped aircraft risk a landing there.

From Nord we veered to starboard, crossing beautiful Independence Fjord (discovered and named by Peary on the Fourth of July 1892) and skirting the northern tip of the vast icecap (page 481). This sheet of fresh-water ice, which covers nearly four-fifths of Greenland's 827,300 square miles, is reason enough for the ancient name: "Land of Desolation," as the English navigator John Davis, called it after his voyage of 1585.

But this forbidding island drew seafarers and explorers and colonists to it from the very morning of history. Eric the Red and his Vikings, manning their shallow, 80-foot, square-sailed ships, headed their high prows for Greenland as early as A. D. 983. For 300 years and more Norsemen settled the country some 1,000 miles south of Thule, established nearly 200 townships, prospered—and perished.

No man knows even now what struck them down. But by 1400 they were gone, remembered only as dim figures in the old, heroic sagas. Not till 1576, when Martin Frobisher saw Greenland's southern tip "like pinnacles of steeples all covered with snow," did European eyes look on Eric's country again.

After Frobisher came Davis, and in his wake a trio of English captains—Cunningham, Knight, and Hall—vainly commissioned by King Christian IV of Denmark and Norway to find the lost Viking colonists. A century later came the father of modern Greenland, Hans Povelsen Egede, who founded in 1721 the tiny camp from which Denmark's chain of settlements would slowly grow.

▲ **Circled Cross on Floe Marks the Pole**

Daily the earth's northern axis alters its face as pack ice drifts across. No marker can ever fix the Pole for long. Here the Arctic Ocean is 14,150 feet deep.

▼ **View of Pole from Other Side of Floe**

Since these photographs were taken the huge ice cake may have traveled many miles, crashing thunderously against other blocks, crushing them or being crushed.

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**A Frozen River Grinds Down to the Polar Sea from Greenland's Eternal Icecap**

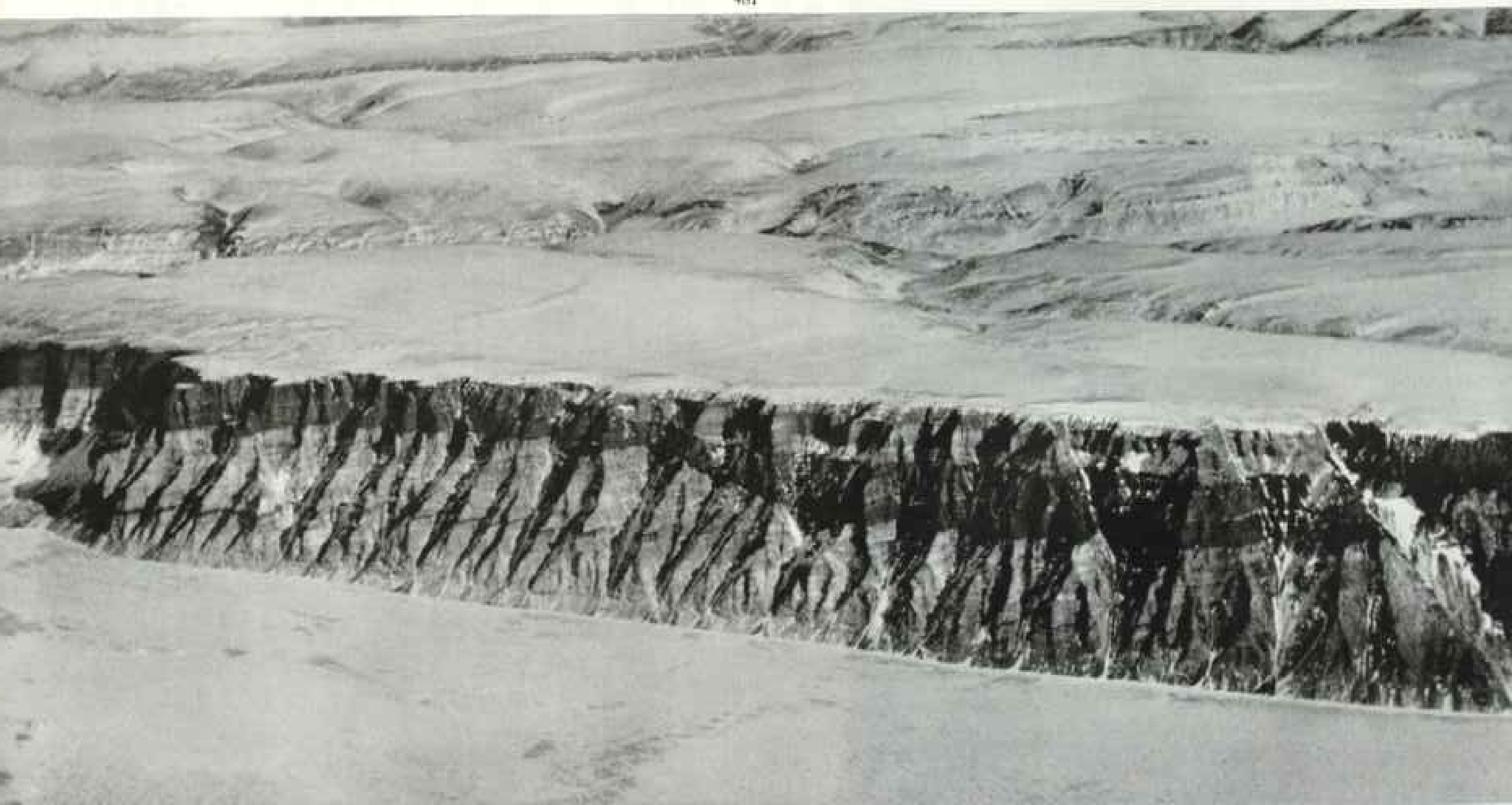
Four-fifths of Greenland's surface lies beneath a sea of ice. At places the cap of solid ice measures more than 8,000 feet in thickness. Here along the coast of Peary Land it tapers to a mere frosting on the exposed rocks. Wind-blown ice crystals blurred the horizon as Mr. McKnew took the picture.

**Peary on His First Great March Across the Icecap Discovered a Majestic Fjord, July 4, 1892, and Named It Independence Bay**

His footwear cut to pieces, the exhausted explorer stumbled to the brink of a gigantic wall 3,800 feet high and saw water stretching eastward. "It was almost impossible," he wrote, "for us to believe that we were standing on the northern shore of Greenland as we gazed from the summit of this bronze cliff, with the most brilliant sunshine all about us, with yellow poppies growing between the rocks around our feet, and a herd of musk-oxen in the valley behind us . . . Down in that same valley I had found an old friend, a dandelion in bloom, and had seen the bullet-like flight and heard the energetic buzz of the bumble-bee."

Last May snow and ice glared from land and bay, but the cliff flashed to the authors' plane a crimson greeting, the result of a cover of lichens. Mr. Grosvenor's photograph, the first known aerial shot of the feature now called Independence Fjord, was taken down-bay from the point described by Peary.





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**Mr. Grosvenor Interviews Lt. Col. Charles R. Meyer, a Veteran of 32 Polar Flights**

Air Force planes of the 58th Strategic Reconnaissance Squadron, Weather, flying missions out of Alaska have shuttled above the Pole so often that Colonel Meyer can describe his many crossings as "purely routine." The 58th squadron sponsors the "honorable & loyal society" of Pole Vaulters, which has more than a thousand military members. The authors became the ninth and tenth civilians to qualify.

Americans played a great role in charting Greenland's ice-shrouded profile. Amos Bonsall, of the Elisha Kent Kane Expedition, searching for the doomed Franklin Expedition, discovered the 50-mile-long front of Humboldt Glacier. Charles Francis Hall pushed 400 miles past Kane's last camp up to 82° 11′ N.; and in 1882 General Greely advanced to 83° 24′—a new "farthest north."

As for Peary, in marches that totaled thousands of miles, he filled in all but a small gap in the coastal outline of Greenland and proved the vast ice mass was an island.

### Danes Mapped Eastern Coast

But the intrepid Danes had not been idle. Men of their Royal Navy—Mourier, Wandel, Holm, Garde, Ryder, and Amdrup—and other daring scientists, Hagen, Koch, Mikkelsen, Mylius Erichsen, completed the dangerous job of mapping the eastern coast.

Peary, recognizing Greenland's strategic importance, thought the United States should stand by its claims upon it. "Stranger things have happened," he wrote in 1916, "than that Greenland, in our hands, might furnish an important North Atlantic naval and aeronautical base."

The Admiral's name is inextricably linked with the country he so appreciated. The big northeastern corner of Greenland over which we flew is now appropriately called Peary Land (page 480).

While we were on this flight, discussions to make this colony an integral part of Denmark were drawing to a close.

Little Denmark continued its benign and able stewardship of an island 50 times its own size until June 5, 1953, the country's traditional Constitution Day. On that day, King Frederik IX signed a new constitution by which Greenland formally became a part of the Danish kingdom.

As we droned across the northern edge of the icecap we kept a close lookout for weasels —the tracked snow vehicles that would be carrying Britain's North Greenland Expedition. Backed by the Royal Geographical Society and the Scott Polar Research Institute and aided by Her Majesty's armed forces, this party is making new scientific studies of the area. But, in the immensity of this white Sahara of ice and snow, we could catch no glimpse of them or of their trail. Later we learned that our course was to the north of the expedition's base at Britannia Lake.

Homing on the Thule radio beacon, we ran once more into heavy undercast. Our plane circled the base carefully, then plunged into the murky clouds and emerged serenely above

the reassuringly familiar runways. In a moment our wheels touched down, 13 hours and 39 minutes after our take-off that morning. We had flown 2,323 miles—enough to have taken us from Thule to Dublin, Stockholm, Liverpool, or Oslo; almost enough to have let us glide over Warsaw, Moscow, Copenhagen, or Leningrad.

Thule's significance as a military air base was by now no novelty to us. Talking with officers, we were impressed by the magnitude of the logistical problem in maintaining these remote northern outposts. It was easy for us to see the need for these on-the-spot inspections, and to realize that such installations require far more than long-range direction from the Pentagon.

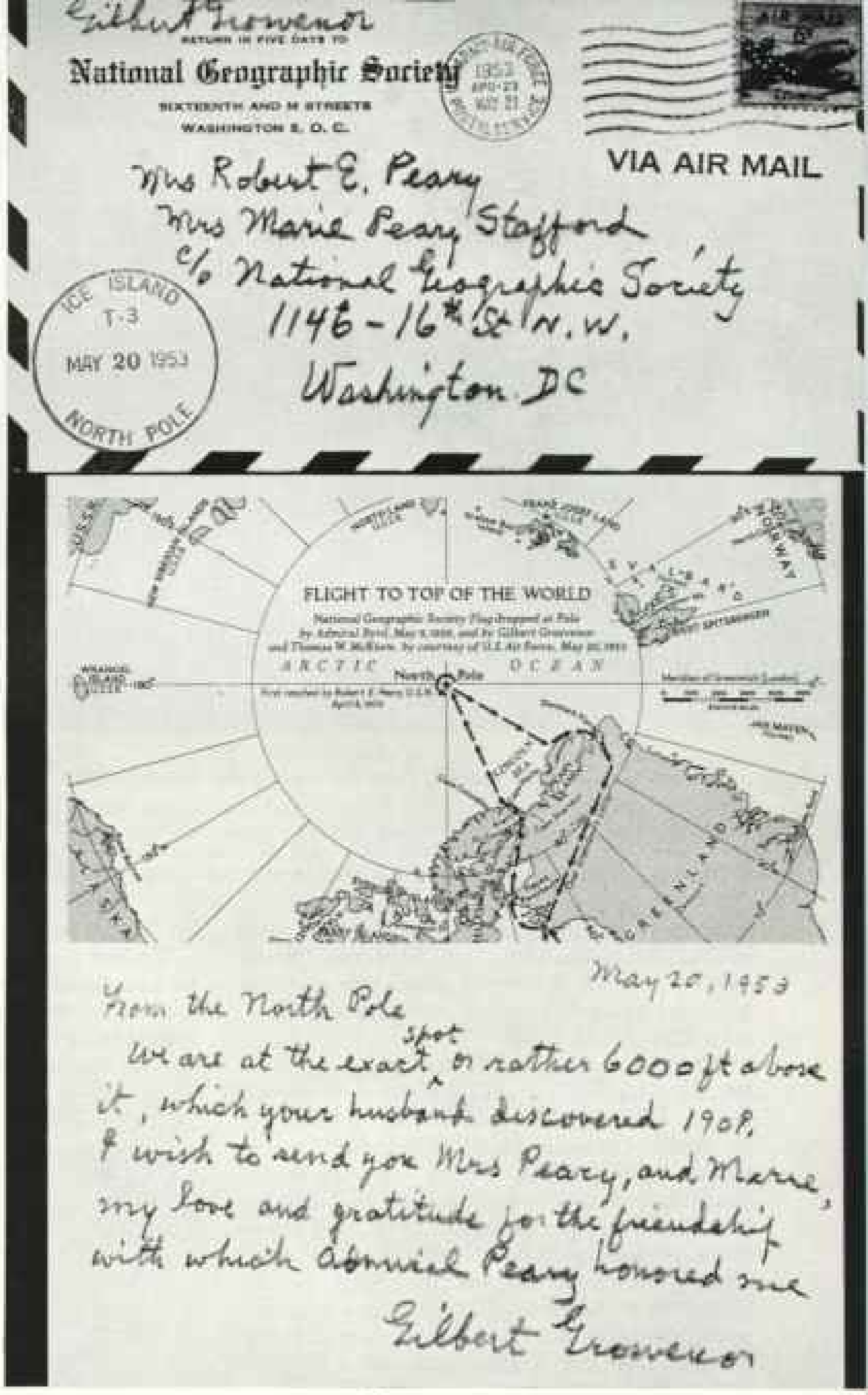
### Radar to the Rescue

Already Thule has proved invaluable to the planes of other nations crossing the polar wastes. The radar defense unit has helped many an uncertain navigator get his bearings and avoid directional errors which could be not merely tedious but tragic.

A dramatic instance came recently when a British four-motored transport carrying high-ranking officers from the Royal Air War College flew over the Greenland cap from Iceland on its way to Alberta. Plagued by low ceilings and poor visibility, the big plane hovered above Thule, unable to land. Its pilot didn't dare risk an instrument approach, and the towering icecap kept him from spiraling down low enough to be picked up by Ground Control Approach radar.

The only hope lay in being "talked down" by Thule's defense radar unit of the United States. Unluckily, the unit had just been installing new equipment—and it wasn't ready. As the plane circled and circled above the clouds, with its gas running low, Thule's radarmen feverishly reassembled their gear.

An hour later the pilot radioed: "I say, chaps, our petrol is rather low. We'll have to ditch the aircraft." He had hardly finished, however, when the "blip," or spot of light, denoting his ship circling east of Thule at 24,000 feet turned up at last on Thule's radarscope.

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North Pole Mail Went to Mrs. Peary and Her Daughter

As their C-54 headed back from the Pole, Mr. Grosvenor and Mr. McKnew wrote notes to friends of The Society, including President Eisenhower, Admiral Byrd, and Commander MacMillan (page 477). Letters were dropped off at Thule, flown to Ice Island T-3 for postmarking, and forwarded by air. Mrs. Peary received hers on her 90th birthday.

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**Peary's Men, Detouring Around an Open Lead, Fight Through Jumbled Pack Ice**

In summer such ice cakes, often 200 feet thick and several miles wide, drift across the Arctic Ocean and, colliding with a cannonlike roar, throw up huge pressure ridges (page 478). Once when wintering in Ellesmere Island's "Great Dark," Peary noted that "only he who has risen . . . and gone to bed again by lamplight, day after day, week after week, month after month, can know how beautiful is the sunlight."

Carefully, quickly, the defense unit men guided the pilot down, level by level, till the ground control operators were able to spot him and bring him safely onto the airstrip—with fuel almost gone.

While our own plane was being prepared for the long flight south, we dined at the officers' club and then took off at 11:50 p. m., in broad daylight, for Newfoundland. We awoke next morning winging our way across Baffin Island and down the coast of Labrador past Hebron, Cape Mugford, Nain, and Davis Inlet to Goose Bay. Then we dog-legged slightly eastward across the Gulf of St. Lawrence to Stephenville. It was a pleasant sensation after our long hours over ice and snow to step out of the plane into a brilliant spring day, bathed in warm sunlight.

From Newfoundland we cruised south along the length of Nova Scotia, passing near Baddeck, Cape Breton, the Bras d'Or Lakes, and the Grosvenor summer home, "Beinn Bhreagh." An over-water hop brought us a landfall at Cape Cod's tip, and a short jog put us on the Boston-New York airway.

When we passed the steel-and-concrete forest of Manhattan, transformed by darkness and a million lights into a twinkling fairyland, we knew we were nearing home. An hour later we picked up the massive beacons of Washington—the red lights at the top of the Washington Monument, the floodlit dome of the Capitol, the Potomac glistening under its six bridges—and made our approach to Andrews Air Force Base, Maryland, near the Capital.

We had been gone some 94 hours, of which we had spent about 48 in the air and we had covered more than 8,800 miles.

Returning to headquarters, we were honored to receive our first letter of congratulation:

THE WHITE HOUSE
WASHINGTON

May 25, 1953.

Personal

Dear Dr. Grosvenor:

The greetings which you and Mr. McKnew sent me from the North Pole on May 20th were received by me at noon today. I am delighted at your thoughtfulness, and with what you say about the Air Force operations.

Please thank Mr. McKnew for his message.

With best wishes,

Sincerely,

Dwight D. Eisenhower

Dr. Gilbert Grosvenor,
National Geographic Society,
Washington 6, D. C.

# At World's End in Hunza

## This Strange Shangri-La Near the Himalayas Has Few Laws or Taxes and No Army; Bridegrooms Take Mother on the Honeymoon

By Jean and Franc Shor

*With Illustrations from Photographs by the Authors*

HIGH up under the roof of the world, where the towering Himalayas reach eastward to Tibet and the rugged Karakoram Range stretches west to Afghanistan, lies the remote and mysterious land of Hunza, peopled by a race whose origins are lost in time.

Hunza's boundaries are indefinite; its populated area lies along the Hunza River Valley, which is seldom more than a mile wide. Its 25,000 inhabitants are taller and fairer of skin than their neighbors; their agricultural methods are superior. They irrigate the rocky soil with water from melting glaciers by a system of canals which is an engineering wonder.

These people have a well-ordered and stable economy. A famous British physician has described them as the healthiest people in the world. They are, as my wife Jean and I found, certainly among the most hospitable.

### Tribal War Causes Detour

We first stumbled into Hunza accidentally. Crossing the Pamir Plateau on yaks with a tribe of Afghan Kirghiz, we had found the border of Chinese Turkistan blocked by tribal warfare. Our military escort and interpreter had deserted us, but a Kirghiz chief lent us horses, yaks, and a guide he said would take us to Turkistan by another route.

We were weary, ill, and unsure of our whereabouts. But our guide led us over snow-capped 20,000-foot Dehli Sang Pass, down steep slopes into a narrow valley where green fields and orchards lined terraced cliffs. Villagers brought us food and gave us a bungalow in which to rest. We were in Hunza.*

The Mir, or King, of Hunza, Mohammed Jamal Khan, made us welcome.

"I think you will like our country," he said. "Our lives are simple but pleasant. We have few laws, almost no taxes, and no army. No one is rich, but neither is anyone in need. We are, I think, the world's happiest people."

The Mir urged us to remain and get better acquainted with his country. But the first snows were threatening to block the passes, and we had to leave. We accepted his invitation to return, but with little hope that we would ever again see his terraced valley.

In the spring of 1952, however, we visited Pakistan on assignment for the National Geographic Magazine.† Pakistan controls Hunza's foreign relations, communications, and defense, though the little mountain country is independent in internal affairs. We asked for permission to visit the Mir.

"I'm afraid there is little hope," a Pakistan official told us. "Hunza is a highly strategic area. It borders Chinese Turkistan and Afghanistan and is only a few miles from Russia on one side and India on the other. Technically it's part of Jammu and Kashmir. Some people might be suspicious if we permitted Americans to travel there."

By good fortune the Mir himself came to Karachi a few days later on one of his infrequent visits to the outside world. He assured the Pakistanis we would be welcome. Finally we found ourselves in the office of Kazim Raza, director of Pakistan's Intelligence Bureau.

"Do not think us rude," he said, "but people who want to visit strategic places are often not what they claim. After we have studied some of the articles you have written, we shall decide."

### Toward Earth's Highest Peaks

In a week permission was granted. We sent a radio message to the Mir and flew north to Rawalpindi. From there a freight plane flew us to Gilgit, Pakistan's most important northern outpost (map, page 493). Syed Faridullah, political agent for the area, told us of developments since our previous visit.

"Hunza is still hard to reach," he said, "but now there is a jeep road to Chalt, first village in the Mir's domain. That 32-mile trip once took two days; now it takes three hours. Eventually the road will go all the way to Baltit, Hunza's capital."

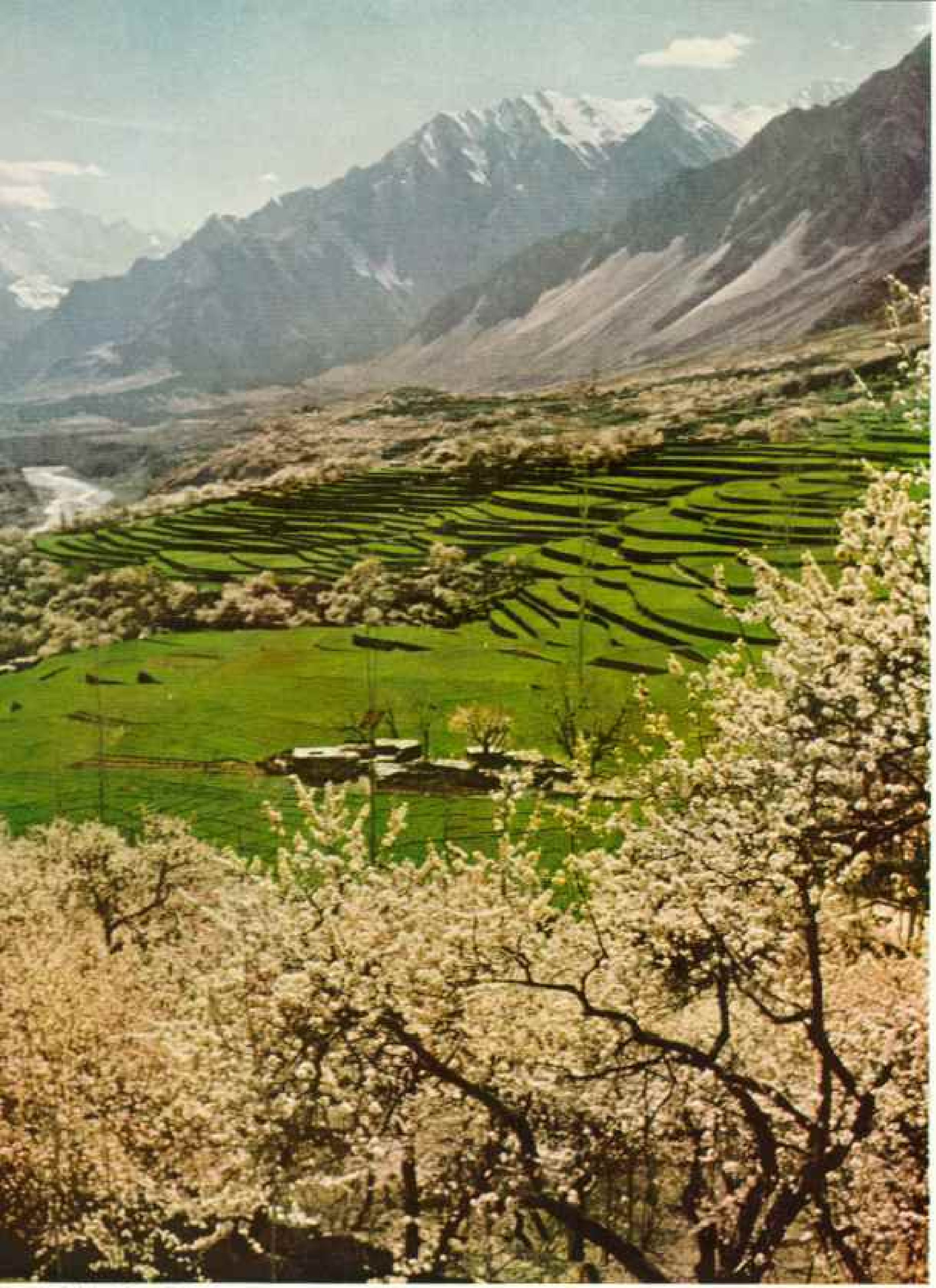
I was upset by the prospect.

"Isolation has been Hunza's salvation," I said. "Its people are healthier, happier, and better off than most in this part of the continent. The road might ruin the country."

"Don't worry," said Faridullah. "The Mir

* See "We Took the Highroad in Afghanistan," by Jean and Franc Shor, National Geographic Magazine, November, 1950.

† See "Pakistan, New Nation in an Old Land," by Jean and Franc Shor, National Geographic Magazine, November, 1952.







Kodachrome by Jean and Franc Shor, National Geographic Staff

**This Lush Valley, Aglow with Blossoming Apricots, Is the Heart of Idyllic Hunza**

Contented villagers of this semi-independent kingdom near the Himalayas spend their lives within sight of some of the world's highest mountains. Terraced fields reflect the labor of generations of Hunzukuts.

is still an independent ruler inside his state, and no one could use the road without his permission. It will bring doctors and teachers to Hunza more easily and won't become an avenue for exploitation."

The next day Mirzah Hussain, a sturdy, 78-year-old Hunzukut who has served the Mir's family for 50 years, walked into Gilgit with a note from the Mir, telling us that horses were awaiting us at Chalt. The note had been written in Baltit, 65 miles away.

"When did the Mir give you this?" I asked.

"Yesterday."

"And how did you get here?"

"I walked."

Syed Faridullah asked a question, then smiled as he interpreted the answer for us.

"He says he would have ridden a horse, but he was in a hurry!"

### Rugged Highroad to Hunza

We left by jeep for Chalt the next morning. For a mile or two the new road ran smoothly beside the Gilgit River (page 488). Jean and I were in the front seat with the driver, while Mirzah sat proudly atop the baggage, which filled the rear. It was his first jeep ride, and he was bursting with pride, salaaming right and left to everyone we passed.

A sharp left turn brought us into the Hunza Valley. The road began to climb. As it climbed it grew narrower, as it narrowed it grew rougher, and as it grew rougher Mirzah began to look worried.

No longer did he smile and wave. His expression grew grim. The road was only a mountain trail now, and every few feet a resounding jolt threatened to toss him into the canyon. I suggested that the driver slow down, but he was deaf to the idea. We skidded around a turn, knocking rocks and pebbles into space. Mirzah grabbed the driver and shouted at him. He stopped.

Mirzah staggered around a corner; after a long five minutes he returned, pale and shaken.

"Horse is better," he said, and reluctantly climbed aboard.

Jean and I came to agree with him. The road became a rocky ledge, blasted from sheer cliffs. We met one horseman, who was forced to ride back half a mile to a place wide enough for us to pass. Men on foot scrambled up rocky walls to make room. Only the driver was happy; he drove with gay abandon, taking his eyes from the road when he spoke to us and using both hands for gestures. We reached Chalt at noon, shaken, sore, and scared to death.

The Mir had arranged a reception. Musicians serenaded us with wailing pipes and thumping drums. Chalt's mayor, tall and dignified, clad in a long woolen robe and sporting a brilliantly hennaed beard, welcomed us to a little rest bungalow. Villagers, wearing the same flowing dress, smiled and salaamed.

Inside the bungalow a lunch of roast partridge, hot flat bread, and fresh fruits and nuts was spread on a hand-hewn table. After we had eaten, we went into the courtyard and found our baggage loaded on two packhorses. Two other ponies, less than four feet tall, were saddled and waiting.

"Mir Sahib sends salaams," said the mayor. "Best horses. Very strong. Good journey."

It is only eight miles from Chalt to Maiun, but the trail makes up in ruggedness what it lacks in length. After a brief and deceptively easy amble through a pleasant glade we followed the Hunza River and started up the Hunza road. This path, which stretches from Chinese Turkistan to Gilgit, has been known for a thousand years for its beauty—and its danger.

Centuries ago it was the chief highway from Kashgar to Kashmir. Daring traders led pack trains laden with silks, tea, and porcelain along its frightening summits and narrow galleries. Returning, they brought spices and gold and ivory. One successful round trip might make a man wealthy—but many a trader lost horses, goods, and even his life in sudden landslides.

Not far from Chalt we gazed at one of the world's most magnificent mountains. Rakaposhi, Goddess of the Snows, held her 25,550-foot peak proudly against the deep-blue sky. An awesome granite pyramid, mantled with snow, caps the unconquered titan.

### Land of Mountain Giants

Of the Hunza Valley, Lord Curzon wrote 50 years ago, "Within a range of seventy miles there are eight crests with an elevation of over 24,000 feet, while the little state of Hunza alone is said to contain more summits of over 20,000 feet than there are of over 10,000 feet in the entire Alps."*

Even among such giants Rakaposhi is inspiring. We stood on the 7,000-foot trail and looked upward three and a half miles at the wisps of snow whipping across its face (page 512).

We moved slowly that first afternoon. The trail alternately rose steeply and dropped with equal swiftness. As we moved upward along a sheer cliff, we came to our first gallery. These precarious bridgelike passages, whereby the Hunzukuts have created footroom where Nature had no such intention, have been

* *Leaves From a Viceroy's Note-Book and Other Papers*, London, 1916; by permission of the publishers, MacMillan & Co., Ltd.

Linking Hunza to Pakistan, This Rocky Road Will Eventually End the Mountain Kingdom's Isolation

## In a Wood-poor Land, Twigs and Brush Keep Home Fires Burning

At the edge of enormous Batura Glacier, Jean Shor chats with guide Nyet Shah. Hunzukuts are famed for their endurance at high altitudes. On long treks they sometimes carry a supply of home-tanned leather; three times during this trip Nyet Shah replaced the soles of his soft, knee-length boots.

When the Shors sighted them, these Hunza girls raised index fingers and moved them in slow circles about their right ears. This, Nyet Shah explained, is a gesture of respect, not derision. The girl on the left carries a basketload of fuel, twigs painstakingly gathered from sparsely wooded Hunza hillsides.

Kodachromes by Jean and Franc Shor, National Geographic Staff

referred to as "triumphs of engineering." I think of them as triumphs of faith!

The principle of the gallery is simple. You are moving along a cliff face, perhaps 2,000 feet above a valley floor. You are on a rocky ledge, say two feet wide. The ledge narrows, then disappears; but 20 feet ahead it reappears. What do you do?

Hunzukut trail builders long ago found a way to bridge these gaps. Usually there is a crack in the face of the trailless cliff. Into this crack they drive a line of flat rocks. On these they lay other rocks, the second layer protruding a bit. They add more layers of rock, interlaced with branches, until the level of the trail is reached. Thus a ledge is built, perhaps 30 inches wide—more likely 18—which is called a *rafik*, or gallery (page 496).

### Across Shaky Man-made Ledges

Men and horses cross these precarious perches. Our packers led the way; Jean and I swallowed hard and followed. Looking down, I was horrified to see daylight through the rocks. From the next gallery I glimpsed several horses lying flattened on a ledge protruding from the cliff 500 feet below.

"Oh, yes," said the Mir, when I mentioned it to him later. "A gallery blew off in a wind. You were fortunate. I worried while you were coming; it was such a windy day!"

The resthouse at Maiun sheltered two very tired travelers that night. Mirzah had walked ahead to prepare for our arrival, and we found him at the fireplace grilling skewers of lamb. Seasoned with cumin, it was delicious. We spread our sleeping bags on beds of crossed rawhide thongs and were soon dead to the world.

We began the 24-mile journey to Baltit at dawn. Above Maiun the valley narrows, and the trail with it. Galleries came more frequently, each shakier than the last. At one corner the path was so narrow we had to unload the pack animals to make the turn. We were climbing steadily. Rakaposhi still towered above us, but more and more magnificent summits were coming into view.

Near midday a sudden turn brought us a view of Baltit. In the clear air its 600-year-old castle towered before us, seeming only a few thousand yards ahead.

"How far?" I asked Mirzah.

"Eight miles," he replied. "Three hours."

I glanced at my wrist. My watch was gone! I remembered that at midmorning I had felt something strike my boot, but had assumed it was a stone cast by the horse ahead. I started to rein up, then recalled the rocky trail. It might be 10 miles back; no watch was worth 20 miles of such travel. I would tell the Mir; he might send someone to look for it.

An hour later, as we slipped down a rocky slope, I heard a shout behind us. Down the trail at a steady trot came a barefoot Hunzukut. He spoke briefly to Mirzah, then came to me and held out my watch.

"Sahib?" he asked, pointing to my wrist.

I looked at my wrist, pretended surprise, then showed him the strap marks. Replacing the watch, I thanked him profusely.

"How far?" I asked in Urdu, pointing to the watch.

He named a village eight miles back. Gratefully I brought out a handful of Pakistan rupees. His face fell.

"Nay, Sahib!" he said, firmly. He seized my hand, shook it warmly, and was trotting back along the trail before I could stop him.

Baltit sits above a broad, green valley, where terraced fields step down to the sheer banks of the Hunza River (page 486). Apricot and apple trees, heavy with blossoms, lined the last mile of the trail. Mirzah led us proudly into the grounds of the Mir's new palace. Fifty yards from the doorway an arch over the path spelled out "WEL—COME" in red letters. The Mir, dressed in flannels and a tweed jacket, came to meet us.

"Welcome home," he said. "We have always been sure you would return."

The Mir is short and squarely built, with dark hair and eyes and a ready smile. He studied English at a British school in Gilgit and speaks it perfectly. Besides Burushaski, the Hunza tongue, he is also fluent in Persian, Urdu, Arabic, and half a dozen dialects of surrounding tribes.

He lives simply. His ancestors owned most of the land in Hunza Valley and collected a tax on the rest. The Mir has given most of the land to the men who till it and collects only a small rental from the lands he has distributed.

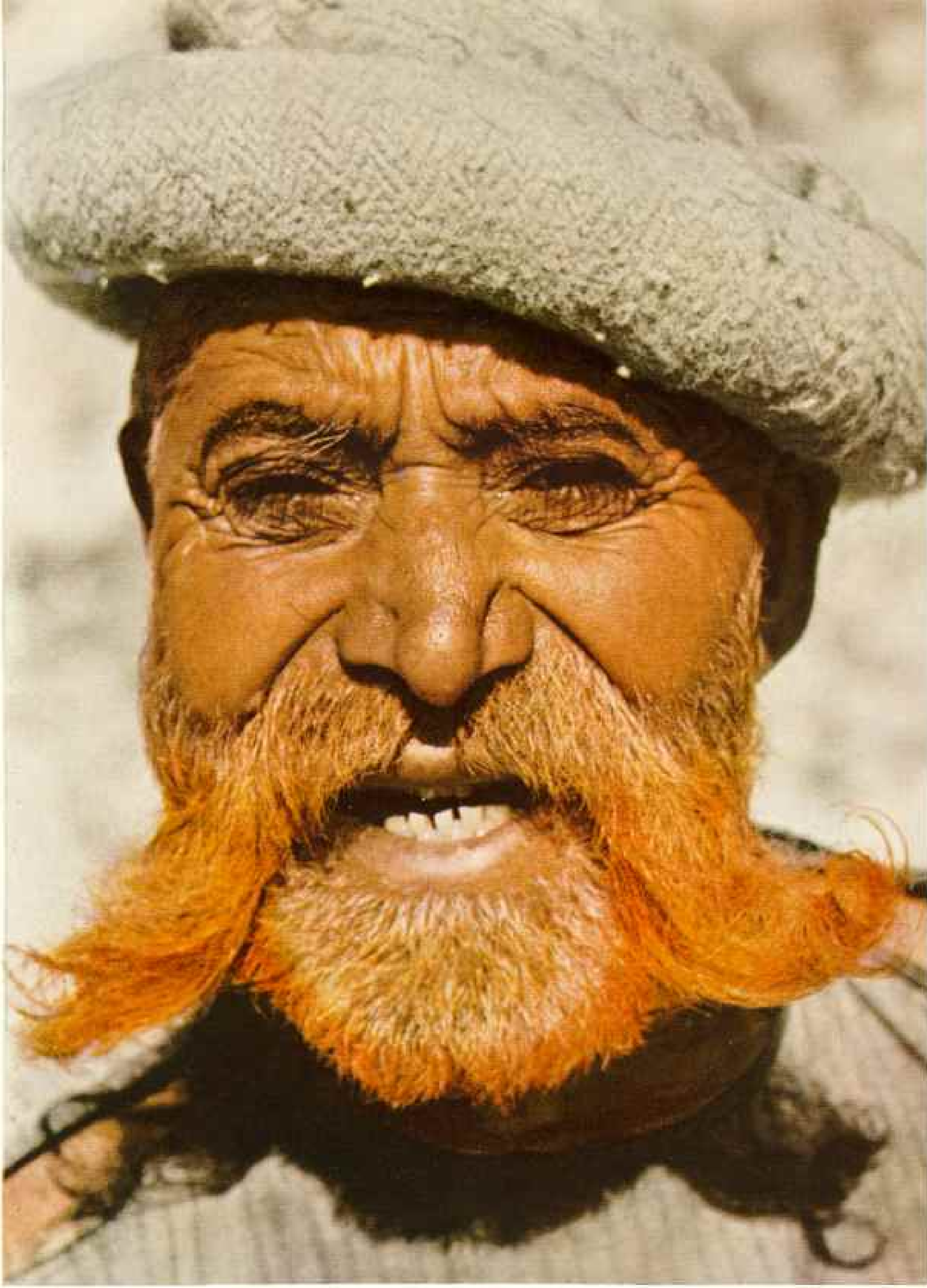
### Modest Castle in Western Style

His new castle is a modest structure built of hand-hewn Hunza granite in Western style. It is comfortably furnished in a Pakistani version of modern. One of the Mir's proudest possessions is an upright piano.

"My grandfather had it brought from Kashmir," he told us. "Twenty men carried it over the mountains."

That night, as we sat in front of a roaring fire, the Mir told us a little about his country and his people.

"We have no written history," he said, "but legend tells that we are descended from three soldiers of Alexander the Great who took Persian wives and settled here 2,000 years ago. We have no proof of this, but some scholars say our people bear a strong resemblance to the ancient Greeks.







Kodachrome by Joan and Franz Shor, National Geographic Staff

**Henna Reddens the Beard of a Jovial Hunza Patriarch**

Hunzukut health is famous; this Baltit elder scorns the weight of 89 years with a four-mile walk to and from the Mir's daily council meeting (page 507). White cap and dyed whiskers are typical Hunza fashions.

"Sir Aurel Stein studied our language and concluded it bore no relation to either the Indian or Iranian language families. Our customs and culture differ from those of our neighbors. We are taller and stronger than they, and our farm methods and sanitary habits are in step with modern Western discoveries."

From a bookshelf the Mir brought down a calf-bound typewritten folio.

"My grandfather wrote this," he said. "It is the story of the descent of the rulers of Hunza, going back 40 generations. He was the first man who *could* write it down. It is full of odd tales—of one Mir who ate young children, and of another who was put in a box on the river and was fished out downstream like Moses.

"In the old days we were great warriors. Even the Chinese empire, at the height of its glory, sent tribute to the Mirs of Hunza to keep them from raiding Kashgar and Yarkand in Chinese Turkistan."

Today the Hunzukuts are a peaceful race. Long ago the Mir disbanded the state's little army. A few years ago he did away with his personal bodyguard.

"Why should I have a bodyguard?" he asked. "I have no enemies. Any man in the country can walk into my office at any time. They bring their problems to me, and I try to help them. The most important thing about Hunza, I think, is this: we are a contented people. There is enough for everyone to eat and wear, and when there is a shortage we share what we have. Only once since I became Mir have we been worried."

"What caused that?" I asked.

"Two years ago," the Mir replied, "someone thought he had discovered a rich vein of gold. Fortunately, it turned out he was mistaken, but for a few days we were alarmed."

I found it hard to believe that anyone would object to owning a gold mine, and I said so.

"It would have meant the end of Hunza and our way of life," the Mir explained. "We are let alone because we have nothing anyone else wants. If we were rich, some country would find a pretext for moving in to 'protect' us."

### Central Asian Hall of Fame

Before we went to bed that night, the Mir brought us his guest book to sign. Jean opened the yellowed pages and gave a cry of delight. The book was a hall of fame of Central Asian exploration. Sir Aurel Stein, Lord Curzon, C. P. Skrine, and Sven Hedin were there. Theodore and Kermit Roosevelt had left their signatures. Maynard Owen Williams, of the NATIONAL GEOGRAPHIC MAGAZINE, had signed it with fellow members of the Citroën-Haardt Trans-Asiatic Expedition.* Proudly we added our names, in small letters.

Mirzah woke us early the next morning. We came into the living room to find the Mir waiting, dressed in a magnificent gown of gold brocade belted at the waist. At his side hung a gold-hilted sword in a scabbard of carved ivory. A jeweled pin held a plume of egret feathers in place on his black cap (page 508). Ayash, his younger brother and right-hand man, wore a similar costume. Even Crown Prince Mohammed was in full regalia.

### Festival Starts Spring Sowing

"Today is our spring planting festival," said the Mir. "A Hunza custom hundreds of years old. We'd like you to attend."

After breakfast we walked to a field where hundreds of villagers had gathered. Two black oxen, scarcely larger than six-months-old Angus calves, were hitched to a wooden plow. The Mir's grand vizier, an 80-year-old dignitary with long mustaches, was waiting. With him was a teen-age lad, who looked as if he were made up for Halloween.

Flour covered the boy's face, hands, and the U. S. Army jacket he was wearing. On his back a bag held a bundle of green branches. Another sack contained barley.

Villagers cheered as the Mir grasped the handle of the plow. The grand vizier made a brief speech. The Mir responded, then drove the oxen down the field and back, plowing a shallow furrow.

The grand vizier took a handful of seed from the youth's pouch and placed it in the Mir's cupped hands. From a purse he drew a pinch of gold dust, which he mixed with the seed. The Mir broadcast the mixture over the new furrows, while the crowd shouted.

Three times the ceremony was repeated. Then the Mir threw a few handfuls of grain over the crowd, and the villagers scrambled madly for the ceremonial seeds. The Mir spoke again and the crowd dissolved, the men trotting off for their own homes.

"Now they will sow their own fields," said the Mir. "They believe that if they catch a few of the grains I throw and mix them with their own seed, they'll have a fine harvest."

"Do you believe it?" I asked.

"If the weather is good, with plenty of water, and they till the fields well, they will have a good crop," laughed the Mir.

The youth with the flour, seeds, and green shoots is a Hunza symbol of fertility, the Mir explained. His position, one of great honor, is hereditary.

From the Mir's balcony an hour later we

* See "First Over the Roof of the World by Motor," by Maynard Owen Williams, NATIONAL GEOGRAPHIC MAGAZINE, March, 1932.

could see hundreds of farmers sowing their fields (page 504). The seeds were thrown on the plowed soil, then oxen dragged masses of thorn bushes across the fields.

At dinner we sipped delicious Hunza wine. Most Moslems drink no alcohol, but the Hunzukuts are followers of the Aga Khan, members of the liberal Ismailian sect.

"Our people make a little wine each summer," said the Mir. "In December, when it is too cold to farm, they drink their wine. They also kill a sheep. It is one of the few times in the year they eat meat."

December is festive in Hunza. Each evening villagers gather for the famous Hunza sword dances, and the merrymaking lasts for the entire month. All marriages are performed in December, too.

A Hunzukut husband can never forget his wedding anniversary, for all weddings take place on the same day. On a mid-month Thursday, chosen in consultation with the diviners, engaged couples of each village gather for a mass ceremony. Hunza parents still select marriage partners for their children, but the young people can refuse their parents' choice.

"We have one custom which Westerners find unusual," said the Mir. "The groom's mother spends the honeymoon with the newlyweds, acting as guide and teacher. Marriage, we believe, is too important to be left to chance. We have very few divorces."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**Sky-high Hunza Borders Afghanistan and Red China**

Three great mountain ranges—Hindu Kush, Karakoram, and lofty Himalayas—converge on this remote Central Asian kingdom. Set apart by unclimbed peaks, deep gorges, and harrowing trails, the Mir of Hunza's domain has no definite boundaries. External affairs are handled by Pakistan.

### Women, Men Have Equal Voice

Women play an important part in Hunza life. They cannot inherit land, since the Hunzukuts feel they could not do the heavy work of tilling the fields. They can own other property, however, and they have an equal voice with men in family matters. The Mir's wife is in purdah and is never seen by men, but other women of the country move about freely without veils. They are shy, but smile and salaam to the passing traveler.

This equality extends to education, too. Hunza is one of the few places in all the East where there are free schools for both boys and girls. The Aga Khan earmarks funds for educational purposes, which are administered by the Mir.

Good soil is so scarce in Hunza that a too high birth rate would be serious. Centuries ago, however, the Hunzukuts solved the problem of birth control. When a woman becomes pregnant she leaves her husband's bed, not to return until her child is weaned—two years for a girl and three for a boy.

One sunny morning we attended a session of the Mir's court (page 507). Each day the ruler and his advisers meet in the palace courtyard. A council of 12 assists the Mir and his grand vizier. Most of them are very old. One henna-bearded elder, who walks two miles every day to attend the council, is 97; half

**Slowly Disappearing Is This Bright Traditional Raiment**

Nyet Shah, the Shors' guide, here wears a gaily embroidered choga of camel's hair. His cap of white hand-woven wool can be rolled down in cold weather to protect his ears. Such colorful garments are slowly giving way to Western styles. Asked to dress for the photograph, Nyet Shah first appeared in a red-flannel shirt and white British riding breeches.



**Bangs Were Favored in Hunza Long Before Mamie Set a Style**

The First Lady's hairdo has its counterpart in Hunza, where these teen-agers wear square-cut bangs. Traditional, too, are embroidered skull caps. Before China's back door was sealed by Communist rulers, Hunzukuts purchased silk scarves and richly colored thread from passing caravans. Now the caravans no longer come, and Hunza menfolk must walk 65 miles to Gilgit to buy sewing materials.

Although they are Moslems, Hunzukut women do not wear veils. The people of Hunza have developed a simple philosophy of hard work by which they wrest a full life from their barren, mountain-ringed valley.

Kodachromes by Jean and Franc Shor,
National Geographic Staff

a dozen others are more than 80 (page 491).

"Our government is democratic," the Mir told us proudly. "Each village selects a mayor. He and his council decide local disputes. If the contestants aren't satisfied, they appeal to me by telephone."

"How do you happen to have a telephone system here?" I asked.

"My grandfather had a battery-powered line installed," answered the Mir. "There is one phone in each village. I call each mayor for a daily report. In an emergency they can call me. All but one, that is."

"Why all but one?"

"He's too talkative," laughed the Mir. "Used to call a dozen times a day about trivial things. I had his telephone fixed so I can call him, but he can't call me. It works very well."

### How Disputes Are Settled

If a telephone decision isn't satisfactory, the contestants walk to Baltit and present their claims in person. We saw three cases decided, two involving water rights and one a question of land inheritance. In two instances the Mir suggested a compromise, which both parties accepted. Each time the two men embraced, kissed each other on the cheek, and left arm in arm.

The last case was put to a vote of the council, and the Mir accepted the majority decision. The losing litigant waved his arms and shouted angrily. He stomped off, yelling his opinion of the court to anyone who would listen.

"That," said the Mir, "is the local equivalent of a free press."

Jean and I spent a week in Baltit, getting acquainted with the villagers and watching them till their fields. One farmer, Nazar Shah, invited us into his mud-and-rock home for lunch. We became friends and spent several days with his family.

Nazar Shah owns 10 *kanals* of land—a little more than two acres. He raises barley and potatoes, the two chief crops, and smaller amounts of millet, wheat, and gram. Carrots, turnips, and green beans are raised in spring and early summer. His trees yield apricots, pears, apples, and walnuts.

Eight sheep provide milk for the family of seven, wool for their homespun garments, and manure for fertilizer. Two sheep are killed for meat during the feast month of December.

Proudly Nazar Shah showed us his square two-room, two-story house. A ladder connects the two chambers.

"All Hunza houses are built like this," he said. "The lower room has only one small window and is easy to keep warm. We live there all winter. Every year, on the 21st of March, we move upstairs, where we have a balcony with a view. There is a Hunza saying: 'Better a home with no roof than one with no view.'"

All Hunzukuts move upstairs on the same day. Even the Mir's palace has duplicate apartments on two floors, and the royal family makes the annual move, too.

Outside, Nazar Shah showed us a rock shelter for his sheep, and two snug storerooms. One held dried apricots and jars of grain; from the ceiling hung strings of pears. Our host handed us each one. They were wrinkled, but tasted as fresh as if picked that day, rather than six months before.

Part of the storeroom was walled off and contained smaller quantities of grain, fruit, and nuts. We asked why the separate supply.

"That is for others, in an emergency," said our host. "Everyone in Hunza sets aside a small portion of his harvest to help others who may meet with misfortune."

Soni Begum, Nazar Shah's wife, prepared our simple lunch. Two handfuls of dried apricots were soaking in a wooden bowl. While her daughter-in-law, Feroza, cooked flat rounds of unleavened bread on a stone, she rubbed the apricots briskly between her palms in the water. The fruit softened, and the water thickened and took on the color of the fruit. When the bread was done we were each given two pieces, and a few apricots and a cup of the liquid were placed before us.

The fruit was delicious. I started to throw away the seed from the first one, but Nazar Shah seized it, cracked it between two stones, and handed me the kernel.

"Eat it," he said. "It's the best part."

It tasted much like an almond. Jean and I ate our fruit, kernels and all, and then, following the family example, we drank the liquid. A handful of walnut meats finished the meal.

"This is the mainstay of our diet," said Nazar Shah. "We eat potatoes, some vegetables, and a little grain. But fruit and nuts are the most important. Maybe that's why Hunza girls won't marry a man who lives where apricots won't grow."

### Fruit Trees for Wedding Gifts

The apricot is so important in Hunza's economy that trees can be given or willed separately from the land on which they stand. Frequently a daughter is given a special tree as a wedding present. Every year she returns to pick its fruit.

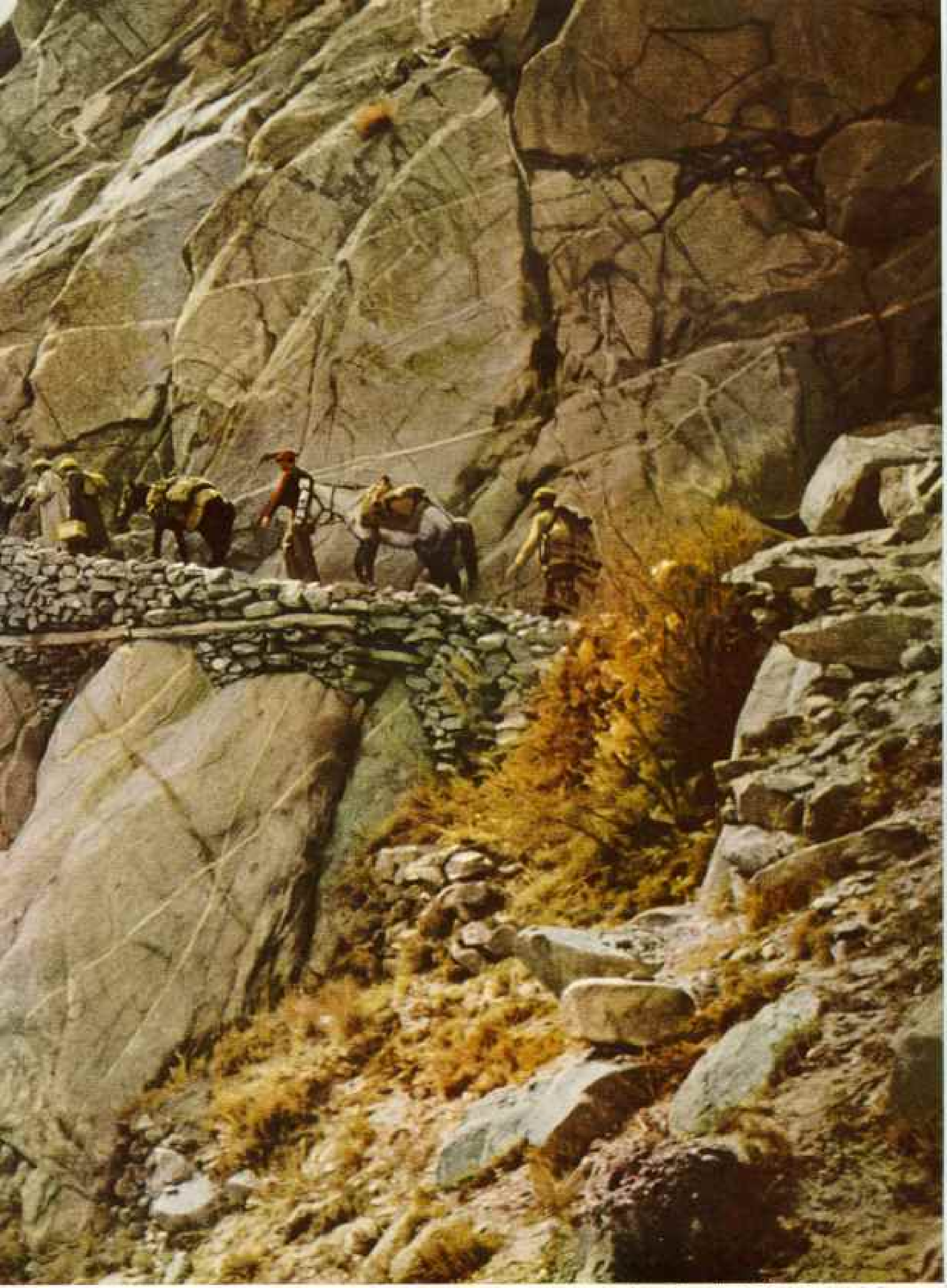
Nazar Shah's family is almost completely self-sufficient. They raise their own food, and Soni Begum makes the family's woolen clothes. She shears the sheep, spins the yarn, weaves the cloth, and makes it into garments.





**Invitation to Vertigo: Precarious *Rafiks* at Dizzy Heights Test Travelers' Nerves**

Each time they successfully negotiated a rafik, or gallery, built of stones wedged into crevices in a sheer cliffside, caravan members—including the Shore—offered a prayer of thanksgiving.



497 Kodachrome by Jean and Franc Shor, National Geographic Staff

**Before Communism Slammed Western China's Door, Her Caravans Went This Way to India**

One trip over this road, which connects Gilgit with Chinese Turkistan, could make a man wealthy—or cost him his life if a rockslide carried his caravan hundreds of feet down into the raging Hunza River.

Only cotton cloth is purchased. Nazar Shah seldom handles more than $15 or $20 a year in cash.

The Pakistani rupee is the currency of Hunza. When the Hunza road was open, the villagers made a little cash by renting horses and serving as porters for the caravans from Chinese Turkistan.

### Ancient Caravan Route Closed

These caravans also served as traveling bazaars, where Hunzukuts could buy utensils, salt, knives, and brightly colored cotton cloth. But the Chinese Communists have closed the border, and the road is little used. Hunzukuts must make the long trek to Gilgit for their few purchases.

Fortunately, the remarkable physique and great endurance of Hunza's mountain people make a long journey on foot a trivial matter to them. Jean and I had read fantastic tales of their endurance, and we asked the Mir if they still had such stamina.

"You may see for yourself," he said. "I am sending a messenger to Gilgit in the morning. Give him a note to the political agent and ask the agent to write down the time of his arrival."

The round trip between Baltit and Gilgit is 130 miles over difficult trails. The messenger, a tall and slender youth of 18, left at 8 in the morning. He returned three days later. Syed Faridullah had written the time of arrival on my note—with a humorous protest against having been awakened at 3:30 in the morning. The messenger had walked the 65 miles to Gilgit in 19½ hours!

Later, Jean and I told the story to an English journalist in Pakistan.

"Ah, yes," he said. "Rather good time. But then, it was downhill, wasn't it?"

Living with the Mir was pleasant, but there was more of Hunza to be explored. So with Mirzah and Nyet Shah, a magnificent specimen of Hunza manhood, we set off toward the Chinese border.

Nyet Shah is in his early thirties, six feet tall, broad of shoulder, and long of mustache. He walked as we rode, carrying 40 pounds of equipment on his back, and frequently enlivened the march by dancing a mile or two to show us Hunza steps. He loved to be photographed—if we gave him warning so he could curl his mustache (page 494).

There were times when language problems grew a bit complicated. The Hunza tongue is amazingly involved. It has, among other difficulties, at least four genders and a bewildering confusion of plural endings.

Both Mirzah and Nyet Shah speak good Urdu and some Persian and Turki, and I have a smattering of all three. I speak Chinese, and they know a few words of that. Mirzah had once been employed in the British Consulate General in Kashgar, but had forgotten most of his English. Nyet Shah knew no English, but said he'd like to learn. The result was frequently a strange mixture, such as I found myself speaking our third night out:

"Farda (Persian: Tomorrow) man (Turki: I) yao (Chinese: want) teek (Urdu: good) khaur (Burushaski: horse)."

It sounded a little odd, and it frequently sent Jean into hysterics, but it worked.

We paused briefly at Altit, a couple of miles from Baltit, to inspect a 500-year-old fort. Its mud walls were still in good shape, the sturdy beams and timbers intricately carved in geometric patterns. The Mir uses the structure as a storehouse.

### Pied Piper of Hunza

As we left Altit, shouting schoolboys fell in behind us, laughing and scrambling on the narrow path. To our amazement they followed us the entire seven miles to Atabad.

"Foreigners must be rare up here if they'll walk all that distance just to look at us," said Jean. "Let's give them some candy."

I walked to my packhorse, where I had a few pounds of hard candy in the pocket of my trench coat. I put my hand in—and found a lone piece of candy and a sizable hole.

A closer inspection of our young escorts revealed bulging cheeks and hands clutching the brightly wrapped confections. A Hunza man may walk eight hard miles to return a valuable watch, but, where candy is concerned, boys are boys the world over.

The 11 miles from Atabad to Gulmit were a nightmare. Between 1,000-foot climbs up almost sheer cliffs we stumbled over rocky stretches of riverbed and dragged our horses through deep sand. Three miles from Gulmit we reached the most fantastic bridge I have ever seen.

Six rusty cables stretched some 300 feet across the Hunza River, about 500 feet above the water. Two cables served as handrails, the others supported narrow, weathered, and cracked branches, which were the footpath. The branches were spaced irregularly, usually

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### In Informal Hunza
### Both Sexes Have Their Say

Just as the Mir of Hunza has his council of elders, his wife meets each day with a group of Baltit women to discuss the problems of the feminine populace. These matrons, sitting on a corner of the Rani's garden wall, are among her closest friends. Behind them towers a giant unclimbed peak.

The Rani herself is in purdah, the only woman in Hunza to be kept from public gaze, and cannot be photographed.


Kodachrome by Jean and Franc Shor, National Geographic Staff

far enough apart to require a long stretch.

I crossed the bridge to photograph a village, but Jean wisely refused. A high wind was blowing, and the old cables creaked as they swayed (page 506). The footpieces gave beneath me at each step. It was a cold day, but I returned drenched with perspiration. Nor did I feel better when, as we rode off, a Hunza woman came tripping across with a baby clutched under one arm!

Dinner in Gulmit was a feast. The mayor presented us with a haunch of ibex and a brace of partridge. Mirzah made soup of the ibex bones, served the partridge grilled on skewers, and then brought roasted ibex.

The Mir telephoned that night. "My shikari [hunter] in Pasu has just called," he said, "to tell me that Marco Polo sheep have been sighted a few miles from the village. It's a chance to get some meat. Would you like to go along?"

The prospect of even glimpsing a rare *Ovis poli* elated me. I assured the Mir I'd like to join the party.

"I'll tell the shikari to wait for you," said the Mir.

I rode ahead of Jean and the packers the next morning, covering the eight miles to Pasu before 10 o'clock. The shikari and two trackers were ready. They presented me with a 6-foot pole topped with a steel point and hook for climbing, and we set off.

The Mir of Hunza is an honest man, and when he said that the Ovis poli were "a few miles" from Pasu, I'm sure he meant just that. But he failed to mention that most of those few miles were straight up!

### Tracking Marco Polo Sheep

We walked along the Hunza road, then turned into the valley of the great Batura Glacier, one of the world's largest. This great mass of detritus-covered ice, nearly 25 miles long and four miles wide, fills the valley. We struggled across it for two hours, then left the trail and headed up into the mountains.

I was in good condition, but my Hunzukut friends found my progress slow. The shikari stayed with me, but the two trackers ranged ahead like hunting dogs, moving in huge circles, traveling at least three times as far as I did, yet never showing fatigue.

Pasu village lies at 8,000 feet; at dusk we had reached 16,000. We paused for half an hour, ate a handful of dried apricots and a few walnuts, then resumed our steady climb.

We made another 1,500 feet in the next three hours. The Hunzukuts were ready to go on all night, but I was through. My feet were leaden, my lungs bursting, and my heart pounded a rumba rhythm. I scooped a hole for my sleeping bag and turned in. My companions wrapped up in their long robes and lay down; we slept soundly until dawn.

Then Tair Shah, the shikari, roused me. I was so stiff and sore I could scarcely unzip my sleeping bag. I finally managed to stand up, and after more apricots and walnuts we set off up the mountain.

The jagged granite peaks turned a rosy gold in the sun's first rays. Below us the valley was still shrouded in semidarkness. The going was even rougher now, but the beauty of the scene and the crisp morning air gave me new strength. An hour of steady climbing brought us to 18,500 feet, where Tair Shah called a halt and sent a tracker ahead to the crest of a slight ridge. The tracker crawled the last few feet, peered across, then silently motioned us to his side.

### Sheep Sighted from Ridge

Quietly we crept up beside him. I lay flat on the ground, inched to the crest, and cautiously peered over. About a quarter of a mile away, standing quietly in a little snow meadow, were seven Marco Polo sheep—four ewes and three rams. The wind was toward us, and they showed no sign of alarm.

Few animals compare in grandeur with the Ovis poli ram. His body is often as large as a donkey's, with a great head and magnificent curved horns. The world-record head, taken not far from where we lay, had horns 75 inches around the outside curve.

These animals were not that large, but they were big. The thought that I was one of the few Westerners to see them in their native habitat sent a thrill down my spine.

I lay quietly for a minute, waiting for my pounding heart and gasping breath to smooth out.

Slowly I squeezed the trigger. The crash echoed back and forth from the towering peaks. I waited a long and awful moment while the bullet sped its course.

Suddenly the grazing animals leaped as if propelled by springs. Straight up the side of a sheer rock wall they hurtled. All, that is, but the great ram. He stood motionless for a second, then collapsed and tumbled silently down a rocky wall.

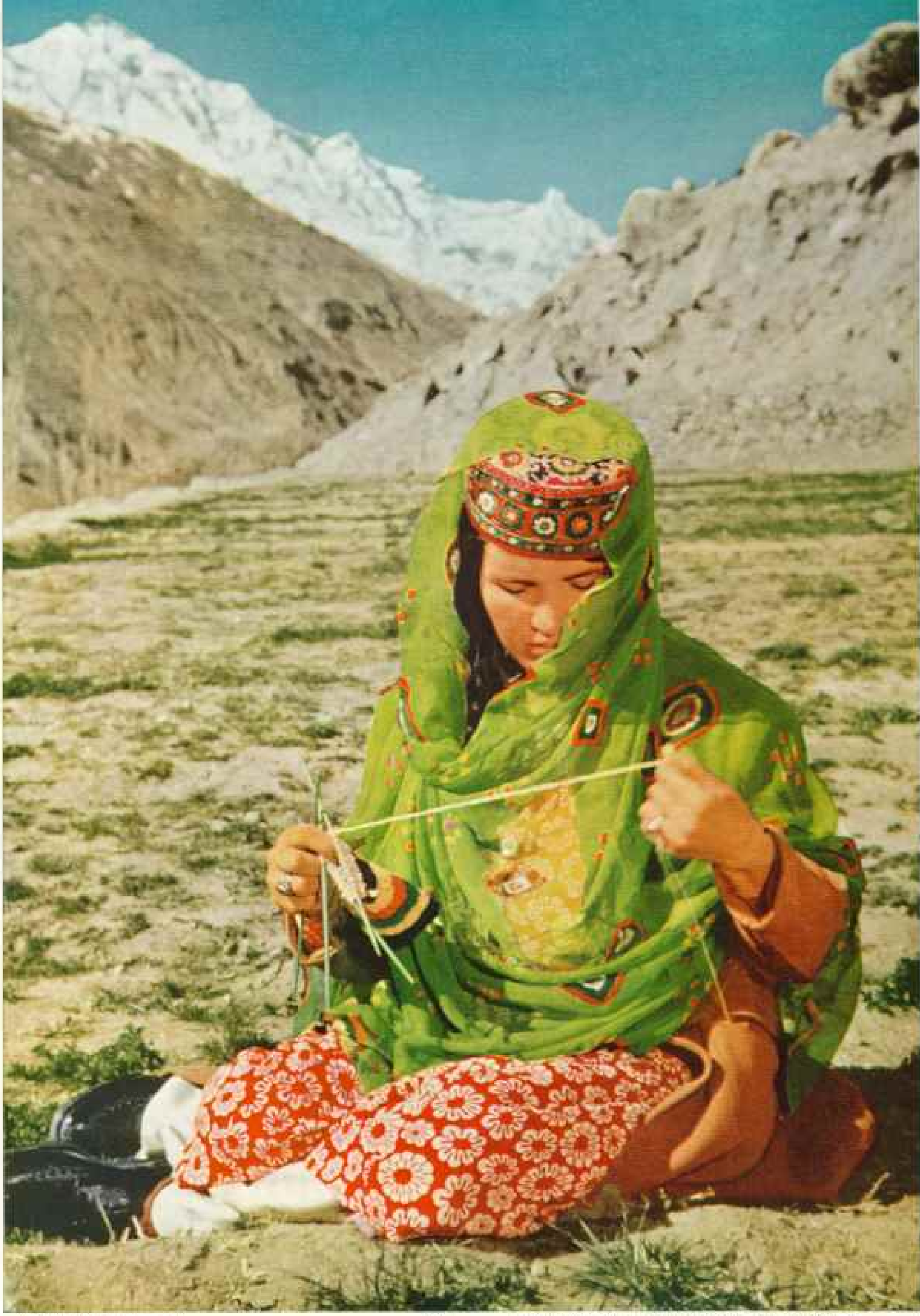
### Trophies Without Heads

Tair Shah fired, and one of the young rams collapsed in mid-flight. I did not fire again.

The two dead rams were only a quarter of a mile away by rifle shot, but so rugged was the terrain that it took our trackers nearly two hours to work their way to the spot and return with the carcasses. I lay down to rest.

In spite of my excitement I dozed off. Tair Shah woke me when the men dragged the

*(Text continued on page 517)*







Kodachrome by Jean and Franc Ilier, National Geographic Staff

A Hunza Woman Knits Homespun Yarn with Needles of Modern Plastic

## Swords Clash in Old-time War Dances

In the natural amphitheater of Hunza Valley, flashing swords and leather shields hark back to a time when raiding Hunzukuts were feared warriors of the Karakoram Range. Though the people of this mountain kingdom have been at peace for half a century, the old war dances still attract Hunza menfolk.

Under blossoming apricot trees centuries-old pageantry is re-created by dancers clad in robes of brilliant Chinese silk. Drummers and pipers set an insistent rhythm for the leaping, twirling Hunzukuts. Some old India hands say these dances are the finest to be seen on the Indian subcontinent.

According to the Mir, the dancers' circular shields have been handed down for more than 300 years. Curved swords are also heirlooms. Robes came originally from Kashgar; they date from a period when the Emperor of China paid tribute to Hunza to protect his border settlements from attack.









**When Fields Need Watering, Farmers Hope for Sunny Days!**

Here, north of Baltit, the Hunza River (center) is but a springtime trickle. Later, summer sunshine will send melting snows flooding over its entire wide bed. These Karakoram peaks resemble Italy's Dolomites.

Kodachrome by Jean and Franc Shor, National Geographic Staff

**Sometimes the Rugged Land Is Sown Before It Is Plowed**

Seed is cast on the bare earth, then an ox-drawn plow furrows the soil. The second team drags a heavy mass of thorns, which acts as a harrow. Though primitive, Hunza farming is effective; crop rotation is an old practice.

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**"Hurry and Cross," Said Jean Shor, "I Don't Want to Be a Bridge Widow!"**

As Franc Shor swayed far above the Hunza River, his wife took this photograph. Frayed cables support crosspieces of wood set a full step apart (right). After one round trip, Shor made a solemn vow: "Never again!"

## Democracy Works Even in the Isolation of a Remote Asian Kingdom

At this daily council meeting, any Hunzukut may have a hearing. Men seated on the Mir's left are the elders of Hunza. Although the Mir has life-and-death power over his subjects, he refuses to consider his vote as being more important than that of any elder.



Kodachromes by Jean and Franz Shor, National Geographic Staff

**Benevolent Ruler of a Pocket-size Kingdom, Hunza's Mir Speaks Flawless English**

Elaborately costumed for the spring planting festival, His Highness Mohammed Jamal Khan surveys a peaceful domain from the roof of his 600-year-old Baltit castle. Behind him looms unclimbed 25,550-foot Rakaposhi.

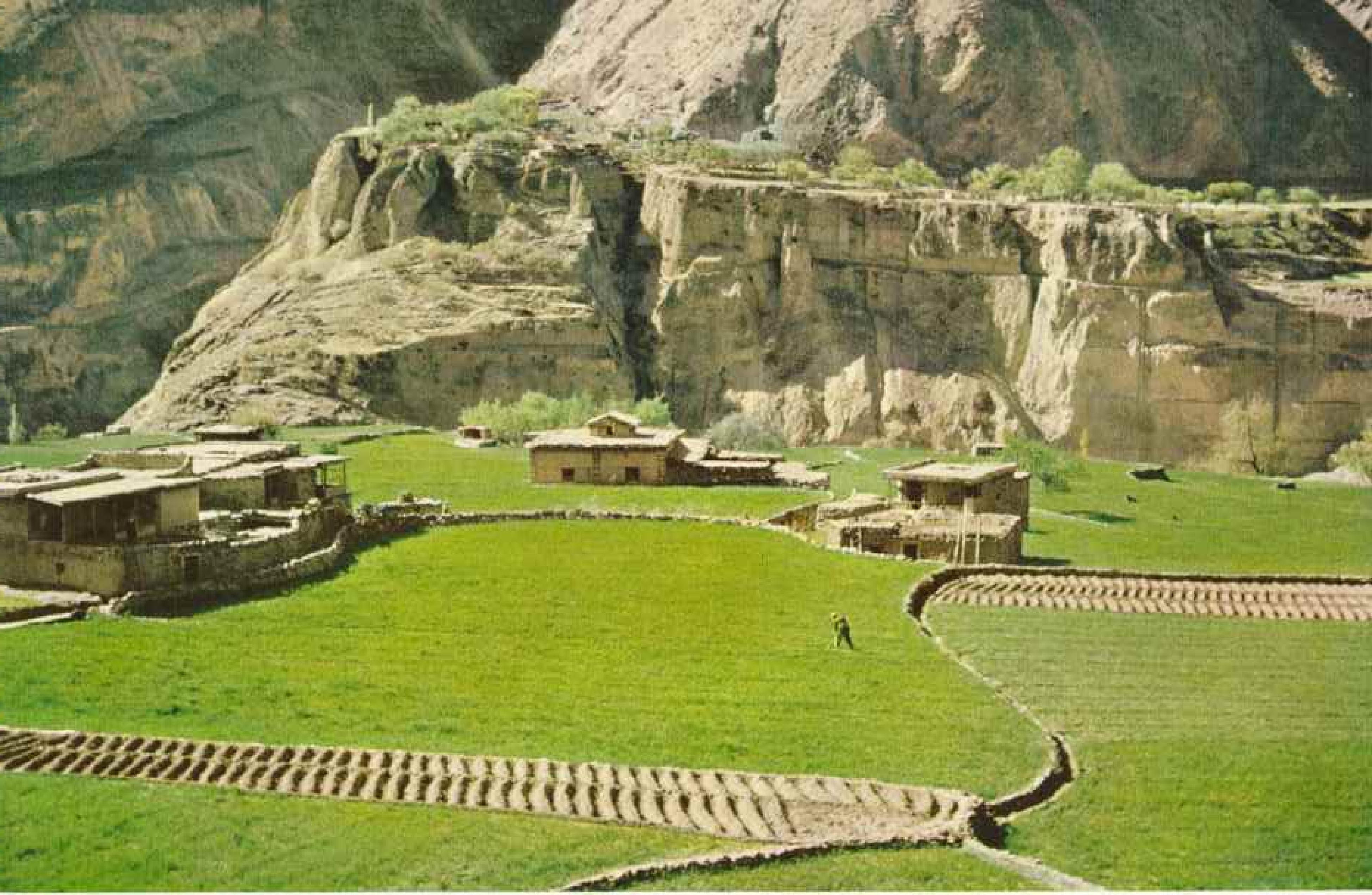
Kodachromes by Jean and Franc Shor, National Geographic Staff

### ↑ A Few Grains at a Time, Millet Drops Between Water-turned Millstones

These little mills, where farmers may grind their grain without charge, are scattered throughout Hunza. Jean Shor took this photograph after the girls screamed and hid from her husband's camera.

### ↓ Sheep's Wool Takes a Beating from These Brightly Garbed Housewives

After shearing, wool is beaten with thin switches until it becomes soft and fluffy. Fine garments are sometimes made of hair from the Mir's Bactrian camels or, occasionally, from that of the wild ibex.



## "Better a House Without a Roof than One With No View"

Most homes have a little balcony where the family gathers in the evening to enjoy the valley's impressive views. Despite some hardship, Hunzukuts treasure life in their wild, mountainous homeland. Here, near Aliabad, every square foot is cultivated. Contour farming is well known to Hunza farmers, as is grafting of fruit trees. The deep furrows are for potatoes, introduced by the British in 1892.

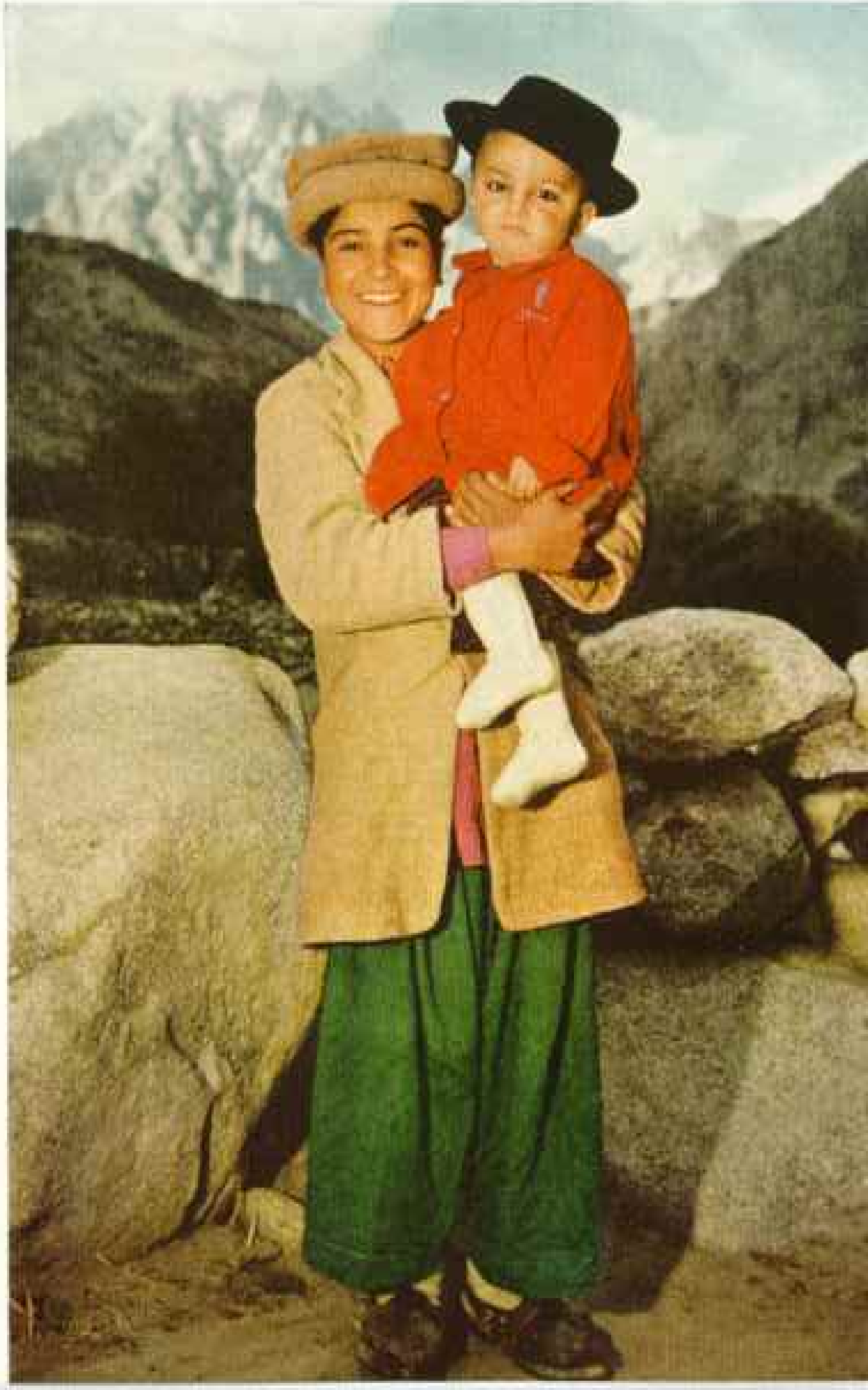
## Hunza Smiles Reflect Contentment and Character

←Although poor, this hospitable Hunza mother invited the Shors into her one-room home to share a handful of nuts and apricot pits. Both are staples of the Hunza diet. A tuft of white feathers in her son's cap typifies the Hunzukut's love for simple finery.

→A distant cousin of the Mir of Hunza, this plump youngster has his own servant, the smiling lad who holds him. In keeping with Hunza's tradition of personal freedom, even servants do not make a full-time job of it. All have their own small farms, and after a couple of years find others to take their places so they can return to the land.

Kodachromes by Joan and Franc Shor, National Geographic Staff





**Rakaposhi, "Goddess of the Snows," Towers Above the Terraced Breadbasket of Hunza**

Grain and fruit are basic foods; meat is tasted only a few times each year. Here, in the broadest part of the valley, every inch of stony mountain soil is painstakingly cultivated.

513 Kodachrome by Jean and Franc Shor, National Geographic Staff

**"Starvation Springtime" Brings Blossoms but Little Food to Hungry Farmers**

Meager supplies are rationed strictly during the year. Even so, the coming of spring evokes few raptures; most families are out of potatoes and flour weeks before the first barley is ripe.

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## Preserved Fruit Spices Simple Fare the Year Round

The people of Hunza have little to learn about food preservation. As tasty as freshly picked fruit were these 8-month-old pears (background) hanging in the Mir's private storehouse. Here the Hunza ruler's storekeeper selects the best from a plate of walnuts; beside him are piled dried apricots. Housewives rub these briskly in a bowl of water (lower right) until some of their original plumpness has been restored, then serve the soupy residue along with the fruit. Hunzukuts have also learned to dry vegetables for winter use. The girl at upper right pounds wild mint, a favorite seasoning.

### Young Appetites Are Alike the World Over

"What's cooking, Ma?" is as good a question in Hunza as it is in Hoboken. Here, in the simple home of guide Nyet Shah, dinner is on the fire; his wife tends a blackened aluminum pot imported from Pakistan, while his youngest son waits expectantly.

A hearth in the floor is a feature of Hunza homes; there is no chimney, and smoke escapes through a hole in the roof. During winter months this vent must be closed, and low-ceilinged interiors are often heavy with smoke. Wood is far too scarce to burn; camel thorn, shrubs, and twigs provide fuel.

Piled blankets are woven of wool from Nyet Shah's own sheep. In years past, dyes were brewed from berries and herbs; now garish aniline colors are used.

Kodachromes by Jean and Franc Shor, National Geographic Staff

Kodachrome by Jean and Franc Shor, National Geographic Staff

**Gay Embroidery and Sheer Silk Frame the Face of a Matriarch**

From teen-agers to grandmothers, Hunza women painstakingly embroider caps and cloaks. Counting each silk thread, they blend rich reds, blues, greens, oranges, yellows, and purples (page 494). Patterns suggest classical Persia's.

animals in. I took one look and let out a scream of anguish.

"The heads!" I shouted in Urdu. "The heads! Where are the heads?"

The trackers had decapitated both animals, bringing back only the bodies.

"Why the heads?" asked Tair Shah. "They are heavy, and you cannot eat them."

My Urdu was far too meager to explain, so I pointed toward the spot where the rams had fallen and firmly repeated the word for head. Tair Shah gave me a peculiar look, but sent the trackers back with orders to bring the carcasses, heads and all, to Pasu.

It took the shikari and me six hours to slide down the cliffs and cross the glacier to Pasu. Soon after our return the trackers walked in, each carrying nearly 200 pounds of sheep. Neither seemed the least bit tired.

The horns of my ram measured 47 inches around the outside turn, a creditable trophy. Excitedly I telephoned the Mir of our luck.

"I am very happy," he said. "Now you will return in good spirits."

"We don't plan to return quite yet," I said. "I think we'll go on to the Chinese border."

"It would be better if you did not go farther," he replied. "You are only a few miles from the Communist border post, and it is unsettled country. If they knew Americans were so near, they might be suspicious."

I promised we would start our return journey the following day.

I napped the rest of the afternoon. Not so Tair Shah. Word had come that ibexes had been seen near the village, and he set off with three companions. At 9 that night there was a knock on our door. I opened it to find the shikari and his friends, each with an ibex slung over his shoulder and the head in his hand. They piled the heads, with long, curving horns, on the porch.

"The Sahib likes heads," Tair Shah explained to Mirzah, who was looking on in astonishment. "How do you cook them? Or is it only the eyes he likes?"

Mirzah explained the Western fondness for trophies; Tair Shah looked much relieved.

### Polo: Hunza's National Sport

At Mirzah's suggestion we walked to Tair Shah's house. There four still-warm ibexes were stretched on their backs. Men held them by the legs while women combed the bellies and sides of the animals. Every few minutes they removed a thick mat of hair from the combs and put it in a woolen bag. Mirzah handed us a ball of it.

It was the softest wool I had ever felt, far lighter and silkier than cashmere. The combing leaves the coarse guard hairs, plucking only the precious down.

Back in Baltit the Mir staged a two-day farewell party for us. Polo is Hunza's national game, and a rousing two-hour contest between the best teams in the country was the first-day feature. The play was wild and reckless, with the most daring horsemanship I have ever seen.

Level ground is rare and precious in up-and-down Hunza, but every village has its polo field. Children play first on foot, then on donkeys, and finally on horseback when they are old enough. Every village has a team, and inter-village rivalry runs high. A top-notch player is as much the idol of Hunza youngsters as a major-league star in our country.

### Archery and Flashing Swords

In the afternoon came exhibitions of horsemanship. The feature attraction was a mounted archery contest. Horsemen thundered down the field at a dead run, firing arrows into a target on the ground.

"In the old days our warriors fought with bow and arrow," the Mir told us. "Many Hunza families have bows of horn and rawhide which are hundreds of years old."

The next day was devoted to dancing. In the morning old men performed ceremonial figures, tripping lightly to the tune of pipe and drum. One red-bearded gentleman, who told us he was 98, did a gay number which resembled a sailor's hornpipe.

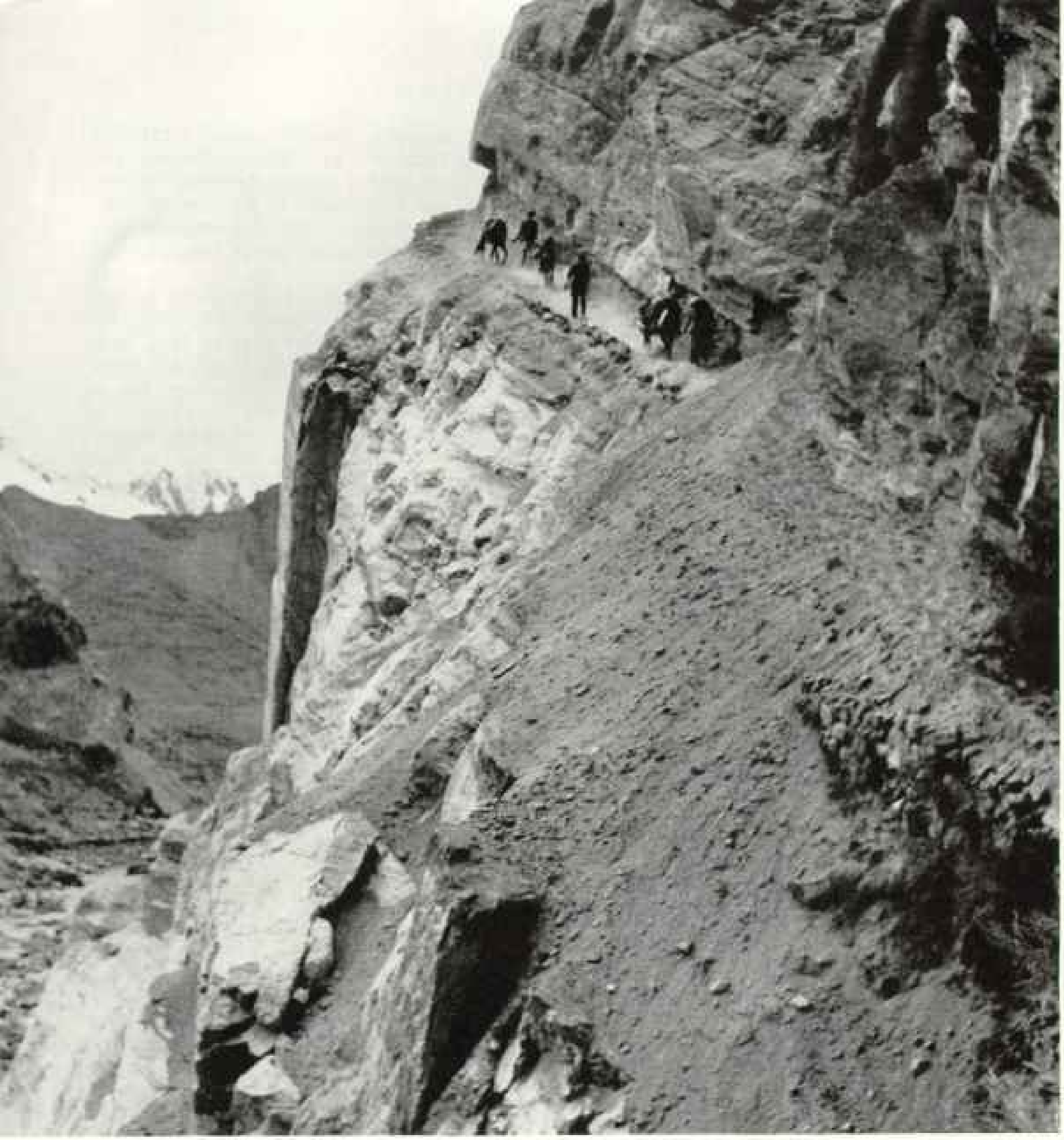
Sword dancing was the afternoon attraction. Dressed in brilliant Chinese silk robes, the Hunzukuts paired off, carrying leather shields and curved swords, and filled the air with flashing steel (pages 502-503). The entertainment ended with half a dozen of the Mir's nine children, wearing grotesque masks, performing a devil dance.

The next morning the Mir called us out on his balcony. There he presented Jean with a bolt of soft, white Hunza wool. For me there was a Hunza robe of ibex wool.

"We get about 20 pounds of ibex wool yearly," the Mir said. "I have one robe made each year. I'd like you to take this one as a remembrance of your visit. But you must never wash it. Just throw a handful of moist sand on it, beat it lightly with a switch, and it will come clean immediately."

I donned the robe, and the Mir and Ayash walked with us to our horses. We rode off, and they waved until we were out of sight.

That afternoon as we crossed a particularly narrow bit of trail, I heard a sudden rumble. The next moment a rock crashed against my shoulder, and a shower of dirt and stones followed it down the mountainside. I shouted for the others to halt and kicked my horse furiously ahead. The trail shook beneath



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**This High Road from Hunza Nearly Cost the Authors Their Lives**

As they returned to Gilgit, a sudden avalanche swept between Franc Shor and his wife; miraculously, both escaped serious injury. Hours were lost getting horses and men around the break.

me, then crumbled away as a landslide roared down the mountain.

I leaped from the saddle and dragged my horse forward through the crumbling debris. We struggled to a rocky ledge. The slide swept by not five feet from us, erasing the trail.

A minute later, when it stopped, there was a 15-foot gap where the trail was—and where I had been. Jean and our packers were on the other side, only a few feet from where the avalanche had passed.

It took two hours to get animals and baggage across the broken stretch. Every step sent rocks and dirt plunging hundreds of feet down the naked cliff.

I slept but little that night. I kept hearing the rumble of falling rocks and feeling the lurch of my horse as his feet slipped.

Syed Faridullah's jeep was waiting in Chalt. As we said goodbye to Mirzah and Nyet Shah, I cautioned Mirzah to be careful of the broken trail on his return. He laughed.

"No worry," he said. "Mirzah on horse. Mirzah safe. But," he looked toward the jeep, "Sahib be careful. Horse have brain. This animal—" his gesture could have meant either jeep or driver—"no brain at all."

# Shetland and Orkney, Britain's Far North 519

## Change Comes Slowly to These Outpost Isles, Where Viking Ways Survive and Near-by Scotland Still Seems a Bit Foreign

By Isobel Wylie Hutchison

ON the islands of Shetland and Orkney life is wedded to the sea. From almost every habitation in these breezy outposts of Britain the restless North Atlantic is visible. Some islanders never get beyond its reach—or want to.

"I wouldn't like to live shut in with trees and hills," an Orkney woman told me in the accents of her island. "I chust couldn't live where I couldn't see da sea."

The marriage is a stormy one. Gales periodically lash the islands and whip the encircling waters into a frenzy. Breakers, striking rocky shores, rise in foam hundreds of feet; spray covers the islands, shrouding every object. Air and water seem one.

### When a Tempest Strikes

"We all had salt on our lips that day," said an island farmer, recalling the record-breaking storm of January 15, 1952. "Strangest of all was the sea. The wind leveled it flat as a table, but you couldn't see the shore for spray."

A lighthouse keeper's wife, who has listened to many a tempest, told me that on that night the triumphing wind struck a note she had never heard before—"a high-pitched scream that was terrifying."

But such outbursts are rare. When I reached the Shetlands it was a golden April day, and quite balmy. Though on the same latitude as northern Labrador, and as far north as you can go in Britain, both Shetland and Orkney for the most part have a mild climate. Warmed by the North Atlantic Current, they often enjoy milder winters than those in the interior of southern England.

A weekday air service whisks travelers from Edinburgh or Glasgow to Shetland in a few hours, but I had no desire to reach this old stamping ground of the Vikings in such unsuitable fashion. Like them, I went by sea. Boarding ship in Aberdeen harbor, I first glimpsed the gray old houses of Lerwick, Shetland's capital and largest town, through a porthole (map, page 522).

Lerwick dates from the 17th century and has been called Scotland's Venice. From the windows of its oldest hotel, built out into the water, you see waves lapping round walls founded below tidemark. At night you may be wakened by the sudden slap of water against stone as the tide swings. Gulls call all day around chimney pots, and a Shetland poet greets the kittiwake in spring ecstatically:

> Peerie mootie! Peerie mootie!
> O, du love, du joy, du beauty!
> Whaar is du come frae? Whaar is du been?
> Wi dі swittlin feet and dі glitterin een.*

I watched an islander feeding a voracious herring gull. The bird resented any interruption, angrily squawking for attention while its patron talked to me in the quick island accents that are so difficult for strangers.

The old Norse language is fossilized in hundreds of place names on the islands and was spoken there until about the end of the 18th century. Shetlanders still look on the Scottish mainland as a little foreign.

"No, I've never been to Scotland," a Scalloway man told me, and an Orkney farmer boasted that during the war he had three sons serving overseas—one in Canada, one in Africa, and one in Aberdeen!

### Base for Viking Sea Rovers

Lerwick is, in fact, almost equidistant between Bergen, Norway, and Aberdeen. Norse earls who ruled the Shetlands and Orkneys for three and a half centuries regarded their grassy holms (islets) and windswept, treeless pastures not as the outlandish fragments of a continent, but as centers from which they steered their galleys south to explore the northwest angle of Scotland, which is still called by the name they gave it, Sutherland, or "South Land."

Earl Rognvald, who founded Kirkwall's noble Cathedral, still the glory of the Orkneys, thought it no rash venture to set sail for Spain, Jerusalem, and Constantinople. Today the islanders, direct descendants of those hardy mariners, are among the most cosmopolitan of Scots. Their blood, however, is mixed with that of the Lowland Scots, many of whom crossed the Pentland Firth long before the islands were joined in 1472 to the Scottish Crown by the marriage of James III to Princess Margaret of Denmark.

The Princess' dowry of "60,000 florins of the Rhine" not being all forthcoming, the Crown lands in Orkney were pledged for the remainder in 1468 and those of Shetland the following year. They were never redeemed and are today as much a part of Britain as the rest of Scotland.

Lerwick was once the "Herringopolis" of

*peerie mootie—little gull
swittlin—splashing; een—eyes

Scotland, employing 21,000 persons during the herring season in one record year.

"I mind when I was a boy," said an old sailor, "da boats were so thick in the Soond you could very near waalk on dem right acrass to Bressay yaander," and he waved towards the green island which shelters Lerwick harbor. "They came from aal over—Germany, Russia, Holland, France. But there's nothing of that now," he added sadly.

Herring steam drifters which ousted the sailing boats are now being ousted in turn by diesel vessels. These are more economical to run and can be converted to seine-net "white" fishing—cod, ling, halibut, winter haddock, etc.—when the herring season is over. Lerwick is still, however, an important fishing center; its vessels hauled in nearly $772,000 worth of fish in 1952.

Lerwick's narrow main street has no sidewalks; pedestrians must hop nimbly into doorways when vehicles come past some corners, but accidents, apparently, are few. On Saturday afternoons the street is thronged with shoppers bustling in and out of thriving stores, many of which were founded by canny Shetland merchants a century or more ago. Lerwick was a good place for shopping even in rationed days, as another local poet sings:

Da butcher maet is just a traet
Whatever sort ye're buyin',
B't roast or chop or tender steak
Or saucermaet fir fryin'.
Da potted-head hits fame has spread
Trow every social section,
And oh! Da puddins! Black or white
Dey're equally perfection!

### Smuggling in Dark Passages

Lerwick merchants once were not above a bit of smuggling in the shelter of their "lodberries"—small piers, usually with an underground passage to a store. These passages are no longer in use (page 536).

The ancient Tolbooth, or Town House, visited by Sir Walter Scott in 1814 when he was gathering material for his novel *The Pirate*, survives as a mission to seamen. In its lower story were housed prisoners, "who would now and then come out for a breath of fresh air and a 'drap o' whisky,' and at the request of the constable would peaceably go back again"!

The Shetlander is an individualist, and Lerwick's 5,500 people may choose from a dozen different places of worship. Steep lanes lead up from Commercial Street in the old quarter to the New Town.

Though Shetland's soil lacks the fertility of Orkney's, it is rich in peat (page 532). The pleasant reek greeted us on the bare road for miles when we drove across the moors to visit the old Norse capital of Scalloway (page 529).

This was a base for Free Norwegian activity during World War II. From Scalloway ran the wartime "Shetland bus," small boats which carried secret agents to Norway on many a daring operation and brought back refugees. It even stirred echoes in distant Florida. At Mr. Churchill's request, three U. S. submarine chasers were detached from their base at Miami and shipped to the Clyde, to be manned by Norwegian crews for this dangerous run. Shetlanders marveled at their central heating, showers, drinking fountains, and other crew comforts.

We found the little port strangely quiet. A few drifters sheltered at Prince Olaf Slipway, for an icy gale which almost snatched our breath away was roaring over the town.

### Ponies, Shetland's Famous Export

But Shetland ponies at near-by Berry were grazing placidly. Apparently a 60-mile-an-hour gale is nothing to these hardy animals, for they remain outdoors all year round.

The origin of these small ponies is still obscure. Some say they were in the islands in the late Bronze Age; others, that they came from Siberia by way of Norway in the 11th century.

The "sheltie" combines great strength with its small stature. Andrew Thomas Cluness, a Shetland authority, tells in his recent book, *The Shetland Isles*, of an American sports promoter who issued an open challenge: his Clydesdale and Flemish draft horses would meet all comers in tests of strength, in feats proportional to their weights.

The challenge was accepted by a man who kept his entry dark. At the last moment he entered the arena followed by what looked like a huge dog. But it turned out to be a Shetland pony, and with it he won the contest easily.

The Shetland pony was the first pony to have its own stud book. Surefooted, intelligent, and easily handled, it is a most suitable first mount for a child (page 526).

In recent years the Shetland pony's popularity has reached an all-time high, especially in the United States, where sales attract dealers from all 48 States and Canada. Bidding is brisk, and purebred stock brings fancy prices. At a Missouri sale last May, King's XX, a champion harness pony, brought $4,000 and the top mare $1,525.

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**← Lerwick's Screaming Gulls Dive-bomb the Harbor for Fish Scraps**

Time was when 2,000 windjammers made Bressay Sound a forest of masts—"you could very near waalk acrass on dem." These herring steam drifters, which ousted the sailing vessels, are giving way in turn to diesel craft.

More than 2,000 breeding farms from coast to coast in the United States are unable to meet the demand for the ponies. The number of purebred Shetland offspring registered in 1952 made a record, climbing to fifth place among the Nation's equine breeds. Registrations for 1953 are even higher.

Near Lerwick I talked with a pony dealer and asked why the Shetland breed is so small.

"Centuries of light feeding and poor pasture," he said. "Take them south and feed them up, and they may be as big as others of their kind in a few generations.

"Our ponies are getting air-minded," he added with a grin. "The last consignment for the United States left by plane not long ago, and last year some American officers who took part in Combined Operations over here flew pet ponies back home with them."

The Shetland Islands also produce small sheep, which are gray, black, black and white, and "moorit" (mild chocolate brown). The latter are almost the same shade as the peat bogs among which they wander, and it may be Nature's protective coloring.

Like the ponies, Shetland sheep remain outdoors all winter. They eat heather tops and may be seen on the shores foraging for seaweed. Hard living conditions give them fine wool; so sensitive is the



William Harrison

**Her Chair's Coffinlike Hood Protects the Lady of the House from Drafts**

Cooking vegetables, the old "kail pot" simmers above a fragrant peat fire. Such old-fashioned fixtures are disappearing; piped water and electricity go into the Orkneys' newer homes.

The Shetlands and Orkneys each contain 100 islands and islets, the majority of them uninhabited. Their combined land area is less than Rhode Island's, and the entire population adds up to only 41,000. Both archipelagoes are sprinkled with curious place names bestowed by the Vikings. Classical writers called the Orkneys the *Orcades*.

fiber, one expert says, that it alters with climate and seasons (page 530).

The finest wool, from the animals' necks, is usually reserved for the now almost extinct "lacework"—shawls of such fine texture that they can be drawn through a finger ring. A Shetland bride recently wore one as her wedding veil, and one was presented to Queen Elizabeth on her twenty-first birthday (pages 525, 535).

Shetland sheep dogs are small too, with long noses and short pricked ears. They are highly intelligent and originated as the "toonie dog" kept by the crofter, or small farmer, for work on his "farm toun." Its dwarf size also comes from "hard living and high thinking."

In Scalloway we found an enthusiastic member of the National Geographic Society. Though he has never left the Shetlands, he keeps in touch with the world through The Magazine's pictures and tales.

His brother is a skilled photographer. While we sheltered in his studio from the icy blast, he recounted with a boy's enthusiasm his first sight of a railway train. Though planes are everyday sights to Shetlanders, many have never seen a train.

"It seemed a terrible thing," he said, "to see such a load of iron and steel rushing at the bridge I was watching from. I felt it would all be shattered to pieces with me on it. But when I cried out to a little boy who was passing to come and look at the train, he stared at me as if I were daft!"

## "The Edge of the World"

The Shetland archipelago contains 100 islands and islets, but only 24 are inhabited, including remote Fair Isle, Foula, and Papa Stour. These are reached by weekly mailboats, but are often cut off in bad weather.

There was much amusement in 1936 on Foula, which Michael Powell had chosen as the setting for his film "The Edge of the World." Scottish newspapers ran banner headlines describing the "desperate plight" of the cast, cut off there by storm. To Foula this was a normal occurrence.

Some scholars believe Foula was the Ultima Thule of the Romans, who could see its

**Can This Sweater Be "Hosiery"? That's What the Women of Yell Call It**

Most Shetland housewives supplement the family income by knitting. Queen Victoria helped to popularize Shetland knitwear (opposite). Instead of shearing the sheep, islanders pluck the fleece.

1,220-foot cliff, the Kame, from Westray in Orkney. Besides boasting this highest sheer cliff in Shetland, the island shelters a tiny field mouse all its own, with the big name of *Apodemus flavicollis thuleo*.

Strange things can happen on these remote islands. The experience of Betty Mouat of Scatness is worth recording, if only because it shows island character. On January 30, 1886, Betty, a woman of 60-odd years in delicate health, set sail in the smack *Columbine* for Lerwick. Shortly after leaving, the skipper was washed overboard and drowned.

For eight days and nights Betty, knowing nothing of navigation, was alone in tempestuous seas. But this daughter of Vikings endured her ordeal "with remarkable and pious calm" and a supreme trust in a Providence that did not fail her. The ship stranded at length on the island of Lepsöy in Norway, "narrowly escaping two fatal rocks between which it came to rest." Betty died in 1918 at the age of 93 and is still remembered by many.

Another strange story is that of the Prisoner of Papa Stour. He was the Honorable Edwin Lindsay, an earl's son and officer in the Indian Army. In the early 19th century he was wrongly certified as insane for refusing to fight a duel and was banished to the island. Twenty-six years later he escaped.

Papa Stour is the home of a medieval sword dance, probably Norwegian in origin. It is performed by men who represent the Seven Champions of Christendom.

Another interesting Shetland survival is the renowned Up Helly A' festival held in Lerwick on the last Tuesday of January. This torchlight procession of the "Guizer Jarl," or Viking chief, in his galley is probably a relic from pagan times when merrymaking greeted the sun's return after winter's long darkness.

Excellent roads lead from Lerwick to all parts of Mainland, which is 54 miles long by 21 at its widest, but only 50 yards across at its wasp waist, the Mavis Grind. Here seasick travelers in vengeful mood may throw a stone

from the North Sea into the Atlantic, or vice versa.

Shetland's larger islands lie together so compactly that a daily bus-and-ferry service from Lerwick links Mainland to Yell and Unst. The North Isles are also reached by the mail-boat *Earl of Zetland;* on this boat during meat-scarce 1946 I was startled to find a mutton chop on my breakfast plate.

My sister and I traveled to Unst by the overland route, a 5-hour journey. The road winds over rolling moorland, into which long, narrow voes, or bays, penetrate for miles. The croft houses we passed here and there were mostly a modern type, wood, brick, and concrete having largely replaced the older thatched dwellings of stone.

Peat stacks stood by the doors, and sheep and ponies grazed on the heather. Piped water and electricity are now being introduced into outlying districts of Orkney and Shetland, but many crofters already make electricity by small wind-driven generators.

### Going to Yell

At Mossbank we boarded a ferry for a quick trip across the sound to Yell, a large island where many ponies are reared. Here another bus was waiting for the run to Mid Yell, where passengers for Unst transferred again.

"Yell is the largest island in Britain still without a pier," said a passenger, "but they're building one at last at Mid Yell that will take the *Earl*—and high time, too."

Shetland's Norse place names sound strange to visitors. *Yell*, or *Jala*, comes from the same word root as Denmark's famous Jelling.

"Did you ever hear," asked my companion, "of the three ministers in a Shetland bus? One was going to Yell, another to Brae, and the third to Houll!"

We topped a rise and saw a strip of brilliant turquoise backing purple peat bogs. It was the well-named Bluemull Sound, through which the tide runs strong and raises walls of water even on a calm day as North Sea and Atlantic Ocean wrestle for mastery round the Shetlands. We crossed it in another motorboat and were in Unst, Britain's northernmost island. There was no sizable land now between us and the polar ice floes.

The small island is of special interest to geologists for an outcrop of serpentine. Iron ore is still mined at Haroldswick. Naturalists delight in the bird sanctuary at Herma Ness, and botanists in the "rare and curious plants" recorded by an early writer.

The first *Flora of Shetland*, published in 1845, was the work of a young Unst botanist, Thomas Edmondston. His discovery, near Baltasound, of a sandwort new to Britain (*Arenaria ciliata* var. *norvegica*) at the age of 11 attracted the attention of Robert Graham and Sir William Jackson Hooker.

Lady Franklin visited Unst, seeking news of her husband's ill-fated Arctic expedition of 1845. Sir John's last port of call had been at Stromness in the Orkneys. Lady Franklin, local people say, even landed upon the Out Stack, a slippery rock beyond Muckle Flugga Lighthouse, last inhabited foothold of Britain in the northern seas.

We spent a week in a little cottage at Uyeasound in the south of Unst. Our hostess, who had just celebrated her golden wedding, looked after an invalid husband, her house, visitors, animals, and garden, and cooked, cleaned, and washed. She still had to carry all the water for the house in pails from a neighbor's, for the piped supply had not yet reached her. The soft light of oil lamps still lighted the cottage.

A traveling cinema visits the village once a fortnight, but our hostess has no time for such diversions. She showed us her own and her granddaughter's handiwork of long, dark winter evenings—gloves and scarves of bright shade and intricate pattern.

Almost all Shetland women add to the family income by knitting, and Unst is famous for its "lace knitters," who work the finest wool. For "lacework" the wool is carded and spun by hand, though spinning wheels and spinners are rare now even in this last outpost of Unst (pages 534, 535).

All other Shetland knitwear is of a heavier type, and the wool is sent to be machine-spun at Inverness, mostly, or at Brora.

The story that Spanish sailors wrecked from the Armada taught Shetland's inhabitants the bright shades and geometric patterns of their "hosiery" may be set aside. One supposition is that the patterns came from the Orient through Scandinavia.

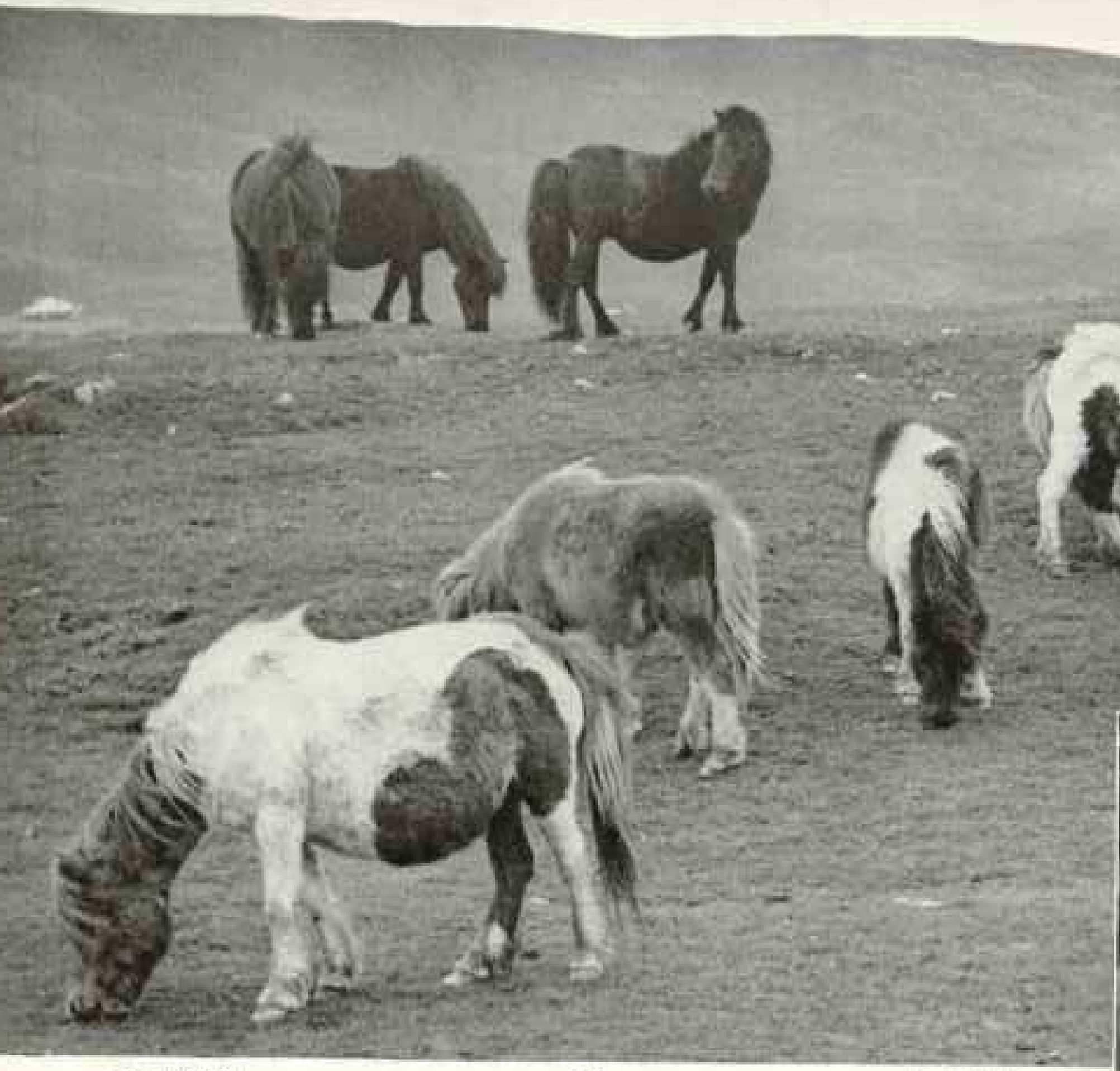
### Tale of a Frustrated Mariner

Life at Uyeasound is by no means dull. All year unexpected visitors come to the cottage, for there is no inn in the little hamlet.

Some summers past one visitor was the harbormaster from Torshavn in the distant Faeroes. He had set out in an open boat on a summer evening to sail to Denmark—just like that! A storm nearly swamped him, but he was rescued by Shetland fishermen and arrived in Uyeasound "flying his strange flag and wid his face all crusted wid salt!"

This daring voyager set out again for Copenhagen, but again he was baffled by weather and obliged to return to the fishery cruiser, which landed him at his destination. He still corresponds with his friends of Uyeasound.

Wartime brought less desirable visitors. While our landlady was milking on a quiet



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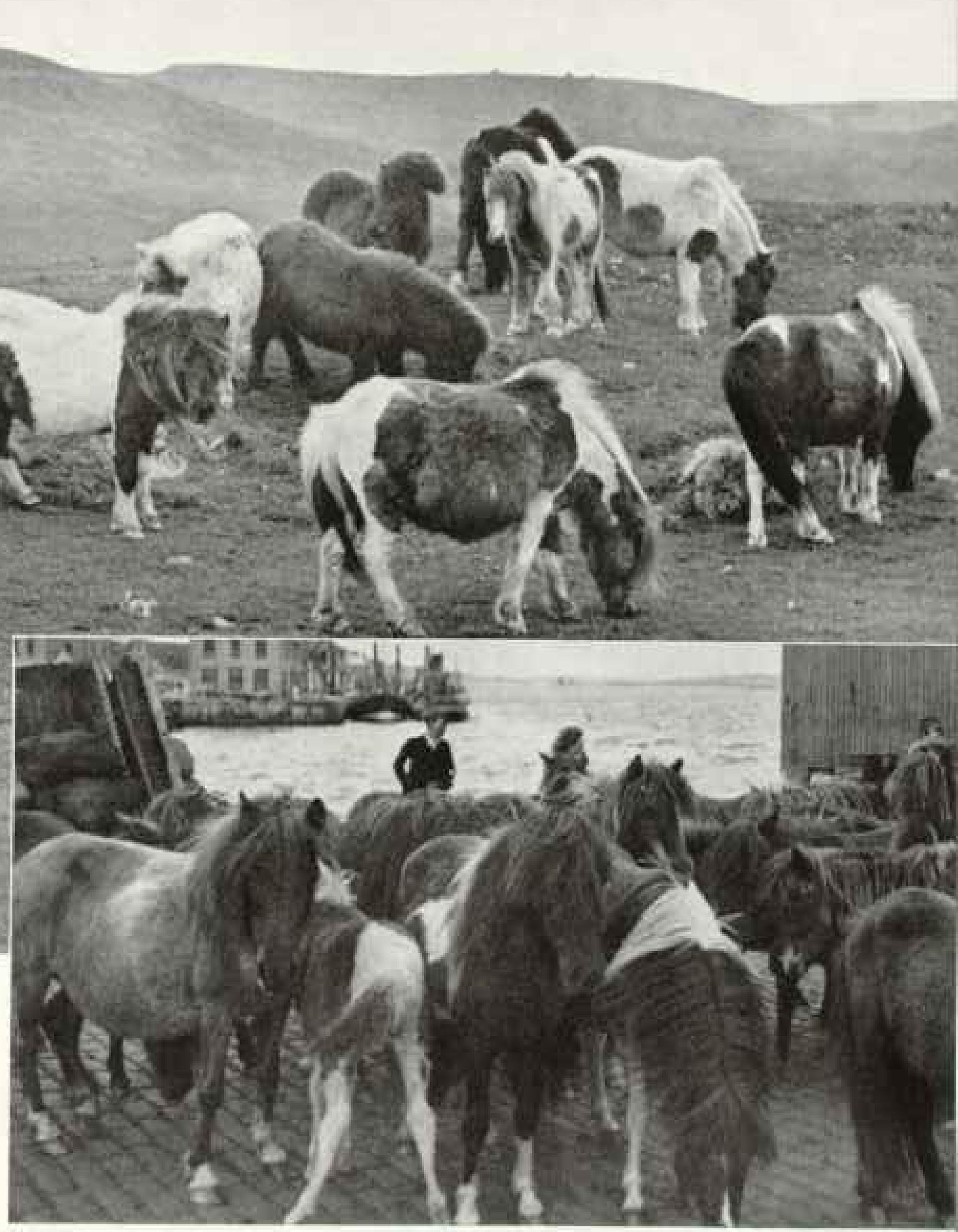
Robert Williamson



### Children's Shetland Ponies Still Roam the Islands

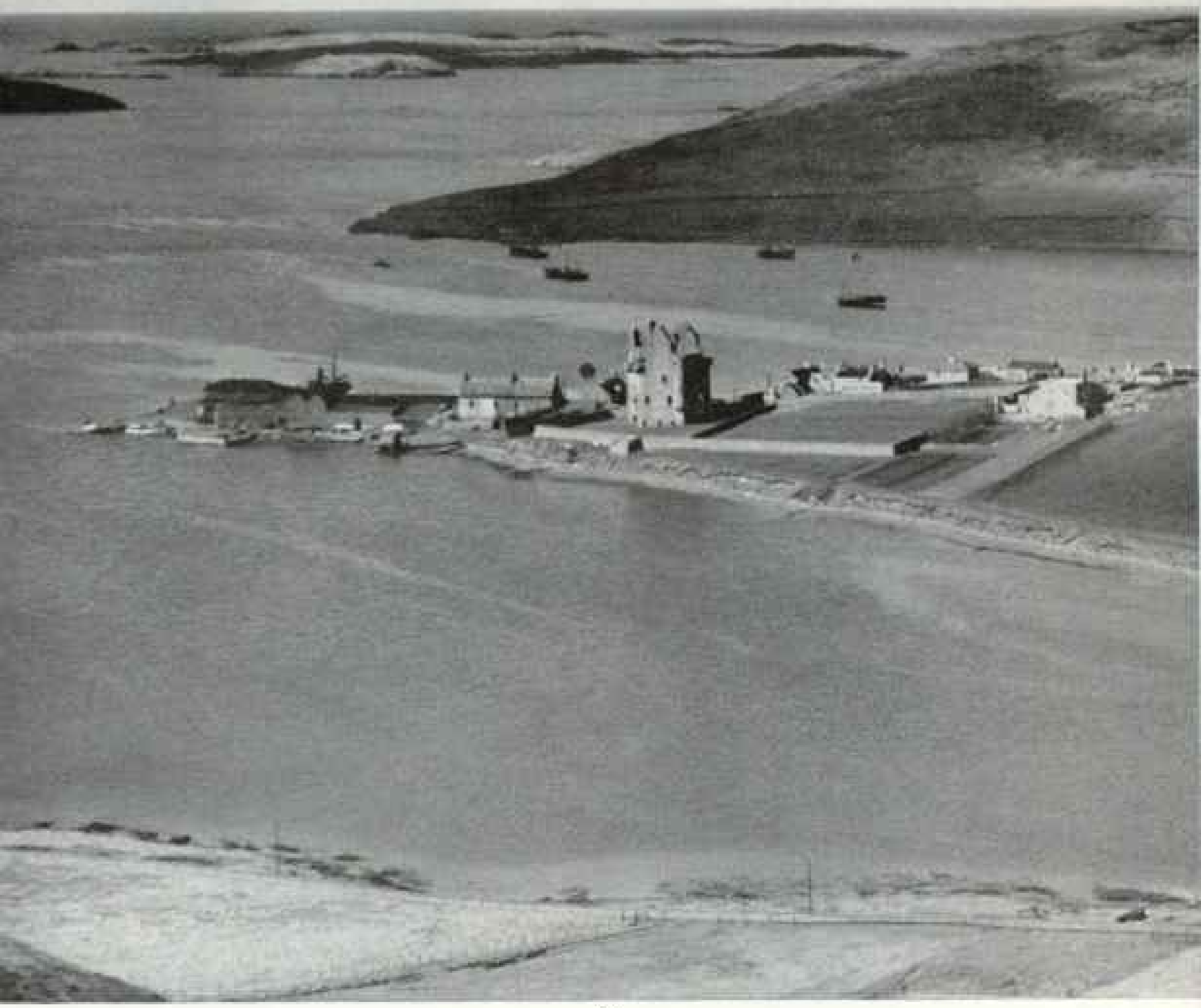
Poor pasture and stern climate through the centuries helped to keep these strong, gentle ponies small. They average 40 inches in height and often live 20 years or more. In their native island they remain outdoors even during gales. Occasionally they pull small carts or carry peat (page 521). Shetland cattle, sheep, and dogs are similarly small. These ponies graze near Scalloway. Others (on pier) await export from Lerwick.

*St. Ola*, Rounding Out Half a Century of Service, Steams into Stromness with the Scottish Mail

Stromness looks southeast toward Scapa Flow, famous anchorage of British fleets. Hoy, loftiest of the Orkneys, fills the horizon. Graemsay, a small low island, protects shipping with lighthouses. A newer *St. Ola* now makes the run under the same master (page 531).



William Hourston



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**Patrick Stewart's Ruined Palace Guards the Point at Scalloway**

The tyrant Earl of Orkney and Shetland, nephew of Mary Queen of Scots, built the castle with forced labor in 1600. From its top he hanged islanders slow to obey his commands. Twenty years of oppressive rule led to his own death sentence. James VI's judges found him so ignorant that "he could scarce rehearse the Lord's Prayer," so they reprieved him for a week to learn it.

Sunday morning, a German plane swooped low and machine-gunned the village. Bullets whizzed past her byre (cow barn), fortunately without harming anyone.

Many Norwegian refugees found their way to Unst in those troubled days, some in open boats. Not a few others, whose ships had been torpedoed on the way to America, were brought famished to her door.

In those days these northernmost bits of land were of more immediate strategic importance to the British Isles than faraway Singapore or Hong Kong. From their windows the islanders had a ring-side seat when British squadrons winged toward the Continent. "We used to count them as they went over, and then when they came back again."

Muckle Flugga Lighthouse, high on a rock about half a mile north of Unst, is the most northerly habitation in all the British Isles.

On Unst itself that proud position is held by a croft called the Skaw, which covers a lonely headland. We visited there on a bright morning; as I approached to take a picture, an elderly woman, her head wrapped in a shawl, peered at us from the little porch which stands in front of most Shetland doors and beckoned us hospitably to approach. But when I offered to take her picture too, as one of Britain's most northerly inhabitants, she shook her head and said politely, "Thank you, no. I have a great aversion to being photographed."

The Skaw was a very hush-hush place in wartime, and, as we picnicked, our feet dangled in an underground passage leading to old tanks and ammunition cellars now in ruins.

While we sat watching the Skaw's sheep

529 J. D. Ratter

**Norwegian Commandos Based on Scalloway Raided Their Occupied Homeland**

Many refugees from Hitler escaped to Scalloway on the wartime "Shetland bus" (page 521). The Stewart castle sheltered wartime supplies. This little port, west across Shetland's Mainland from Lerwick, was once the Norse capital of the island group. The rugged skyline of Foula, a lonely isle 27 miles to the west, stands out on the horizon behind the town.

feeding on seaweed in a sandy cove, the lighthouse steamer suddenly appeared, making her pitching way around the headland on one of her occasional trips to the Flugga. Landing there is no easy job, for cliffs tower 230 feet above the surges, and the swell is constant.

On my visit to Unst in 1946 I had found shore keepers at Burra Firth setting out in a motorboat and had joined their party. For miles we sailed sheltered waters between Herma Ness and Saxa Vord; their towering cliffs are among Britain's finest rock scenery. Thousands of sea birds frequent their vast caverns.

Leaving the shelter of Burra Firth, we landed at the lighthouse pier and climbed to the high tower. Up this almost sheer rock workmen in 1854 carried tons of material on their backs to build the original tower. They completed it in the record time of 26 days! Shetland's first lighthouse, at Sumburgh Head, was built in 1821.

In the old visitor's book at the Flugga, under date of 1869, is the signature of Robert Louis Stevenson, with that of his father, Thomas, whose engineering skill went into the building of the tower. In World War II many German bombers passed the Flugga, but they dropped no bombs.

"We were probably too useful a landmark for them," said the young keeper, who showed us literally round his circular kitchen.

On our return journey we circled the Out Stack, but, unlike Lady Franklin, did not land on it, though it was not uninhabited. On this uttermost tip of Britain lay a gray seal, quite undisturbed by our nearness.

Gone are the days when Shetland clergy-



**A Shetland Girl Bottle-feeds Her Lambs**

Rugged climate and terrain keep Shetland sheep small but make their wool extremely fine. When they grow up, these lambs may forage seaweed.

men, attending the General Assembly of their church in Edinburgh, took a fishing vessel to Holland, crossed to London, and then went north.

The first scheduled air-mail service was inaugurated between Inverness and Orkney in 1934, and the first regular air mail to Shetland in 1937.

Shetland's small airport is at its southern tip under Sumburgh Head. Near it is a famous prehistoric village of the Bronze Age or earlier, surmounted by the ruins of a 16th-century castle which Sir Walter Scott christened Jarlshof. The name stuck to it, and to the ruins underneath.

A fine road links Sumburgh airport to Lerwick, 25 miles north. On their way to catch a plane, travelers get a glimpse of Shetland's archeological curiosity, the Broch of Mousa, on a small island off Sandwick.

These circular, unmortared towers called "brochs" are unknown outside Scotland. They were probably built for defense or refuge against the Norsemen by the Picts.

Numerous brochs have been uncovered, but Mousa is the supreme example, since it is structurally complete. Owing to its remote location, it has survived to a height of 45 feet, and despite its grim exterior it has a romantic history. Sagas tell that 1,000 years ago it sheltered a runaway couple from Norway, and that another pair of lovers were besieged in it 250 years later by the lady's son.

Up from the Sumburgh sand hills soared our crowded plane, heading southward for Kirkwall in the Orkneys. In 20 minutes we passed over Fair Isle with its cliffs and grain fields, the last in the islands to be plowed by oxen.

Like Helgoland, Fair Isle is a noted bird observatory. A banding station has been installed by its owner, Mr. George Waterston, for the study of its migrants.

Soon we were over the Orkneys' low-lying North Isles. The first, North Ronaldsay, has a wall around its shores to keep the sheep *outside* its fields. The island has its own breed of small sheep, and, like the Shetland ones, they can thrive on seaweed.

### To Kirkwall in the Orkneys

Westray, Eday, Stronsay were soon beneath us, a glittering spectacle with their white sands, emerald pastures, and brown fields where, small as toys, farmers were at work with tractors. Here the Ice Age was a more generous godmother than in Shetland, folding over the islands the rich calcareous sea beds from the bottom of what is now Moray Firth. Thanks in large measure to the industry of its farmers, Orkney has become one of Britain's richer farm counties.

Like strips of gummed paper, white roads score the islands and little farmhouses stand trimly, like stranded arks. Over Kirkwall I looked down on a throng of gray houses beside blue waters, with the steep roofs of St.

531 © Oscar Marton, European

**Automobiles Bob and Weave Among Pedestrians on Kirkwall's Main Street**

Stiff sea winds discourage most trees in the Orkneys. These specimens prosper among sheltering walls. Vikings a thousand years ago used Kirkwall as winter quarters for their galleys.

Magnus Cathedral spreading long wings over it like a mother tern guarding her nest.

Though many travelers now prefer to fly to Orkney—it is only 25 minutes by air from Wick in Caithness—Pentland Firth is crossed daily (except Sundays) by a sturdy vessel, the *St. Ola*, in two and a half hours. This is the most impressive approach to Orkney. The ship usually passes near Hoy, highest of the Islands, then under St. John's Head, a sheer precipice of 1,141 feet, where gulls circling far overhead are dwarfed to the size of sparrows (page 527).

The crimson stack of the Old Man of Hoy, as high as St. Paul's Cathedral, stands watch before this fearful height. The Old Man is the product of countless ages of erosion, which have separated him from his background and are slowly weathering his features. Enigmatic as the Sphinx, he seems to hold the key to Orkney's mysterious past, with its stone circles, sepulchral mounds, and unrecorded races.

Like Lerwick, Stromness has grown up around its bay, and its narrow street twists with the shore, steep lanes leading up to newer houses above. "Stromness is very near the gates of Heaven," said a homesick woman who left the island to be married in Glasgow in 1877.

### Famous Ships Called at Stromness

There has always been much coming and going between Stromness and America. In the Napoleonic Wars, as later, convoys assembled here to await escort across troubled waters.

Here came sailing ships to recruit hands for the "Straits," as Shetland and Orkney sailors called Davis Strait between Canada and Greenland; and here Hudson's Bay Company ships were regular summer visitors. Here lived the Company's agent, who hired its men and flew the flag of the red cross and four beavers. At the end of the long, narrow





**Peat Lies 10 Feet Deep in a Shetland Moor**

This man uses an L-shaped cutting spade. Since the tool lacks a foot rest, power must be supplied by the arms.

street is a low locked door with a tablet on which is inscribed:

> There watered here the Hudson Bay Coy's ships 1670-1891
> Captain Cook's vessels Resolution and Discovery 1780
> Sir John Franklin's ships Erebus and Terror on Arctic Exploration 1845
> Also the merchant vessels of former days.
> Well sealed up 1931.

War years unstopped Login's Well, and it was found to be still full of pure water. Now it is again sealed up.

A century and a half ago, 78 percent of the Company were Orkneymen; but that is no longer true. The most northern Company official I ever met—it was on Herschel Island off Canada's Arctic coast—was Mr. James Sinclair from the Orkney island of Burray.

I met him again in Stromness. He shook hands as if it were the most natural thing in the world that our last encounter should have been on the edge of the polar sea, and kindly arranged for us to visit one of Orkney's most up-to-date farms.

The farmer, a tall, kindly man of few words, was waiting for us. He had the air of contentment that seems characteristic of Orkney people. Like most islanders, he owned his 260-acre farm.

"That's big for an Orkney farm, isn't it?" we asked.

"Yes. Most range from 30 to 50 acres upwards. Ours is a dairy farm, with 60 cows."

He opened the door of a long byre; a line of plump cows, mostly Ayrshires and Friesians, lay couched in stalls with a few calves. The animals remain indoors from October to May; soon they would be going to pasture. But they seemed in no hurry about it as they ruminated contentedly.

"How much milk do your cows yield?"

"About 145 gallons a day. It goes to the cheese factory at Kirkwall."

"So Orkney makes its own cheese?"

"Yes. We converted the old Air Force cinema into a cheese factory after the war."

"What sort of cheese?"

"Oh, just cheese."

"And your cows are milked by machines?"

"Yes, and they're all T.B. tested. If they're not 100 percent clear, as the Shetlanders say their cows are, they're not far off it."

"Do you keep horses?"

"No, not now. Everything's mechanized. We use tractors."

The heavy byre door, of wood and iron, caught my eye. It was automatically controlled.

"The hurricane storm blew it right in," said our host. "You wouldn't credit that, would you? And hurled a big concrete block after it. Luckily there were no casualties."

A tractor-driven ripsaw in a shed was noisily sawing up that rarest of Orkney commodities, home-grown timber blown down in the recent gale on one of the island's few woodlands.

### Hens Are Women's Work

We passed from cows to poultry. The farmer disclaimed all credit for these; hens are women's province. His wife sends about 100 eggs a day to a big egg-packing station at Kirkwall.

The farmhouse itself is a plain two-storied building. The interior is mechanized and labor-saving, with piped water and electricity.

"They never want for labor here, they treat their men so well," Mr. Sinclair said as we thanked our host and said goodbye.

**Stacked Peat Dries in an Orkney Yard. In Winter It Moves Indoors to Heat the Cottage**

Moist air, bacteria, and fungi teamed to decompose a bog of aquatic reeds, rushes, and mosses. The result was peat, which might have become coal if man had left it to Nature. Dog and sheep oversee this job.

A day's motoring can cover the Orkneys' main island, which is only 25 miles long.

"I'll show you a contrast to Herschel," said Mr. Sinclair when he took us to visit western Mainland.

Orkney's Mainland is an island of contrast. From the Stone Age village of Skara Brae, three or four thousand years old, we passed under the gleaming pylons of the Hydro-Electric Board's experimental wind generator on Costa Head—the biggest in Britain, I was told—where tests of wind power and appropriate machinery are being made.

We rolled back the centuries again when we stood by the remains of the Stones of Stenness, four gaunt monoliths of an unknown past, on a bare moor between two lochs. Near by is another megalithic monument, the Ring of Brogar, where 27 out of some 60 monoliths still stand, one more than twice the height of a tall man. They have stood there probably since the early Bronze Age. Even World War II did not disturb them, though scarcely a mile away, in March, 1940, German bombers reaped the first of their grim harvest of British civilians at the hamlet of Bridge of Waith.

Farther along is the famous chambered cairn of Maeshowe. A low tunnel gives stooping entrance to a dark chamber with vaulted roof. The flickering candles which had lighted it when I first saw it in 1946 had given place to electricity, but candlelight seemed more suited to its mysteries.

### Plundered by 12th-century Norsemen

Maeshowe has attracted warriors of every age. Norsemen in search of buried treasure plundered it in the 12th century and carved their names and those of their women in runes on its walls:

"Ingigerth is the fairest of women." "Hermundr of the hard ax carved these runes."

More recently, a daring RAF officer spent the night in a small stone chamber off the central hall. He was untroubled by dreams of Ingigerth, Hermundr, or even Hitler, for people say the airman never slept at all!

Kirkwall, Orkney's gray capital, is in danger of losing its charm. The 18th-century houses that once shouldered its narrow causeways are giving way to the characterless buildings found in mainland suburbs (page 531).

Fortunately, time cannot dim Kirkwall's crowning glory, the Cathedral dedicated to St. Magnus in 1137. Set in a tree-fringed

**With Her Sheep Dog for Company, Grandmother Combs Wool Beside a Shetland Hearth**

Once a chattering throng of womenfolk, carding and spinning, might have worked in this room. Now these timeworn hands toil alone at a task usually given to machines at Inverness (page 525).

square and looking as fresh as if it were but newly out of the mason's hands, it is a neighbor of the Renaissance ruins of Earl Patrick's once magnificent castle and the much older Bishop's Palace.

In later years, during repair, human bones were found in both end pillars of the nave. They are believed to be the bones of St. Rognvald, founder of the Cathedral, and of St. Magnus himself, who was murdered in 1116 on the island of Egilsay by his cousin and rival, Earl Hakon.

In one of the Cathedral windows may be seen the three holly leaves of the Irvines or Irvings, from whom Washington Irving is descended. The founder of the family was secretary and armor-bearer to Robert Bruce.

Two marble monuments commemorate the Orkney explorers William Balfour Baikie (1824-64), who explored the Niger and translated part of the Bible into the Hausa language, and Dr. John Rae (1813-1893), first to discover traces of the Franklin polar expedition. Rae was born near Stromness and is buried in the Cathedral churchyard.

Buses now link Kirkwall not only to the villages of the main island but to some of the south islands as well.

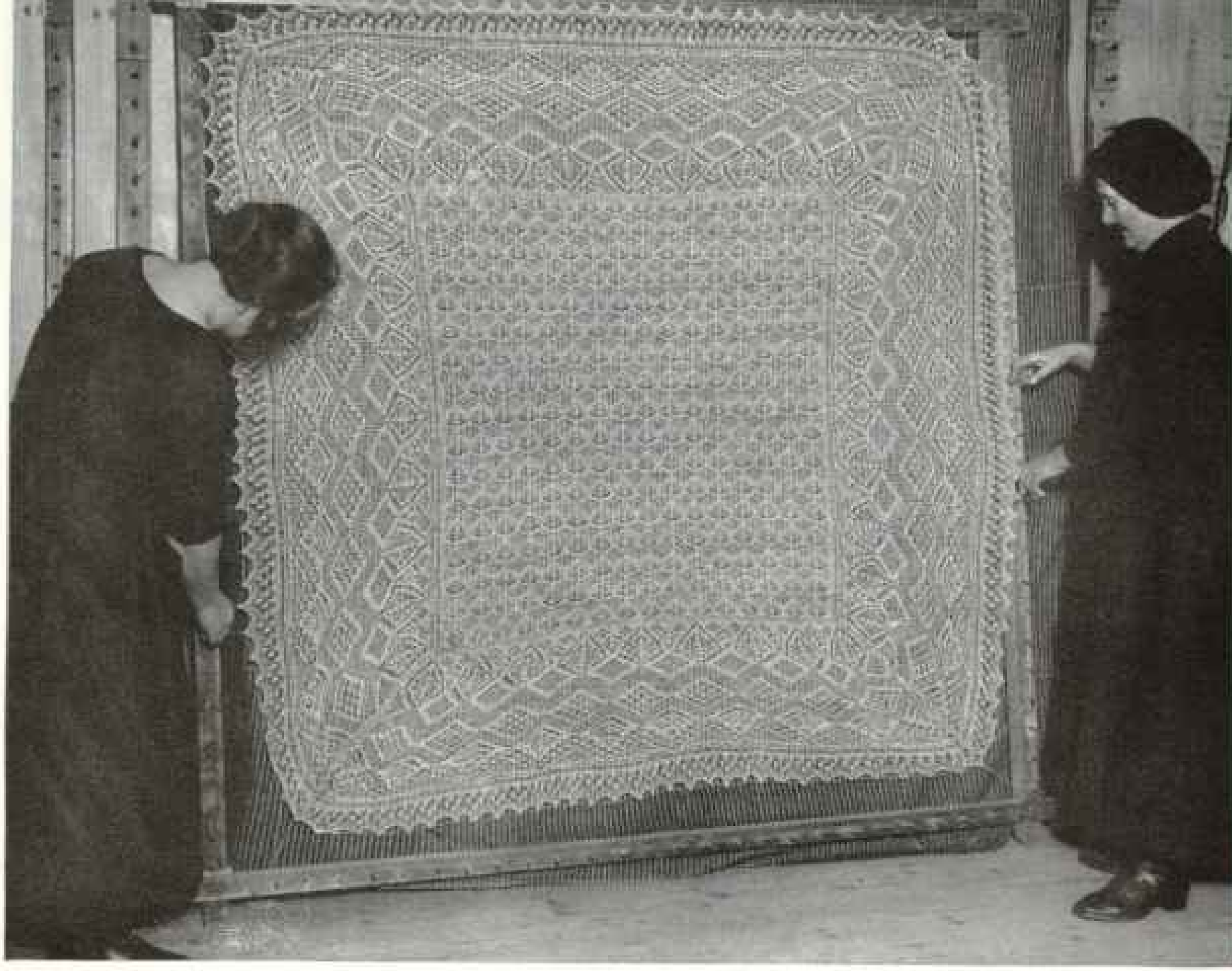
After the sinking of the *Royal Oak* in October, 1939, by a German U-boat that had penetrated the defenses of Scapa Flow, Mr. Churchill visited Kirkwall. Engineers soon began the titanic task of filling up, with huge concrete blocks, the east end of the Flow, which sunken blockships had failed to protect. This feat has altered the geography of South Ronaldsay and Burray and changed the lives of their people, who now market by car instead of boat.

### Church Built by Prisoners

We crossed the causeways to visit a small church built on Lamb Holm during the war. Italian prisoners converted an army hut into this place of beauty, its entire furnishings made from scrap material. Before it stands a statue of St. George slaying the Dragon.

A hand-wrought screen of iron rods divides the altar from the rest of the chapel.

Buses took us on to South Ronaldsay's picturesque village of St. Margaret's Hope. This parish was once famous for its piper "who



**Shetland's Gossamer Woolen Shawl Could Slip Through a Wedding Ring**

Lacy in look, it covers nearly three square yards but weighs three ounces. Its wool, plucked from necks of sheep, was hand-spun into thread thinner than fine cotton. Few women skilled in the art are left.

professes by means of his music to banish the rats from their habitation."

The atmosphere of Orkney buses is leisured and serene. Passengers greet each other cheerily in curiously high-pitched voices and give an impression of friendliness and well-being.

The source of much of Orkney's prosperity is the egg. Its export of eggs is worth about 14 times the net taxable value of the islands. At big packing stations they are tested, graded, and shipped to Leith and Glasgow. The Ayre egg-packing station at Kirkwall is one of the largest in Scotland.

### Sixty Million Eggs a Year

Orkney handles 60,000,000 eggs a year. At the season's height a million and a quarter eggs a week may go through the station at Ayre, where an old mill was converted for this use.

I watched girl workers testing the grading at a machine which can handle 10,000 eggs an hour. Most testers pass 2,000 to 2,500 eggs through their fingers hourly. The annual turnover of the Ayre station alone is worth more than $2,100,000, and local farmers and crofters are themselves the shareholders. Orkney's income from eggs is about half the islands' total farm income.

From eggs we passed to cheese, visiting a factory run by the Milk Marketing Board. About 6,000 gallons of milk pass through it daily, and whey and butter are also produced. The cheese finds its chief market on the Scottish mainland. The whey is sold back to the farmers for pig food, which may be one reason why pig breeding is becoming very popular in Orkney.

To catch a boat to Orkney's North Isles one must be up betimes. Delicate opal tints of moonset and sunrise competed in the mirrorlike lagoon when I reached the *Earl Sigurd* at 6:30 on a calm morning. Breakfast on board should be previously ordered, but the steward was obliging, though there was no mutton chop this time!

From the peaty isle of Eday we turned east to Stronsay, once an important fishing center. So flat is the island that from a distance its gray two-storied houses seem to rise out of the water.

**Lerwick's Chimney-potted Houses Wet Their Feet in Bressay Sound**

Ebb tide leaves watermarks on stone buildings at the town's south end. Merchants used to smuggle contraband through tunnels leading under the street from the water front (page 521).

Next came Sanday, with white beaches. It was the birthplace of the Burness family, some of whose members emigrated to Kincardine in the 18th century. Robert Burns's father was a Kincardine man who spelt his name Burness. Viking blood may have run in Rabbie's veins.

### Last of Orkneys' Great Auks

We sailed between the striking red and black headlands of Eday and Calf of Eday and waited off the small island of Papa Westray, which has no pier, for the boat to come out. Probably the survivor of the last pair of great auks to nest in the Orkneys was killed on Papa Westray around 1812. The male is now in the natural history collections of the British Museum.

Opposite Papa Westray lies the larger island of Westray. At Pierowall, its village, *Earl Sigurd* tied up for the week end, and I found comfortable quarters in the little hotel.

Next day I visited the ruins of Noltland Castle, a strangely magnificent pile for its remote situation. Tradition says its governor, Gilbert Balfour, prepared it for Mary Queen of Scots after her defeat at Langside. Had the unfortunate Queen gone north instead of south, Scottish history and her own might have taken a very different turn.

From Noup Head Lighthouse at Westray's extremity there is a fine view of Orkney's western approaches and the waters under which Earl Kitchener of Khartoum and the men of the cruiser *Hampshire* sleep their last sleep.

There are 100-odd islands in the Orkneys; each has its own charm. Their future seems bright if their young folk will stay there, for the islands are a larder in a hungry world. But here as elsewhere employment dwindles as machines replace men, and people tend to drift citywards.

With so many modern improvements it is hoped, as someone has remarked, that "man will not be so ousted that there will be a swingback to 1795, when labour was so scarce that one man, classified as a 'jack of all trades,' was reported as 'the kirk officer who serves the parish in the different capacities of beadle, sexton, cooper, slater, plasterer, boat-beater, gardener, kelper, mason, quarryman, labourer, thatcher, farmer, and the most fortunate begetter of boys in the parish, for his wife bore him three at one birth, and most of his children are boys.'"

# Our Navy in the Far East



By Admiral Arthur W. Radford, United States Navy

*With Illustrations by National Geographic Photographer J. Baylor Roberts*

ASIA'S great importance lies in the single overwhelming fact that more than half the world lives there.

Add to this the military commitments of our mutual-assistance pacts, involving millions of people on the periphery of Asia, and you can understand why our fighting ships are deployed from the Sea of Japan to the South China Sea.

The white hats that bob along Tokyo's Broadway—the Ginza—and on Hong Kong's Gloucester Road are out there on Navy business involving the security of American interests in a score of widely scattered Asian places with names unknown to most of us a decade ago. (See the National Geographic Society's new map, "China Coast and Korea," a supplement to this issue.)

### Our Far-flung Interests

American contact with the Far East began with the opening of our trade there immediately after the American Revolution. Our interests were compounded when Commodore Perry opened Japan to the West 100 years ago and amplified half a century later when Admiral Dewey steamed into Manila Bay.*

Since the signing of the Japanese surrender on the *Missouri*, our Asian responsibilities have been rendered infinitely more complex. The support of South Korea, Japan, Okinawa, Formosa, the Philippines, and other important free countries on the fringes of Asia indirectly concerns the protection of an area and a population far larger than our own.

Only a nation with a powerful navy could undertake such an enormous task five to eight thousand miles from its homeland.

Involved is more than the limited naval role of keeping the sea lanes open and supplying our troops. The blockade of North Korea, the patrol of a thousand miles of the China Coast, and the active participation of fast carrier task forces and the Fleet Marines in the Korean struggle have added up to no small task. Yet these have been only a part of Pacific Command responsibility.

To picture the disposition of our Navy in the Far East, think of a giant hand articulated by a wrist that is Hawaii, headquarters of the Commander in Chief, Pacific Fleet. From Pearl Harbor fingers of operations, supply, and administration extend to several spheres of naval activity.

Chief among these is the Naval Forces, Far East, which includes the Seventh Fleet and all activity in Japan.

Second is the big Marianas Command, operated from Guam, the westernmost segment of United States sovereignty in the Pacific.

At Sangley Point, on the calm waters of Manila Bay, is the Commander of Naval Forces, Philippines, who keeps a concerned eye on troubled Southeast Asia while directing activities at the naval base on Subic Bay.

The remaining forces are the lesser installations on Formosa and Okinawa, where the routine patrols of the international waters off the China Coast are launched (page 562). These are administered from Hawaii, but in the case of Okinawa through Japan.

United States Naval Forces, Far East, is under the command of Vice Adm. Robert P. Briscoe, and its operations are directed from his headquarters at Yokosuka. Also from there, as a part of the unified command, he directs the strategy of the Seventh Fleet, and at the request of the Japanese assists in building their defense forces.

On a recent visit to Yokosuka I observed a squadron of American-made frigates flying the Japanese flag. I recalled that only eight years ago I had commanded a naval task force bent on the destruction of the Japanese fleet. Now, here were ships we had given them for patrol and harbor defense. Moreover, Japanese crews are being trained by Americans to handle the vessels.

Yokosuka, only an hour and a half by rail south of Tokyo, was Japan's largest naval base. It serves now as our Far East naval headquarters and a rest area for crews on

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### The Author

Admiral Arthur W. Radford, United States Navy, knows the turbulent Far East as the average householder knows his own back yard. Because of this first-hand knowledge and his keen grasp of global strategy, he was named by President Eisenhower to serve in the Nation's highest military post—Chairman of the Joint Chiefs of Staff. The accompanying article sums up the author's impressions formed during a four-year tour of duty as Commander in Chief of the Pacific Fleet. It was written before his promotion.

As CINCPAC, Admiral Radford traveled more than 300,000 miles from his Pearl Harbor headquarters to visit every section of a command stretching from Korea to Indochina. On his official journeys he often conferred with such leaders as President Rhee of Korea, Premier U Nu of Burma, and Generalissimo Chiang Kai-shek of the Chinese Nationalist forces on Formosa.

Admiral Radford during World War II commanded a carrier group. His performance in the Baker, Makin, and Tarawa landings won him the Distinguished Service Medal. He has long been an outspoken advocate of air power.—Editor.

* See "The Yankee Sailor Who Opened Japan," by Ferdinand Kuhn, National Geographic Magazine, July, 1953.





**U. S. Navy Ships off Korea's Battled Coast Draw Sustenance from a Moving Oiler**

Seventh Fleet ships cruising slowly in the Sea of Japan replenish food, fuel, and ammunition. Looping feed lines pump gasoline and oil from oiler *Cacapon* to destroyer *Taussig* and carrier *Princeton*.

539 Kodachrome by National Geographic Photographer J. Baylor Roberts

**Wings Folded, Combat Planes Crowd *Princeton*'s Deck Like Butterflies at a Water Hole**

Red Baker flag above each ship spells danger—fueling is in progress. Destroyer waiting its turn at rear serves as life guard in case a man falls overboard during the operation.

rotation from weeks at sea. Its dry docks, bigger than Singapore's, can accept any vessel in our fleet. This 500-acre peninsula, cut off from the mainland by hills, has seen as many as 50 United States ships under repair or overhaul at one time.

The same civilian workers—some 15,000 of them in Yokosuka—who ran lathes and pounded rivets for the Japanese Navy have proved willing hands in repairing American ships. And the base's machine shops, 1,000-bed hospital, and housing facilities (7,000 Americans live there) were adapted with amazing ease to our requirements.

All this constitutes an appreciable contribution to the Japanese economy. American spending is the difference between Japan's survival and bankruptcy.

Add to this the 20 million South Koreans, and there are almost as many people in the Orient directly dependent on our economy as there are Americans here at home. And to complicate tomorrow's economy, the United Nations will soon be faced with the problem of rehabilitation in Korea.*

### Liberty in Yokosuka

Norfolk, Long Beach, and Honolulu have reeled under the impact of large liberty parties from the fleet. But they have never seen anything like the 25,000 sailors, many fresh from patrols and the "bomb line" off Korea, who have descended on little Yokosuka from noon until midnight.

Liberty parties center on the Enlisted Men's Club, where 27,000 sailors have been entertained in a single day. Free movies run continuously in its huge theater, while boxers spar and weight-lifters grunt in its gymnasium.

"The men try to squeeze 48 hours into 12," says the club's manager.

Yokosuka businessmen have been quick to adjust to the recreational role. The town's few recreation spots of 1946 have blossomed into a neon-lighted strip a mile long and three blocks wide. Street signs are in English, and the loudspeakers so beloved by Japanese merchants bellow Stateside phrases. Sailors' dollars, converted to yen to avoid black-market problems, are trapped by a multitude of shops.

We get on fine with the Japanese there. Capt. Joseph P. Thew, American commander of the base, is a member of the local Chamber of Commerce and of Rotary. Our personnel cooperate with the Japanese in many matters, even to teaching local police how to handle pistols in exchange for judo lessons.

"When I had a party for the mayor and 250 other people," Captain Thew told me, "he played the piano and the rest drank Cokes and ignored the tea!"

Not all Navy life in Yokosuka is lived to music. Many men stationed there waited long months for American housing. They finally paid exorbitant rents so families could join them in substandard Japanese houses among the mustard and peach blossoms of the surrounding hills, or on the graceful crescent beach of near-by Hayama, where the Emperor has a summer home.

But the Navy in the Far East is much more than foreign place names, titles, and chains of command. The Navy is Americans trying to adjust the ways of Peoria and Phoenix to life at sea or in sandbagged bunkers ashore.

The Navy is a sailor relaxing at the soda fountain on a large combat ship, and it is 600 movie screens all over the vast Pacific served with the latest films. It is weary eyes watering after hours of scanning a radarscope, and numbed blue hands exploring a fouled propeller in freezing waters.

The Navy is a Marine helicopter landing at night in a pitch-black ravine to evacuate a coughing, bewildered boy with shrapnel in his chest. Always it is dedication to the eternal vigilance necessary to maintain American security in far places.

In rear areas the Navy is wives and families, too—schools on Guam, harassed mothers in isolated areas teaching Calvert home-study courses, a ship's store on Formosa with shopping carts made of bamboo, and a Navy wife on Okinawa who turns a metal Quonset hut into a homelike model apartment (page 575).

### Flying the "Codfish Line"

Inland from Yokosuka lies Atsugi Naval Air Station, where planes are readied for combat. A four-hour flight from Atsugi on the "Codfish Line" will deliver you over the Seventh Fleet wherever it may be cruising in the Sea of Japan.

Landing directly on a carrier's flight deck, Codfish is the most unusual airline since the Army, Navy, and Marines operated SCAT from New Caledonia to Guadalcanal in the early, catch-as-catch-can days of World War II. Its name comes from the term "Carrier on Deck Delivery," or COD, and the line operates with no more amenities than the name suggests.

Flying converted Avengers anywhere, anytime, COD pilots make passengers wear rubber survival suits and offer facetious apologies for the lack of comely stewardesses and chewing gum. Organized in April, 1951, COD has carried thousands of passengers to and from the fleet. Most were specialists,

*(Text continued on page 547)*

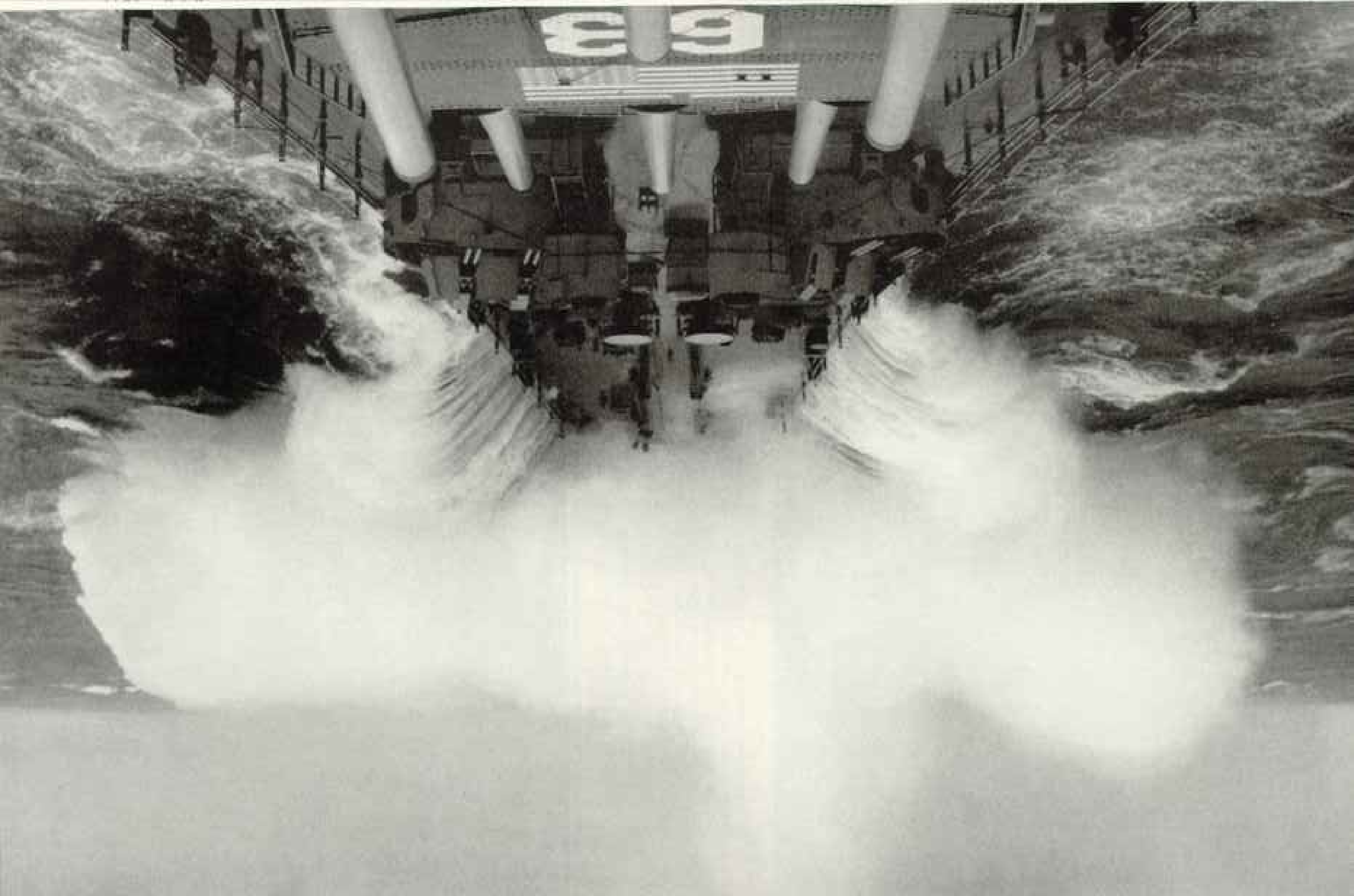
* See "The GI and the Kids of Korea," by Robert H. Mosier, NATIONAL GEOGRAPHIC MAGAZINE, May, 1953.

## ▲ Admiral Radford, on Farewell Tour, Visits Pacific Fleet Leaders

Before giving up command of the Pacific Fleet, the author (hand on phone) meets in flag plot of *Philippine Sea* with Vice Adm. Robert P. Briscoe, Commander Naval Forces, Far East (leaning on dead-reckoning tracer); Vice Adm. Joseph J. (Jocko) Clark, Commander Seventh Fleet (hand in pocket); and Rear Adm. Robert E. Blick, Commander Task Force 77.

## ▼ Marine Flyers in Mae Wests Report on the Results of a Strike

Leathernecks flying Panther jet fighter-bombers from South Korea chopped up enemy transport and supply dumps and gave close infantry support. Here, in a debriefing hut, a flight leader gives data on weather, enemy action, and bombing results. His life-preserver vest holds flashlight, flares, and other gear. Crash helmets and oxygen masks lie on the sergeant's desk.



▲ **Spray Flying, *Missouri* Sticks Her Nose Under**

Forty-five thousand tons of battleship kick up a 100-foot-wide plume as the Mighty Mo returns to Japan after a tour of duty in Korean waters. To the right of these turrets bristling with guns, a plaque in the deck marks the spot where the Japanese signed the surrender in 1945.

◄ **Huge Floating Dock Lifts *Wisconsin* from the Water**

Navy's 70-odd floating dry docks repaired nearly 7,000 ships in combat zones during the last year of World War II.

Here, in Apra Harbor, Guam, the *Wisconsin* is repaired in the largest and newest type of floating dock, which can lift more than its own weight of 80,000 tons.

Its tanks partly filled with water, the dock sinks deep enough to allow a ship to be moved into position between the walls. When the tanks are blown out, the dock floats, raising the ship.

Hollow steel walls contain machinery, pumps, and officers' quarters. Crewmen live in a hotel barge (upper left) and reach the top of the dock in elevators (center foreground). Two cranes travel rails atop the dock walls.

With the hollow walls folded down, the dock's 10 sections were towed separately across the Pacific by ocean-going tugs. Seen on the horizon, they looked like lonely Toonerville Trolleys.

U. S. Navy, official





**Aerial Bombs Swing Aboard the Carrier *Oriskany* Replenishing at Sea**

Provisioning at sea, developed by the Navy in World War II, saves long trips to base and effectively doubles the fighting fleet's size. These ships, steaming at 14 knots, keep distance about 100 feet apart.

Kodachrome by National Geographic Photographer J. Baylor Roberts

**_Oriskany_'s Gaping Hangar Bay Frames the Ammunition Ship _Mount Baker_**

Feverish bustle, punctuated by the rumble and hiss of winches, marks the swift transfer of 100 long tons an hour. At operation's peak this hangar-deck crew handles a hoist load every 45 seconds.




**Perched on an Elevator over the Water, a Panther Rises Swiftly to the Flight Deck**

Three elevators connect hangar and flight decks on *Philippine Sea*, one forward, one aft, and one portside. The 90-odd planes travel chiefly by the side elevator, leaving the deck clear for landings and take-offs. Moving of planes is tricky; a gust of wind, a sudden lurch of ship, or improper spotting of plane may hurl a quarter-million-dollar investment over the side. Plane captain or pilot in the cockpit must keep foot on brake and be alert.

visiting staff officers, or men on sick and emergency leave.

Only a part of the naval power available to us has been employed in the Korean War. Using the ships and men necessary to keep the fleet in balance with our air and ground effort, we still have had much in reserve. This has permitted rotation of active vessels in the Pacific through Admiral Briscoe's command, together with many ships from the Atlantic and the Mediterranean. In addition to harm done the enemy, the operational training has been invaluable.

Korea's geography was tailor-made for fast carrier strikes. Carrier planes could range the whole peninsula. But because the industrial northeast of the country was far from South Korea's airfields yet within easy reach of naval air, its destruction became the primary task force target.

Highways and rail lines forming a V north from Wonsan toward Mukden (Shenyang) and Vladivostok have been among the chief Communist supply routes. The success of the carriers' work has been shown by the destruction of all major targets along both sides of this V within Korea. In fact, the job was so well done that for the past year nearly half the carrier sorties have been diverted to close air support of our ground forces.

This may make the campaign sound too successful. Actually, while all profitable targets have been destroyed and leveled again when rebuilt, Communist supplies continued to move south. Most have come after dark by oxcart, and when they arrived the driver shouldered his gun and became a replacement, while the ox found its way into his rations. Enemy supplies have been packed in small bundles, lashed to A-shaped wooden frames, and strapped to the backs of thousands of coolies, who trudged down the mountain passes under darkness.

### Naval Air Supported Ground Forces

So, at the request of the ground forces, naval air shifted its emphasis to bombing supply and build-up areas directly behind the enemy lines.

"We let 'em carry all that stuff down by foot if they want to," one intelligence officer remarked, "then blow it up where it finally comes to rest, wearing 'em out in the process!"

Carrier air operations never fail to thrill even an old naval pilot.* There is the full-throated howl of the jets as they are jockeyed toward the catapults, followed by the scramble of the deck crew under the plane to set the bridle. Then the crew rolls clear, like so many agile tumblers, as the craft hurtles down the track. Finally, there is that moment, repeated every half minute, as a plane screams forward into the wind, when every eye on the flight deck instinctively turns to watch the wings bite air as they clear the bow (pages 553-559).

In war, when a carrier sends off its final strike before rotation home, the ship has the feel of the last day of school. To heckle newcomers, departing crews paint planes with names like "Flak Bait" and "Fuel Hog."

On the last day of his tour as Commander of Task Force 77, Rear Adm. Robert F. Hickey let his pilots list targets they would most like to hit. With an eye to operational requirements, he used their suggestions to draw up a final mission chart which proved to be their most daring and productive assignment.

### War Lessons Improve Carriers

Each new carrier, like Admiral Hickey's flagship, *Oriskany*, shows technical and operational improvements. A moving stairway carries cumbersome-clad pilots from ready room to flight deck (page 555). An automatic helmsman does better, in rough seas, than a skilled quartermaster. Recalling damage to controls from Kamikaze hits, naval architects have fitted the 33,000-ton *Oriskany* to be steered from any of six locations—with a portable helm the size of an ashtray!

The scarcity of air opposition introduced some strange twists in the Korean war. Jets, for example, were no more effective in long-range bombing and close support work than the slower, piston-driven Skyraider of World War II with its bigger bomb load.

The speed of the Navy's Panthers fits them equally well for reconnaissance and aerial combat. In one incident, two Panthers from the *Oriskany* encountered a flight of seven MIG's over northeast Korea, not far southwest of Vladivostok. Both jets came home, after shooting down two MIG's and a probable.

On the other hand, the AD Skyraider, workhorse dive bomber of the fleet, has been most effective as a fighter against the slow, propeller-driven aircraft the Communists have used to heckle and harass our troops after dark.

But Task Force 77 is not just carriers. It is a fast, well-balanced force capable of a sustained speed of better than 30 knots; and it combines the defensive gun power of many antiaircraft battalions with the high-flying offensive punch of its sleek fighters and bombers. Screened against submarine attack by divisions of shark-gray destroyers bristling with depth charges and "hedgehogs," and with at least one heavy support ship always in company, the force is the

* See "New Queen of the Seas" [Aircraft Carrier], by Melville Bell Grosvenor, National Geographic Magazine, July, 1942.

## Cleo the Mascot Proudly Wears Marine Dog Tags

Nobody in the 1st Marine Aircraft Wing gets better treatment than Cleo, mascot of Able Eagles Squadron. She went to Korea with the Leathernecks. Here, on the wing of a Panther, Cleo and Cpl. Stanley Rogozinski of Brooklyn, New York, watch mechanics servicing jets at a South Korean base. A pilot's Plexiglas canopy and twisting microphone cord show in the background.

Japan, by the 1951 treaty of San Francisco, turned over civil administration of Okinawa and most of the Ryukyu chain to the United States. At Naha, Okinawa's largest city, the United States Navy maintains a land base for planes of the Formosa patrol.

These shore-based sailors buy gifts for the home folks at Naha's shopping district. The toy store offers wood and plastic gadgets made in Japan. A bird-cagelike novelty in one sailor's hand tinkles as it sways in the breeze.

Taking advantage of low prices in Hong Kong, Japan, and Okinawa, officers and men from many ships have filled not only cabins but empty cells in brigs with their purchases.

hard-hitting spearhead of the Seventh Fleet.

In the course of the Korean war, thousands of men have been transferred between ships under way by a sort of breeches buoy, called a "highline," that swings its passenger across the intervening sea in a twirling, swinging cage. An amusement park operator would find this a thrilling substitute for the roller coaster.

With COD flights, helicopters, and highlines, there is no ship in the Seventh Fleet that can't be boarded at sea.

During visits to the fleet, I have called for a helicopter to move freely between ships as I would a taxi on land. Thus, in an hour I could move from a battleship to a carrier and on to a tender for inspection.

Helicopter and highline have made the fully equipped hospital of a battleship immediately available to an injured man on the smallest mine sweeper. They also bring the shorthanded commanding officer replacements when he needs them most.

For the Navy, Korea has borne many parallels to the British-French assault on the Dardanelles in World War I. There have been vast mine fields to sweep, concealed shore batteries to engage; and the Communists, copying and improving on the Turks at Gallipoli, have built coastal earthworks rather than old-style forts, knowing them to be poorer targets for an attacking fleet.

But amphibious operations have come a long way since World War I, and when we chose to invade the enemy's area through Inchon we overcame these obstacles without great difficulty.

### Bombarding Enemy Shores

Surely the sensation on a battleship bombarding shore positions has not changed since World War I. Unlike smaller cruisers and destroyers, which are organized bedlam in combat, aboard a battleship the controlling impression is one of utter stillness, except for the occasional roar of the big guns and the louder, faster "slap, slap" of the 5-inchers.

Between salvos there is no sound but the rush of the sea and the tinkle and rattle of enemy fragments dancing along the teak and ricocheting off the armor. There is no movement on the usually active deck but the splatter of spray from the bow wave and the splash of probing enemy shells.

In the open sunlight of the bridge you think of the 3,000 men in the hull beneath you—men reading boiler pressures, twisting the dials of the complex fire-control system, feeding shells to guns, or electronically reading the surrounding skies. You think also of hospital corpsmen and bakers, damage-control parties and electricians waiting in dim companionways, listening to the muffled thump of guns above and wondering whether enemy fire may bring a hit.

Unlike land operations, combat at sea is seldom sustained.

I accompanied Vice Adm. J. J. Clark, who has commanded the Seventh Fleet for the past year, into Wonsan harbor aboard a battleship scheduled to shell its defenses. His ships turned 45 guns on the enemy and fired nearly 200 tons of ammunition—more than was spent during many a history-making sea battle in the days of sail.

The talk in the admiral's mess that night, after discussion of the day's action—common-place for destroyers, cruisers, and battleships of the Seventh Fleet—revolved about future task-force operations and cooperation with the Fifth Air Force.

### "The Fleet Goes Where We've Been!"

While we were slowly cruising in Wonsan harbor that day, firing "call missions" in response to requests from Allied-held islands near by, aptly named little ships like *Chatterer* and *Osprey* were performing the dangerous task of sweeping enemy mines. Fired on by Communist shore batteries almost every day, though seldom hit, dodging mines and sweeping mine fields, setting off heavy blasts with small-arms fire, the resolute crews of these venturesome ships have been heard to remark, "The fleet goes where we've been!"

In an assault landing, a sweep is led by a squadron of 40-foot MSB's (Mine Sweeping Boats) in echelon. The 10-man crews of these unarmored open craft performed with great gallantry in a feint landing at Kojo on Korea's east coast, where only enemy nerves were at stake. Nothing has alarmed the Communists more, or drawn more point-blank fire, than these purposeful MSB's.

Searching for floating mines loosed in northern waters to drift south along Korea's coasts, AMS's (Auxiliary Motor Mine Sweepers) had to clear the way for the day bombardment of the coast by capital ships.

Mother ship of the AMS is the utilitarian LSD (Landing Ship, Dock), affectionately known as "dog boat." Originally designed to transport and repair landing craft, the LSD is built with gates astern that open on a cavernous built-in dry dock. This void, big as five basketball courts laid end to end, has met many uses. The LSD *Gunston Hall* (page 568), in her tours off Korea, has served variously as a compound for 4,000 prisoners of war and a camp for a regiment of Marines. The latter pitched their tents and built their campfires right on the well deck of their seagoing bivouac!

Ships like the LSD are but one element in

## ▲ Navy's Long Rifles, Belching Flame, Blast Enemy Targets

The battleship is no longer queen of navies; she has lost her crown to the carrier. The United States now has only four battleships in active commission, with eleven others in mothballs. Great Britain has one active today; 28 flew the white ensign at the Battle of Jutland in 1916.

Nevertheless, the huge battlewagons proved extremely useful in Korean shore bombardment. Here *New Jersey*'s 16-inchers pound railroad yards in Wonsan harbor.

*New Jersey* can deliver one-ton projectiles on targets 18 miles away. Her nine 16-inch guns can fire several salvos a minute. Accuracy is remarkable; control mechanisms automatically compensate for pitching and rolling even as the vessel zigzags at full speed. Guided by radar, she is undaunted by fog or darkness.

➤ Six-inchers on the light cruiser *Manchester* make a gun strike against coastal defenses near Hungnam. Gun spotters watch results and telephone talkers relay messages.



Kodachromes by National Geographic Photographer J. Baylor Roberts

the pattern of mobile support, developed by Americans during World War II and refined in Korea, that has revolutionized naval warfare. Much credit for developing the underway replenishment system goes to the Service Force in the Pacific. Current commander of these forces, Rear Adm. B. B. Biggs, says, "We can support the fleet anywhere, anytime, from the Aleutians to Madagascar."

Supply of the fleet begins with the problem of stocking and controlling an inventory of 589,482 items. Eighty percent of the business is done in 20 percent of the "line." So mobile support units stock only the 80,000 things used most, plus some "insurance" items, such as mines and torpedoes.

Few Americans realize the truly vast distances of the Pacific Ocean. Many Easterners, accustomed to think of oceans in terms of the 3,000 miles across the Atlantic to France and England, are amazed that it is more than 7,000 miles from San Francisco to the Philippines, and more than 6,000 to Korea.

Headquarters at Hawaii had to anticipate needs on the Korean bomb line by six weeks. Human nature leads every ship to want a full stock of everything it can possibly need. But, by careful analysis of rates of use and study of future operational plans, we were able to cut ammunition deliveries by 50 percent without reducing combat theater operations.

### Floating Bases Follow the Fleet

Sasebo (Saseho), a former Japanese naval base near Korea Strait in westernmost Japan, is the port which has given logistic support to the fleet while operating off the bomb line. But few American warehouses line the Sasebo water front. As Admiral Biggs puts it, "With mobile support, the fleet is no longer tied to a palm tree."

Virtually everything is afloat, from hospitals and machine tools to barracks and electronic repair shops. Even small craft, the dories and gigs, can be picked up by LSD's and moved at a moment's notice to Buckner Bay or Subic, wherever fast-moving developments in the Far East might dictate.

From the green hills surrounding Sasebo harbor you could watch the milk run start as the supply train got under way, sailed past swarms of vessels—many flying the varied flags of the United Nations—and moved out to sea for its regular rendezvous with the fleet. The next day, somewhere off Korea, the speeding formation of battleships, cruisers, carriers, and destroyers would slow for the key to our success in mobile support—replenishment at sea (pages 538, 544, and 577).

En route, this replenishment group would steam the strait past Tsushima, scene of the disastrous Russian naval defeat by the Japanese under Admiral Togo during the Russo-Japanese War of 1904-05.

Standing on the bridge of a carrier like the veteran *Princeton*, you watch her go alongside an oiler and hear shotguns crack as "messenger" lines are shot to the clutter of ration crates, bombs, mail sacks, and repair parts on her deck. The light lines give way to heavy ones for the transfer of cargo and of hoses that pump oil and aviation gas to depleted carrier tanks.

### Striking Power Doubled

By such means a carrier can be readied to fight again in four hours. Dry cargo moves across the lines at 100 tons an hour, five times as fast as stevedores can handle it across a dock. Commanding officers say they prefer to replenish at sea.

The practice, moreover, is one of the best things that has happened to taxpayers since World War II began, for one task force can do the work of two.

Only the crew's morale or battle damage requires a ship to return to port. What is more, mobile support reduces the need for a multitude of shore bases.

Replenishment hours give the fleet a change of pace. Amid the bustle of the hangar deck, certain scenes are remembered—a sailor, with an airmail envelope between his teeth, leaning against a 2,000-pound bomb and reading a letter, or a boatswain's mate in a battle helmet trying to make the shrill call of his anachronistic pipe heard above the music of the ship's band on the flight deck above.

If you transfer by surging, swinging highline to the decks of the oiler USS *Cacapon* alongside, you find men hard at work rolling ammunition into slings, breaking out chilled meat and vegetables from reefer boxes, or hauling on highline hawsers in a hearty fashion that recalls the days of sail.

Measure the service force mobile support effort this way. During the Korean War more than 2,000,000 tons of dry cargo were moved across the Pacific to the fleet. That is more than moves overseas through Los Angeles harbor in a year. In addition, 400,000 tons of ammunition were delivered.

### 135 Million Christmas Letters

Mail is a big and important item in the Navy, much of it moving by air. Last Christmas alone post offices of the Pacific Fleet delivered 135,000,000 letters.

Supply is more, however, than food and ammunition, mail and paint. It is recreation, character, and health as well. The Navy's film distribution system has put the latest

*(Text continued on page 561)*





Kodachrome by National Geographic Photographer J. Baylor Roberts

## A Flattop, Picking up Speed, Prepares to Launch a Jet Strike

Two Panthers, soon to be thrown skyward, crouch astride the catapult slots on the bow of *Philippine Sea*. Others await their turn amidships and in the port line-up. Propeller-driven Skyraiders, resting on the afterdeck with wings folded, will roar along the runway under their own power.

Jet bombers climb quickly to 20,000 feet or more, where fuel consumption falls off to a third that at sea level. Speeds exceeding 500 miles an hour carry them to targets within minutes. Missions must be completed in 90 minutes, for 1,000-gallon gasoline loads are by then close to exhaustion. An hour after missions amid barrages of flak over North Korea, pilots were often playing acey-deucy in the ready room.

## ↑ Bright-jerseyed Crewmen, Filling Thirsty Tanks, Swarm over Panther Jets

Confusion seems to rule a carrier's deck during gassing-up between strikes. Actually, highly trained crews move with all the speed and precision of a football team. Here men in red pour gasoline, arming crews load bomb racks, mechanics and plane inspectors make their checks. *Philippine Sea's* broad flight deck is a jumble of fuel hose and fire extinguishers. Planes are lashed tight against high winds.

← When the squawk box rasps, "Pilots, man your planes," men rush from the ready room in inch-thick quilted underwear, watertight "poopy suits," and hard hats, with shark-chasing dye-and-acid bags, maps in knee pockets, and other items. On older ships they reach cockpits sweaty and breathless because of the steep climb from hangar deck to flight deck. Aboard the modernized *Kearsarge*, this moving staircase saves time and energy.

↓ Comdr. R. W. Windsor in *Kearsarge's* ready room briefs pilots of Squadron VF-24. Flight gear hangs on wall.

Kodachromes by Melville Bell Grosvenor and J. Baylor Roberts, National Geographic Staff

## ^ Two Panther Jets Scream Away over the Choppy Sea of Japan. Another Taxis onto the Catapult

Hydraulic catapults, operating like slingshots through slots in the deck, hurl 10-ton jets into the wind at air speeds exceeding 100 miles an hour. More powerful steam catapults, soon to be adopted, will do the same job in a dead calm. *Philippine Sea*'s plane directors, catapult officers, and handling crews wear colored jerseys and helmets denoting each man's role. Within 60 seconds they will be launching another pair of planes into combat.

← Lt. (jg.) Alexander G. B. Grosvenor, in a new F9F-6 Grumman Cougar, checks to be sure his wings are spread and locked in position before undertaking a qualification flight from *Kearsarge*'s deck. A radio trouble shooter stands alongside. Flag bridge, captain's bridge, and bullhorn loudspeaker show above the plane; service ribbons denote areas in which the ship has served.

↓ "Release your brakes!" signals *Kearsarge*'s yellow-jacketed plane director as a Cougar is positioned for a take-off. The catapult bridle is snapped on behind the nose wheel. In a moment these two jets will rev up to an ear-splitting scream, their fierce blasts diverted by baffles on the deck. Catapults fire them in swift succession.

Pilots brace themselves against the jolt, which may reach six times the force of gravity. Within 150 feet they are airborne. A helicopter hovering close by swoops down for rescue in case of ditching.

Kodachromes by Melville Bell Grosvenor and J. Baylor Roberts, National Geographic Staff



**Four Swept-wing Cougars Circling *Kearsarge* Prepare to Peel Off and Land in Turn on the Emptied Afterdeck**

A heavy crane (left of the island) disposes of crack-ups that pierce the nylon-webbed barricade (right). Yellow mules, or tractors, stand ready to tow planes. Fox flag (red diamond on white) hangs on the island tower, telling the force that planes are being launched or recovered.

**"You're High!" Signals the LSO. A Cougar, Hook down, Comes in for a Landing**

Fate of a returning plane lies in the hands of the landing signal officer, whose fluorescent stripes and red-and-yellow paddles flash from a lonely perch far out above the water. Himself a veteran flyer, the LSO weighs speed and wind, pitch of deck, and height of plane, and fuses all into lightning flag signals, bringing in his birds like a falconer. To avoid crack-ups, pilots follow his coaching implicitly.

Thirteen arresting wires attached to hydraulic shock absorbers rise from the deck; one engages the plane's slender hook, or "stinger." Miraculously it holds, and the heavy plane, its speed violently arrested, shudders to a stop with a screech of scorched rubber. Should a hook miss or cable break, two wire-and-nylon barriers and a nylon-webbed barricade halt the plane.

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Kodachromes by Melville Bell Grosvenor and J. Baylor Roberts, National Geographic Staff

movies on combat screens first, then routed them back to rear areas; it serves more theaters than many a Stateside chain.

Through a system of "circuit-riding" chaplains, who shuttle through the fleet, religious counsel reaches even the smallest craft. Navy medical officers and dentists watch the health of a quarter of a million Americans in the Pacific; and Navy ships fully equipped with laboratories for the analysis of new and alien diseases have helped stamp out epidemics in South Korea, Okinawa, and the Philippines.

There have been substantial advances in the unification of supply as well as command since World War II. For example, the 1st Marine Division and 1st Marine Aircraft Wing ashore in Korea were supplied rations through Army sources.

Going into action in August, 1950, Marine ground forces were not relieved until May of this year. At the end, Maj. Gen. Edwin A. Pollock's command, which covered a 30-mile front embracing the "low-level" invasion route to Seoul and the Panmunjom area, numbered more than 30,000 men, including 5,300 KMC's (members of the Korean Marine Corps). Of the Americans, about half were regulars. General Pollock refused to make the distinction. "Once they're Marines, they're professionals," he says.

Asked his opinion of the newly trained KMC's on his left flank, the general replied, "I feel secure. Those fellows are fighters, and they're just as proud of being Marines as we are. We have to be very careful to call them KMC rather than ROK. They insist on our camouflaged-type of helmet, and they've even set Korean words to our Marine hymn."

This past year you have read much of the Marines fighting for outposts with names like Carson and Vegas, and hills like Punch Bowl. Once truce talks began, action was limited to an aggressive defense. All that could be contended was control of the ground having immediate tactical value for artillery observation or harassing fire. Most of the skirmishes occurred at night.

Battalion commander Lt. Col. Henry Lawrence, when asked if his share of the line would hold against an all-out Communist attack, said, "Sir! If they'd only try just that. All we need is to get at them!"

### Marines Supplied at Night

It was a Marine rule that every man in the line share in some aggressive patrol every four days, but parties sent out to man an outpost stayed a week or more. The outposts were supplied with ammunition, fortification materials, and mail at night through mine fields. The mail was burned when read, lest it fall into enemy hands.

Marine planes have been fully integrated with the Fifth Air Force in Korea and have often been assigned to close support of the Marine-held portion of the line.

When I discussed the effect of Korean geography on air operations with Maj. Gen. Vernon E. Megee, Commander of the 1st Marine Aircraft Wing, the general said, "It is good in one way—the mountains force railroads and highways to follow the coastline or the few valleys, so we know where supplies are moving. But it's bad in that all these hills look alike from 20,000 feet at 600 miles an hour. The lads say it's not like terrain at home, although I think it's like the brown foothills of Arizona."

To help pilots find their objective, relief maps were molded from papier-mâché for all enemy-held Korea. Strapped to a flyer's thigh, these realistic models have been a great aid in fixing objectives confused by snow, haze, and the shadows cast by the hills themselves.

For close support work, the Marines have used experienced and specially trained pilots who were sent to forward ground observation posts to talk flights onto targets. They knew the problems of both pilots and ground troops.

Listening in on these tactical radio channels, I have heard such centers guiding flight leaders four miles above to pinpoint targets. I have also heard the last words of a pilot bailing out of his jet, and ships of our blockading force reporting the coordinates of an enemy boat detected by radar. War today is waged by electronics and techniques.

A Marine photo-reconnaissance squadron, flying jets from a South Korean airfield, helped map most of Korea. Flying planes with names like Cyrano and Durante—their noses are extended to hold a battery of cameras and range finders as long as a man—Marines have mapped up to 5,000 square

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### Hong Kong Merchants Set Up Shop Aboard the Destroyer *Lofberg*

Whenever an American naval vessel puts in to Hong Kong's harbor, it is welcomed by a flotilla of Chinese merchants, all competing vigorously. Floating salesmen offer to paint the ship or repair canvas for the privilege of carrying goods aboard. Many disappointed vendors must be kept away with fire hoses.

Here on *Lofberg*'s crowded weather deck sailors pick up bargains in suits, shoes, and souvenirs. An itinerant tailor repairs uniforms and sews on hash marks. Depth charges line the side; fueling hose drapes the armor shield at left. Green-topped "walla-walla" boats and sampans cluster around *Lofberg* awaiting passengers to shore. A U. S. Navy transport lies in the harbor.

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**Marines Aboard an LST Move out of Inchon Harbor for Amphibious Exercises. A Land-based Neptune Checks a Japanese Freighter**

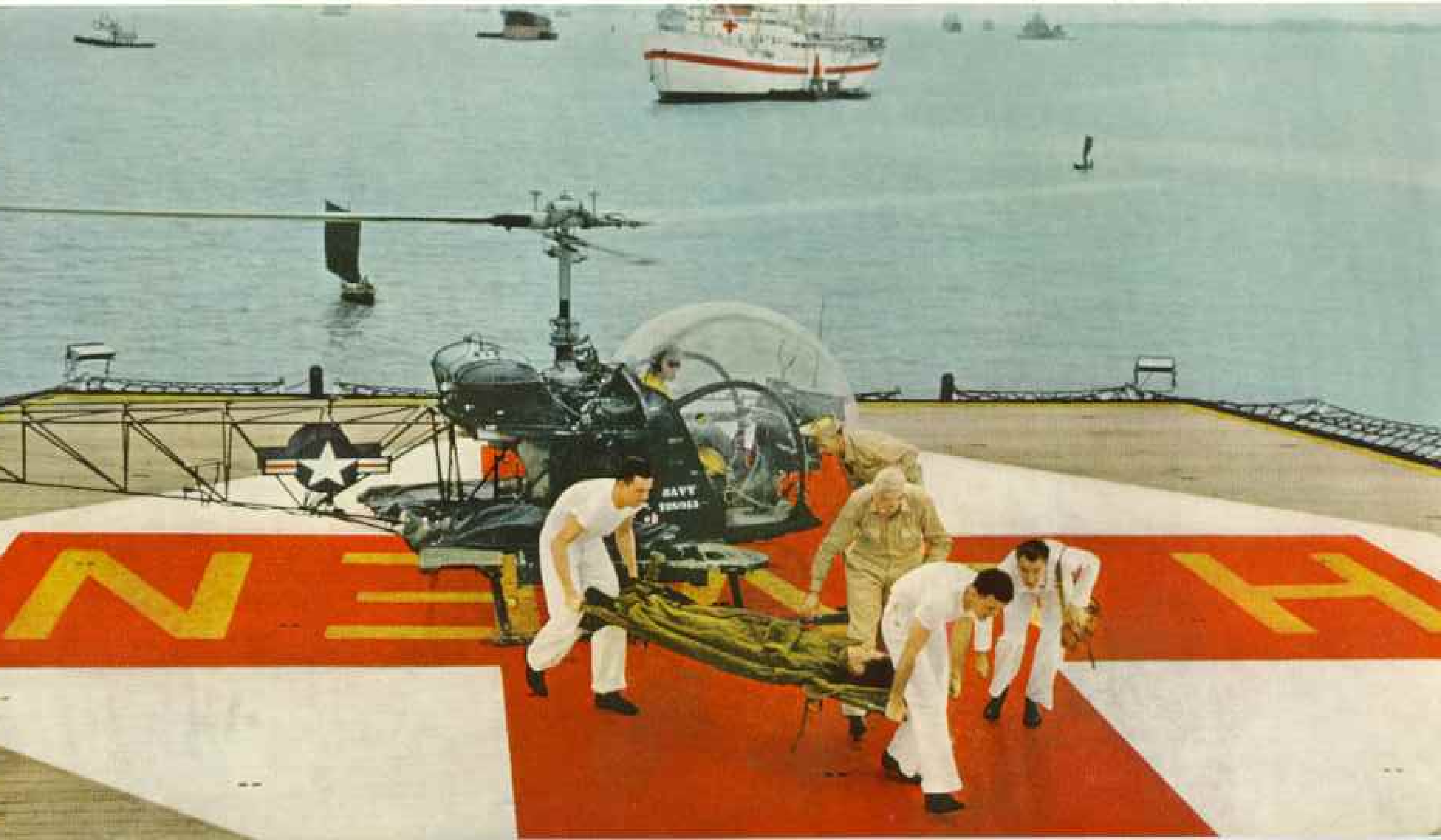
Above: Freighters carry supplies to Inchon, Seoul's harbor. Brown framework along the landing ship is designed to float ahead as a temporary ramp. Below: Patrol plane from Okinawa keeps track of Communist shipping in the East China Sea. The right wing tip carries a powerful searchlight to aid night identification.

**Litter Bearers Rush a Casualty to Surgery on the Hospital Ship *Haven*. They Dodge the Helicopter's Slashing Rotor Blades**

Troops wounded in Korea's front line were only 30 minutes by helicopter from this six-deck floating hospital in Inchon harbor. Here a doctor lifts heavy blankets protecting the wounded man. A Danish hospital ship lies in the background.



Kodachromes by National Geographic Photographer J. Baylor Roberts



miles of Korea in a day. Excluding overlaps, this would cover a path two miles wide from San Francisco to Washington, D. C.

Marine aviation in Korea provided many contrasts. I recall a secret underground control center where, almost magically, the course of every plane over Korea was traced. Standing in a wind-swept wheat field overhead, I watched a stolid-faced Korean till the dry soil with a wooden plow, unconscious of the marvels beneath his feet.

Near a debriefing hut, where aviators report the results of their mission, I saw a returned pilot, still in his crash helmet, indulging in his latest amusement in a cold and barren field. With arm outstretched, he was turning slowly while holding the wire that controlled a model airplane in flight!

### Helicopters Performed Near-miracles

Navy men off Korea have often used their spare time constructively. One Panther photo pilot, dissatisfied with the detail in the pictures he brought back, felt there should be some way to compensate for jet speeds to bring depth to aerial photographs, which are characteristically flat.

The pilot and a machinist's mate worked nights after combat and finally came up with the first successful image-compensation camera. Its details are still secret, but the result is pictures so clear that targets stand out as never before.

Helicopters have continued to perform near-miracles daily. On one of my nighttime visits to the front two marines were wounded near by. In the time it took to examine and dress their wounds, a "helo" arrived, and, guided only by flares, landed in the dark and was ready for their evacuation. The medical officer said they would be under surgery on a hospital ship less than an hour after being hit (pages 563 and opposite).

A Marine regiment in combat was supplied for three days entirely by a flight of helos. And last Christmas General Pollock was able to visit some 20 units in his command in one day. The trip, he said, would have taken a week by jeep.

Ingenuity has not been confined to combat problems. For any sailor or marine, the first rule of war is to be as comfortable as circumstances permit while waiting for something to happen. Thus mortar casings become chimneys, and old tin cans are strung to serve as doorbells in marine dugouts.

But if Americans have found modest comforts in Korea, they didn't get them from local resources. During much of recorded history Korea has been a battleground for alien forces. Poor in the beginning, the country is now bereft. The most simple requirements, such as timber for fortifications and ice for messes, come from Japan.

Civilians by the hundreds of thousands have been killed during three years of war. There are more than 100,000 war orphans. Though the United Nations has already spent vast sums on an emergency relief program, more than half the millions of refugees from the north are still homeless.

Under the truce our Army, Navy, and Air Force will operate jointly, as they have in war. Cooperation of forces under joint command has worked well in Korea. The air has been completely integrated. The Air Force's medium bombers, whose great value has been limited by the confined combat area, have been escorted by Navy and Marine jets as well as the fighters of their own service.

Off the west coast of Korea, British and American light carriers have rotated assignments without regard to flags. British, Australian, Canadian, Colombian, New Zealand, Thailand, Netherlands, and South Korean destroyers and frigates formed a large segment of the west coast blockade force. Ashore, Marines and United States and Allied ground forces have been deployed under American Army commanders with little reference to uniform or nationality.

Just as a stable, free Korea is essential to our protection of Japan, friendly forces on Okinawa and Formosa are essential to the defense of both Japan and the Philippines.

### Planes Patrol China Coast

With its blue-tiled airport terminal, four-lane highways, and typhoon-proof barracks, the southern end of the long, narrow island of Okinawa appears as American as the drive-in theater. Primarily an Air Force center, Okinawa is also a base for the naval patrol of Formosa Strait.*

Like Sasebo, Buckner Bay has the facilities to serve in the mobile support of the fleet if action should develop in Southeast Asia.

From Okinawa's Kadena Air Base twin-engined Neptunes have been taking off on grueling 14-hour, day-and-night searches of the waters off the China Coast. Their primary purpose is to detect in its early stages any assault against Formosa by Red China. But a profitable by-product is the disclosure of ships and flags trading with the Chinese Communists (page 562).

Little escapes these radar-equipped Neptunes, which fly low to photograph, identify, and plot every vessel passing through the international waters off the China Coast. They have made more than 1,000 such inter-

*See "Okinawa, Pacific Outpost," 30 illustrations with full legends, National Geographic Magazine, April, 1950.





Kodachrome by National Geographic Photographer J. Baylor Roberts

**Nurses on *Haven* Lounge Beneath the Hospital Ship's Identifying Cross of Lights**

Air-conditioned *Haven* boasts 802 beds and three operating rooms. Latest facilities for diagnosis and treatment kept the death rate of the wounded in Korea a fourth lower than that of World War II.

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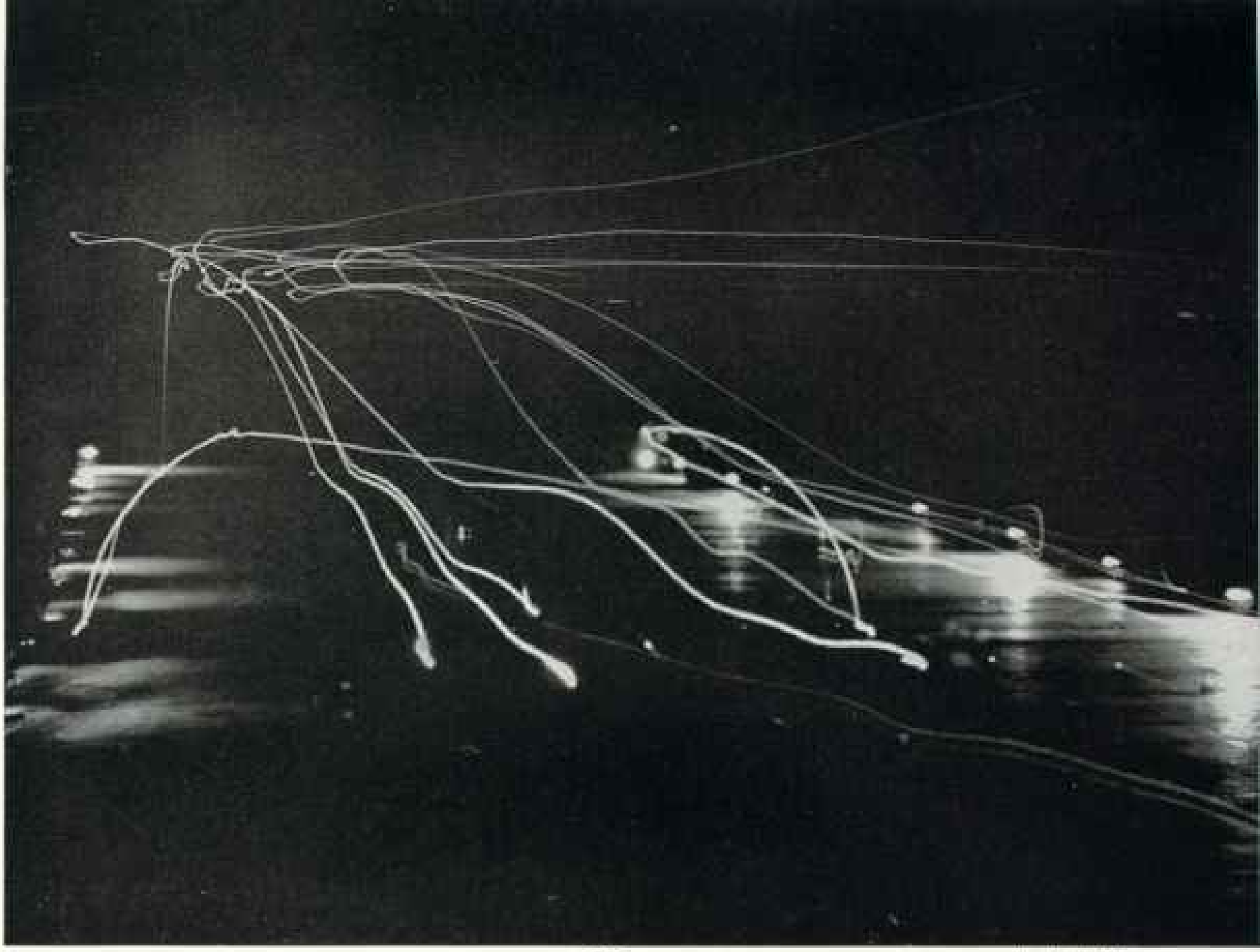
U. S. Navy Official

**Howling Down on Korea's Countryside, Marine Bombers Ferret Out Enemy Depots**

Nearly 100 planes taking part in this raid last summer set fire to farm villages that sheltered enemy billets and supplies. Here a Marine Panther flashes away through dense smoke. In a moment its own load of cocoon-shaped bombs (lower foreground) will send additional geysers of smoke skyward as their jellied gasoline explodes. A trench with earthworks zigzags across the middle distance.







**Night Hecklers, Landing on *Kearsarge*, Weave Light Trails Like Erratic Tracer Bullets**

To an observer on the carrier's island structure, jets coming in at night suggest red- and green-eyed monsters that hang motionless in the sky and then lunge threateningly forward. Filmed by time exposure, the planes record tangled light trails that tell many things to the initiated.

Diagonal line in upper right reveals a plane that came in too high and was waved off by the LSO (page 559). Plane at extreme left made a wobbly approach, landed too far to starboard, and almost went into the catwalk. Confused by this near mishap, the pilot forgot to cut his lights, which continued to trace a path as the wings folded up and the plane taxied to the right. Other lines show planes approaching the carrier correctly, turning and jockeying to get in the groove, and bouncing to an abrupt stop. White dots in the distance are running lights of guardian destroyers.

cepts each month. It is hazardous duty. Frequently challenged by ships, they have also occasionally drawn fire from batteries on islands off the coast. During one night when photographer Roberts flew with the patrol the strong searchlights of his plane were turned on 12 vessels.

At the Naval Air Facility ashore, Okinawans are trained to help Americans maintain planes and ships. Like Koreans, who become good tank mechanics though they have never driven a car, Okinawans make good repairmen. The trouble is, once they've learned, they depart to reap a cab driver's fortune from the pedestrian GI's on the island.

Much remains to give hot, dusty Okinawa the pleasures of a Coronado, but service families can now buy local meats and vegetables with confidence, golf on the nine-hole sand-green course, dance at American-style service clubs, or make their own fun spear fishing with Aqualungs off Naha's coral reefs. The best steaks west of Chicago are said to be served at the Merchant Marine Club near Naha's busy harbor, and the little Okinawan lobster is a delicacy.

### Island Fortress of Formosa

Farther southwest, on mountainous Formosa, most heads are turned toward the mainland of China.* To Chiang Kai-shek's fine army, navy, and air force, the mainland is the goal toward which all sacrifice and training are directed. To many of the 2,000,000 Chinese refugees who arrived on Formosa, the mainland is where wives and children are.

To our Military Assistance Advisory Group on Formosa, under Maj. Gen. W. C. Chase, mainland China is the springboard for a possible attack which we are pledged to repel. And to the staff of our Embassy and old

* See "Formosa—Hot Spot of the East," by Frederick G. Vosburgh, NATIONAL GEOGRAPHIC MAGAZINE, February, 1950.

### ↑ Music and Acrobats . . .

Chinese merchants in Hong Kong go to great lengths to obtain the privilege of coming aboard Navy ships to sell goods or collect dry cleaning and laundry (page 560). Occasionally they present a USO-type show as payment for the concession. Here an entertainment troupe on the station ship *Oreo* offers dances, magic tricks, acrobatics, vaudeville acts, and music.

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### ← A Mine-sweeping "Pig" Gets Fresh Make-up

Some sweepers are large seagoing vessels. Others are so small they take haven aboard an LSD (landing ship dock).

Here a small mine-sweeping boat is chained on the grated deck of the *Gunston Hall*. When this mother ship prepares to recover her brood of landing craft, she sinks her stern, lets the boats float in under their own power, and then pumps out flooded tanks, leaving her catch high and dry. The mine sweeper, however, is lifted on deck by crane.

This boatswain's mate paints a paravane, commonly called a pig, which is towed behind a mine sweeper to hook and cut the cables of mines. Once afloat, mines are destroyed by gunfire. The red-and-yellow flag flies above the paravane as it moves under water.

### . . . Please Sailors on *Orca*

A station ship is occasionally found in foreign ports frequented by U. S. Navy vessels. The seaplane tender *Orca* serves as U. S. naval headquarters in Hong Kong's harbor. These sailors crowd the ship's fantail aft of a 5-inch gun to watch the fun. Boatswain's mate Bill Hicks of San Diego, his arms tattooed, captures the performance on film. A freighter stands in rear.

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### An Old Salt Wears Hash-marked Sleeve

In 1899 Louis Little fought with Commodore Dewey's forces in Manila Bay. This experience was one of the high spots in Chief Petty Officer Little's life, which has been built around the Navy for 64 of his 80 years. He enlisted in 1889 and retired from active duty in 1919 as a chief quartermaster. Since that time he has been one of the Navy's biggest boosters.

Little is the oldest living member of the Fleet Reserve in the Philippines. At 68 he reported for duty when the Japanese invaded the islands. Fighting as a guerrilla, he was captured in 1943.

Here at the Olongapo Naval Base on Subic Bay a petty officer talks to the chief at his home. An 8-foot wood-and-canvas model of an old-type gunboat stands in the yard.

Kodachromes by National Geographic Photographer J. Baylor Roberts

U. S. Navy, Official



National Geographic Photographer J. Baylor Roberts

**To a Jet Bomber on a Dangerous Mission, Task Force 77's Ships Spell Home and Security as They Streak Across the Japan Sea**

Three carriers—*Essex*, *Princeton*, and *Bon Homme Richard*—move on Red Korean targets amid an escort of destroyers and cruisers. The flattop immediately below the flying Panther has cleared her forward deck for launching.

Opposite page, upper: U.N. warships worth the fortunes of several maharajas lie at anchor in a Japanese harbor. With replenishing at sea (page 538), such concentrations rarely occur. Lower: Seabees' earth movers level ridges and jungle for a big naval air station on the Philippines' Subic Bay, where carriers will be able to tie up alongside the landing field.



U. S. Navy, Official

### Gunfire Spotters Call Their Shots on a Model of Korea's Tumbled Hills

A student at Camp McGill's training center near Yokosuka, Japan, uses field glasses to call the range for the destroyer on the blue sea (left). A smoke puff rising from the terrain will show whether the target finder has hit or missed.

### Freedom Village: Months of Misery End for a Repatriated Prisoner

A cheap Chinese overcoat covers this American, one of 684 sick and wounded Allied prisoners exchanged last spring for 6,670 Red POW's. Medical attention and clean clothes await in the tents near Munsan, which fly both U. N. and U. S. flags.


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U. S. Navy, Official

**Jokesters Aboard *Princeton* Chalk Wisecracks on a Jet Plane from *Kearsarge***

During most strikes one flattop keeps a ready deck cleared for emergency landings by planes of all ships. Such landings arouse no comment, but the occasional pilot who gets mixed up and lands on the wrong ship is razzed unmercifully. This F9F-5, ready to return to its mother ship, gets decorations as well as fuel.

China hands like Naval Attaché Capt. Henry T. Jarrell, China is the key problem in world diplomacy.

If Nationalist forces were to land on China's mainland, they might receive popular welcome. The controlling fact, however, is that Gen. Chiang Kai-shek could never hope to cross the 100-mile Formosa Strait against opposition without suitable landing craft, air cover, and logistical support, which only the United States can provide.

On the other hand, with the training and equipment we have provided, the Nationalists appear thoroughly competent to defend Formosa against invasion, particularly since we have pledged the assistance of our Fleet and Air Force in that eventuality.

Our naval advisors in Formosa are divided between the capital in Taipei and naval headquarters at the south of the island. At Taipei, in the midst of telephones and teletypes, our officers sit side by side with Chinese, assisting in their planning and helping solve supply problems.

At the National Defense College, built with Mutual Security Agency funds and patterned after our Armed Forces Staff College at Norfolk, we teach Nationalist ground, air, and naval forces from paraphrased American texts.

In the south, at Tsoying, Marine Maj. Robert B. Carney, Jr., who has been training Nationalist Marines, said, "Asians are excellent fighters anywhere. They have courage and discipline in abundance."

At Tsoying Navy men go to sea with Chinese crews on frigates and destroyer escorts we have given them, teach them the vessels' characteristics, and help plan gunnery exercises and escort missions.

Over all this rich, tropic island one feels the presence of Chiang Kai-shek in every phase of life, and senses in this ascetic, hard-working man an element of greatness and certainly of dedication.

Formosa is the keystone in the arch of naval deployment in the Far East, its continued denial to hostile forces being essential to the defense of the Japan-Korea-Okinawa complex and of the Philippines.

### Philippine Base Watches S.E. Asia

At Sangley Point on Manila Bay, adjoining the historic old Spanish base of Cavite, known to many generations of the United States Navy, Rear Adm. Richard H. Cruzen maintains his headquarters. Overnight he could direct the operations of U. S. Pacific Fleet units should trouble break out in Southeast Asia.







**800 Flashbulbs Light *Antietam*, First American Carrier with a Canted Deck. A Crimson Banshee Catapults from Her Bow**

Navy carriers can launch and recover planes at the same instant with a radically new landing platform known as canted deck to the United States Navy and angled deck to the British Royal Navy, which originated the idea. Instead of landing down the center of the deck, a plane now comes in at an angle and sits down on a runway slanted from starboard corner to portside elevator. With both ends of the ship operating simultaneously, landings and take-offs are speeded. Propeller craft can take off aft while jets catapult from the bow. Handling of planes on deck is faster. If an incoming plane's hook misses the wire (page 559), the pilot keeps on flying and comes around for another try. Costly crashes into parked aircraft are averted. So successful is the new concept that most carriers will be converted.

This remarkable photograph, a joint enterprise of Navy and Sylvania Electric Products, was lighted by lamps fired by radio from the photographer's blimp and shot with a Fairchild aerial camera.

## A Quonset Hut Becomes an Attractive Home in the Hands of a Resourceful Navy Wife in Okinawa

Ronnie Brady entertains his family with a good-luck symbol—a make-believe dog's head with flexible jaws. Ronnie's father, Lt. Comdr. Gordon G. Brady, is executive officer of the Naval Air Facility at Naha. Their five-room Quonset hut is lashed down against typhoons.



Kodachrome by National Geographic Photographer J. Baylor Roberts

His current responsibilities are divided between assistance to the Philippines in building coastal-patrol and harbor-defense forces and the development of our base and new naval air station on Subic Bay.

I flew with Admiral Cruzen across Manila Bay and the plains of Pampanga to Subic not long ago. With us went Capt. Chester Smith, of my staff. As we circled Corregidor, viewing the charred remnants of warehouses and coast-artillery batteries and the chalk-white Malinta Tunnel entrances, he pointed out the inlet where he surfaced his submarine four times during the historic siege of Bataan to deliver supplies and to evacuate women and wounded.

In the calm of a bright tropic morning we flew on over Mariveles and other Bataan villages reminiscent of those stirring times. Forests on the peninsula still showed marks of shelling, and, as we approached Subic, old hulls could yet be seen, rusting in little coves.

We landed at Cubi Point, where a big new naval air station is being carved from the mountains that ring Subic Bay. It is an unusual place for an air base, but it offers the operational savings of an airstrip on deep water, where carriers can unload their "duds"—planes so badly damaged they can't be flown ashore.

### Seabees' Biggest Job

Cubi Point is the biggest earth-moving job ever undertaken by the U. S. Navy. It has occupied 3,000 Seabees in the bamboo forests and swamps of Subic Bay two years. Using World War II equipment, they will finally move more than 23,000,000 yards of fill and dredge a carrier anchorage and a seaplane harbor in the course of the job.

In their tent camp overlooking the swirling dust that now characterizes Cubi Point in the dry season, the Seabees have monkeys and pythons as pets, build crude furniture from near-by stands of mahogany, and have their second movie show at 1:00 a.m., when the swing shift comes off.

On Subic Bay also is the Navy Base and native village of Olongapo, both leveled by Japanese in the early days of World War II. The town is included in the area retained by agreement with the Philippine Government, and is under Navy jurisdiction.

Subic's officers have made Olongapo's administration their hobby. Proudly they point out that its infant mortality is the Philippines' lowest and its water the purest. One officer, while on duty there, organized Sunday parties to scavenge lumber for a civic need. Today you see the result in a modern building—Jackson High School.

A 1,700-mile arc drawn from Subic embraces Japan, Korea, Formosa, Hong Kong, Indochina, and Malaya, and with them the historically strategic cities of Dairen, Shanghai, Victoria, Hanoi, Saigon, and Singapore. In case of necessity, Subic as a base could lend mobile support to the fleet in any of these areas.

### Booming Guam Goes American

Backing up Sasebo, Buckner Bay, and Subic is Guam, where any Far Eastern operation could be staged. There Americans and Filipino laborers now outnumber natives, and the Navy occupies a third of the island. Guam now is emerging from the Quonset period; myriad huts give way steadily to concrete barracks and stucco homes.

With so much building, Guam at times is labor-short, despite Seabees, civilian construction workers, and the Filipinos. Rear Adm. Ernest W. Litch, commander of the Marianas, says this has so inflated wage rates in civilian enterprises, such as clubs and restaurants, that Guamanians demand and get better rates than west coast workers in similar establishments.

Business at the Navy Exchange reflects the presence of wives and children. Biggest demand is for utensils like cheese graters and garbage pails.

American children venturing in the hills after school still find old Japanese machine guns and unexploded shells. The latter keep bomb-disposal men busy.

Athletics are the major outlet for enlisted men there. Competition is keen, and winning teams travel from Japan to San Diego in intra-fleet tournaments. Stateside sports are eagerly followed. Because of time differences, they are usually rebroadcast some 10 hours after the event, lending an unreal air to the otherwise American scene.

It is a long way from Guam to Hong Kong, but like every other Navy man in the Far East, those stationed in the Marianas hope to make it.

The quiet, the good food, and the European comforts of Hong Kong convinced me that the Crown Colony should become a major rest and recreational center for men and officers of the fleet. In recent years American ships of every description have rotated even more frequently through this colorful port.

When the now familiar lines of an American ship show up in the entrance to the harbor, "walla-walla" boats—water taxis—put out from Victoria and Kowloon with Cokes and jade, shoeshine boys and tailors. By the time the anchor is down, scores of craft are jostling for position by the sea ladder (page 560).

The measured, pleasant life of Hong Kong's European residents goes on seemingly undis-

577

Romaine L. Mayo

**Heavy Seas Pummeling an Oiler Threaten to Break Its Slender Ties with *Kearsarge***

Refueling at sea goes on in fair weather or foul. Winch operators here, braving drenching spray and blizzard, must be extra vigilant to maintain even tension on cables between the ships. An octopuslike bundle of fuel hose swings from tanker to carrier. Another hose (left) is already rigged.

turbed, despite the crowding of refugees and the foreboding hills of Communist-held China that overlook this teeming bit of Britain in the Orient.

This Crown Colony is a thermometer under the tongue of Asia, indicating much that transpires behind the Bamboo Curtain.

### Battleground of Ideas

Visiting there, you become aware of the Communist planning, begun years ago, that has won most of Asia for the Soviets. You think of the methodical pattern of upheaval that has followed World War II. You picture the elaborate apparatus that extends from Moscow to communities all over Asia, a system of youth organizations, political commissars, and study centers devoted solely to the Communist idea. And you wonder, how then to regain a friendly Asia?

Guns alone won't achieve that end. It is principally a matter of ideas, and in our present relations with Korea, Japan, Okinawa, Formosa, and the Philippines we have abundant opportunity to demonstrate to Asians that our ideas are best.

In this struggle of ideas our Navy discharges a further and fundamental responsibility in the Far East, for sea power is also a symbol of assistance and friendliness. Many a community suffering from typhoon or earthquake has rejoiced at the sight of American ships which have brought rapid succor and understanding, and our trim bluejackets on liberty in foreign ports are often among our most effective ambassadors of good will.

One of the great traditions of our naval service is the employment of fighting ships on peaceful missions to bolster friends, reassure allies, and strengthen allegiances.

The sight of American sea power strengthens the spirit of our friends in the Far East; they know that even though America is 6,000 miles away, she has a means of keeping her word.

See also "Your Navy as Peace Insurance," by Fleet Admiral Chester W. Nimitz, NATIONAL GEOGRAPHIC MAGAZINE, June, 1946.

# National Geographic Map Shows the Troubled Face of East Asia

A 2,200-mile sweep of the Far East, studded with place names of historic and tragic significance, appears on the National Geographic Society's new 10-color map, "China Coast and Korea," distributed with this issue to The Society's 2,150,000 member families throughout the world.*

The map should be used for reference while reading the article, "Our Navy in the Far East," by Admiral Arthur W. Radford (page 537).

So timely is the map that readers can hardly point to a section of it that is not featured in recent or current news dispatches.

Look, for example, in west-central Korea. There is Panmunjom, scene of the truce parleys between UN and North Korean negotiators. To the south is Seoul, capital of President Syngman Rhee's battered republic.

### Korean Cease-fire Line Shown

A red cease-fire line, winding across Korea from the Sea of Japan to the Yellow Sea, indicates the 2½-mile-wide buffer zone established by the truce signed July 27, 1953, at Panmunjom. The line cuts through areas of bitter and costly fighting, many of them bearing unforgettable GI names such as Heartbreak Ridge, Bunker Hill, the Punch Bowl, Sniper Ridge, Old Baldy, and others.

Indochina's northernmost corner noses into the lower left section of the map. Places there, such as the French stronghold Hanoi, and Dien Bien Phu, also were linked with active war. Actually not a country, Indochina is merely a geographical term embracing the three Associated States under the French Union—Viet Nam, Cambodia, and Laos.

Most of the fighting between Communist forces and the French and their local allies has occurred in Viet Nam. Here, in the rice-rich, thickly populated Red (Rouge) River Delta, which appears on your map, as many as 1,400 persons crowd the square mile.

The map shows the three main offshore garrisons serving as springboards for Chinese Nationalist guerrilla raids on Red-held territory. These are the Tachen Liehtao (Archipelago), Matsu Tao (Island), and Quemoy and Little Quemoy. Chiang Kai-shek's Nationalists also hold some 30 smaller islands off the Fukien-Chekiang coast, plus Formosa and its 13 offshore islands and the 64 Pescadores (Penghu) in Formosa Strait.

The Communists recently massed a strong force on the Chekiang coast, only 12 miles from the Tachen groups, and began exploratory attacks on that island complex.

To produce the map, your Society's cartographers worked 5,337 man-hours over a 6-month period. Many problems were encountered; among the thorniest was that of place-name spellings. Tientsin, for example, may be spelled also as T'ien-ching, Tienchin, or T'ien-ching-shih! For Penki, in Manchuria, there are a dozen other spellings.

Since the maximum size of the usual supplement map is fixed by the size of the presses, the only way the cartographers could increase the map's scale was to put China on an angle (note the slant of the meridians). This way the scale became one inch to 55 miles. It would have been only half that had China been shown the usual way, with north at the top.

The map is constructed on an oblique Mercator projection computed for the great circle running northeast through the center of the map. Along this line distances are mathematically accurate between Hong Kong, Shanghai, Seoul, and Vladivostok. Since the whole strip extends only about 10° to each side, the maximum variation within it is only 1½ percent.

It is significant that if this 20° strip were extended around the globe, it would include Singapore on the southern tip of Southeast Asia and extend in the opposite direction to embrace Kamchatka, part of Alaska, and pass over Seattle, Washington. A ship's or a bomber's shortest course between Occident and Orient is directly along this strip.

### Mountains in Two Colors

Mountains have been shaded in blue and yellow—blue on the shadow side and yellow on the light, assuming the light comes from the northwest. Such a color scheme is particularly useful in this instance, for mountains dominate the map's land area.

Six shades of blue indicate the depth contours of the ocean floor—the lightest for the shallow continental shelf, darker shades for the deeper waters.

Two important new railways appear in the lower left corner of the map. One, considered a chief supply route for the Communists in Indochina, connects Liuchow in Kwangsi with Chennankwan on the border. The second, between Liuchow and Kweiyang, is completed to Tuyun and is a link in the proposed western Chinese trunk line. It presumably will extend northward to tie in with the trunk line.

* Members may obtain additional copies of the China Coast and Korea map (and of all standard maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices in the United States and elsewhere, 50¢ each on paper; $1 on fabric; Index, 25¢. All remittances payable in U. S. funds. Postpaid.

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In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus. By dating the ruins of vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for 300 years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest dated work of man in the Americas. This stone is engraved, in Mayan characters, November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, the stratosphere flight of the world's largest balloon, *Explorer II*, sponsored by The Society and the U. S. Army Air Corps, reached a world-record altitude of 72,395 feet. Capts. Albert W. Stevens and Orvil A. Anderson took aloft a ton of scientific instruments and obtained results of extraordinary value.

A notable undertaking in the history of astronomy was launched in 1949 by The Society and Palomar Observatory of the California Institute of Technology. This project will photograph the vast reaches of space and provide the first sky atlas for observatories all over the world.

In 1948 The Society sent seven expeditions to study the sun's eclipse on a 5,328-mile arc from Burma to the Aleutians.

A Greek cargo ship sunk in the Mediterranean 2,300 years ago was found and raised in 1953 by the National Geographic Society-*Calypso* Marine Expedition led by Commandant J.-Y. Cousteau of the French Navy.

The National Geographic Society and the Royal Ontario Museum in 1951 explored and measured newly found Chubb meteor crater, 11,500 feet in diameter, in northern Quebec.

The Society and individual members contributed $100,000 to help preserve for the American people the finest of California's sequoias, the Giant Forest in Sequoia National Park.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration in 1938.

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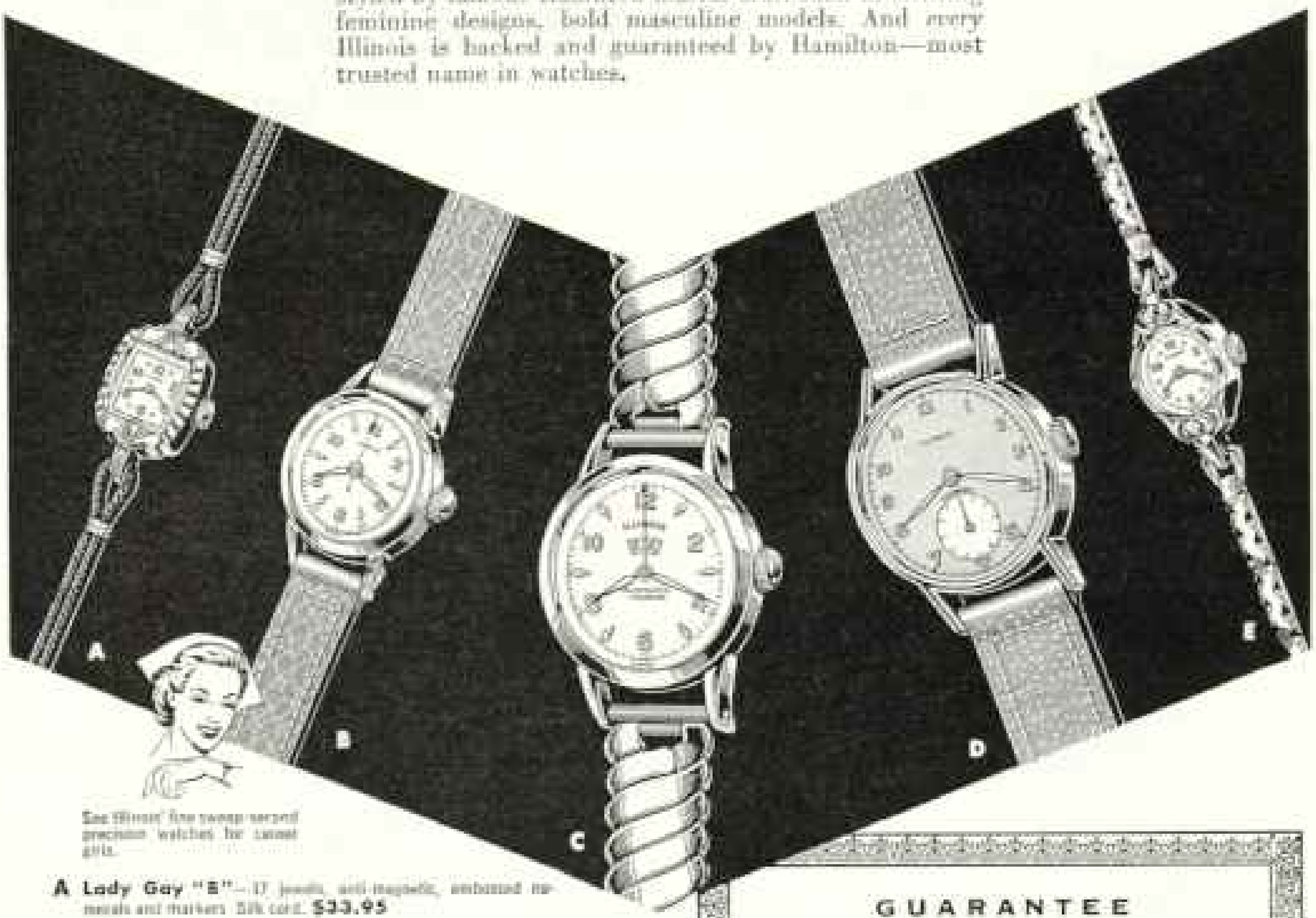



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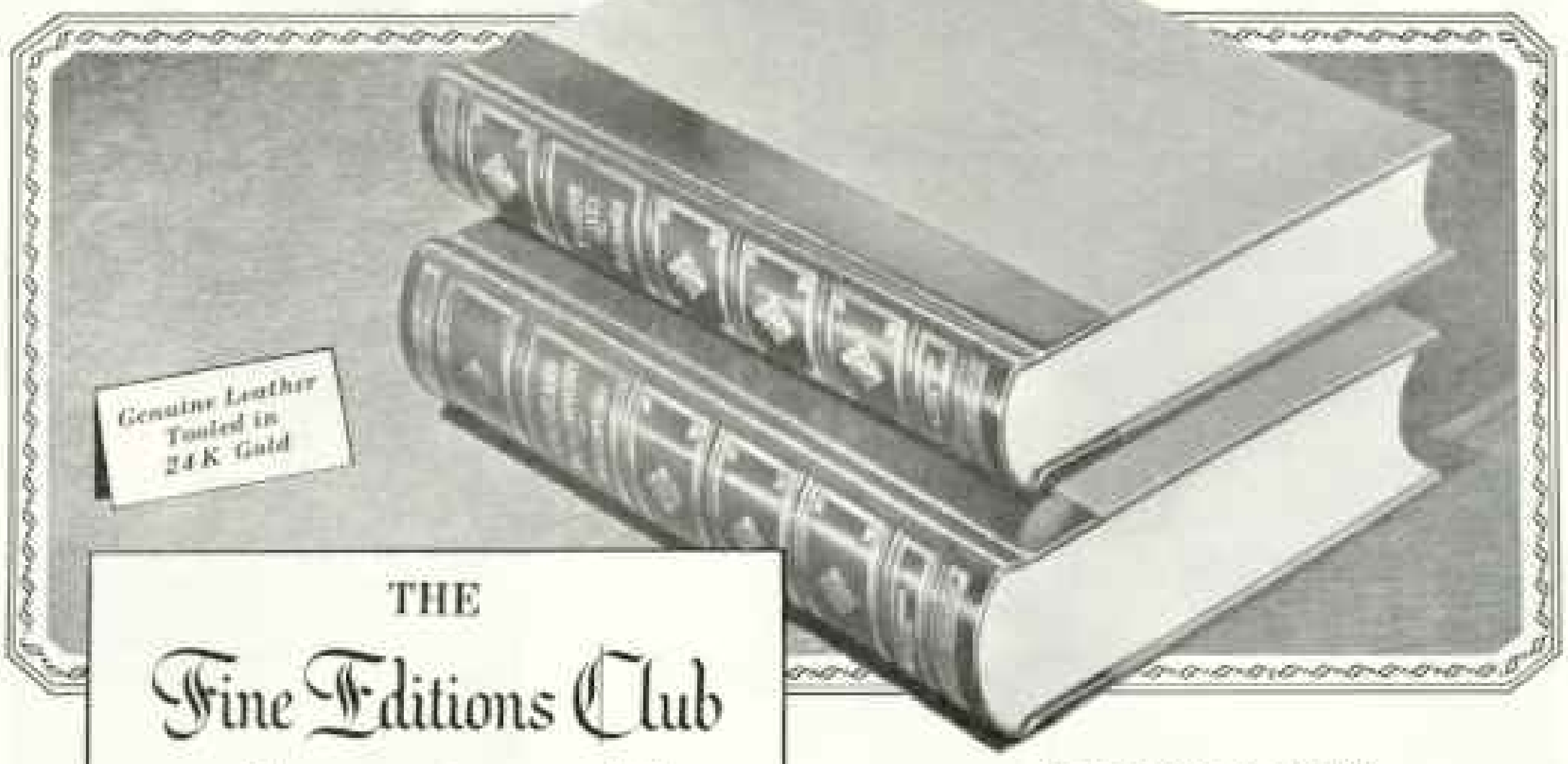


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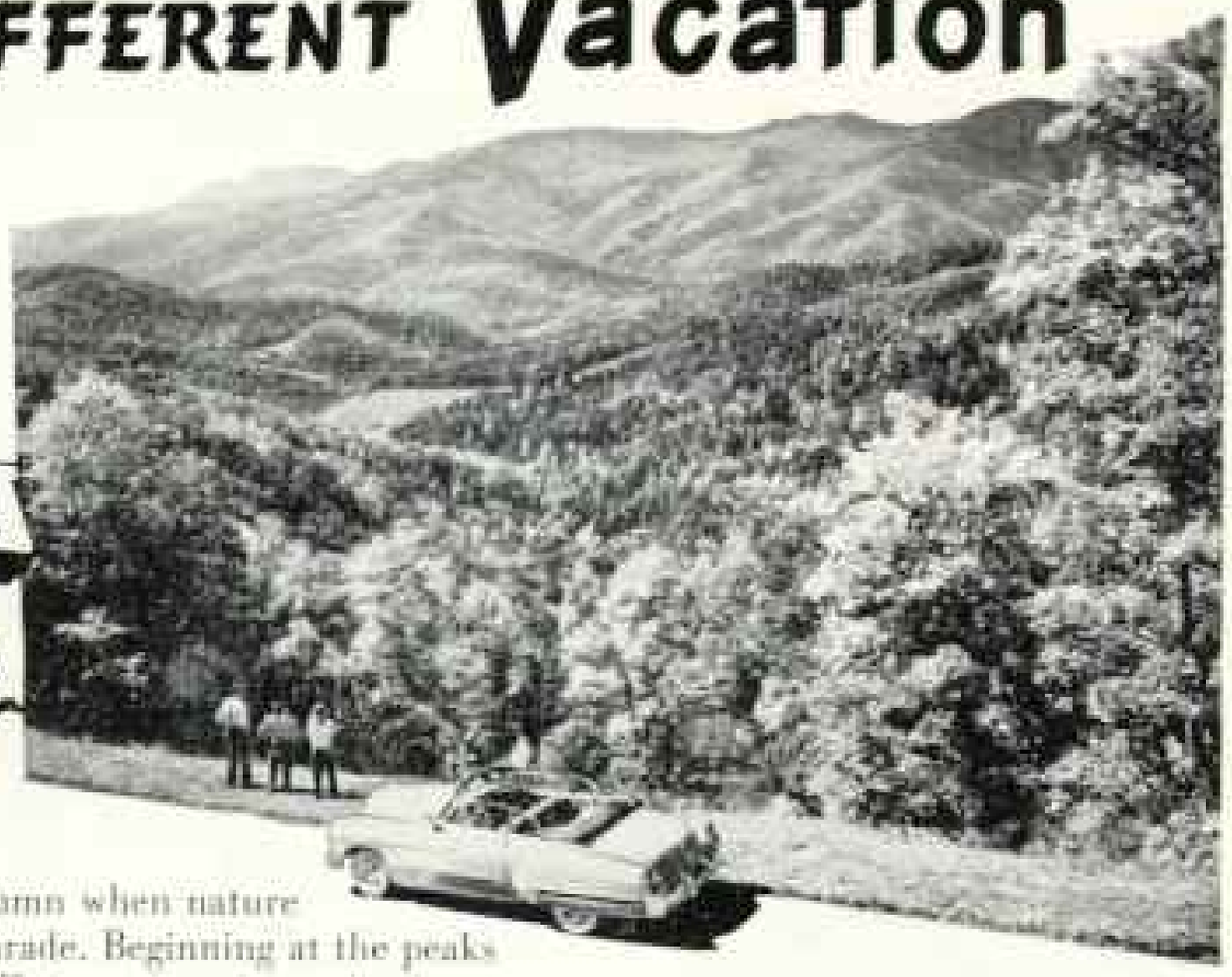

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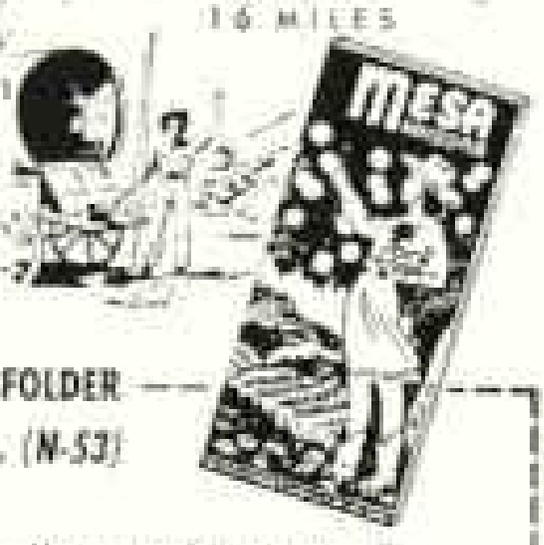


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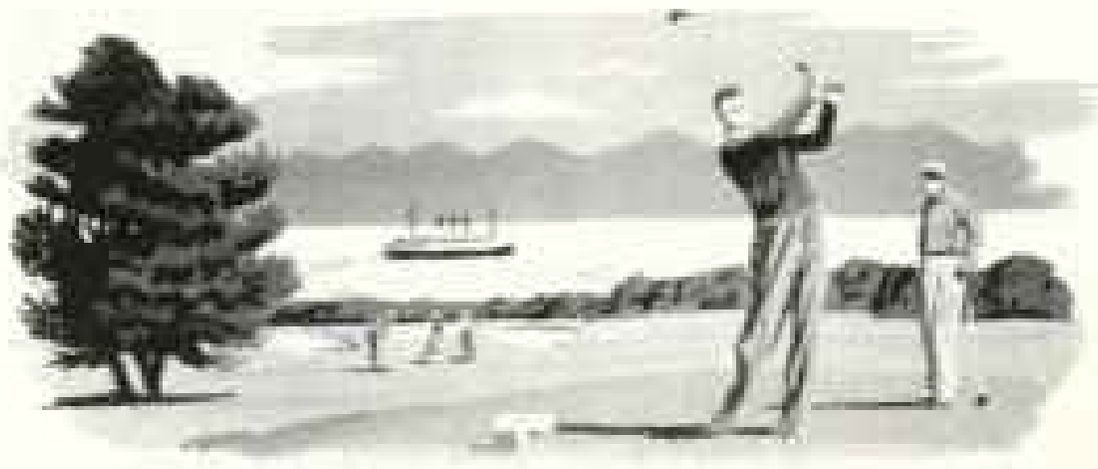

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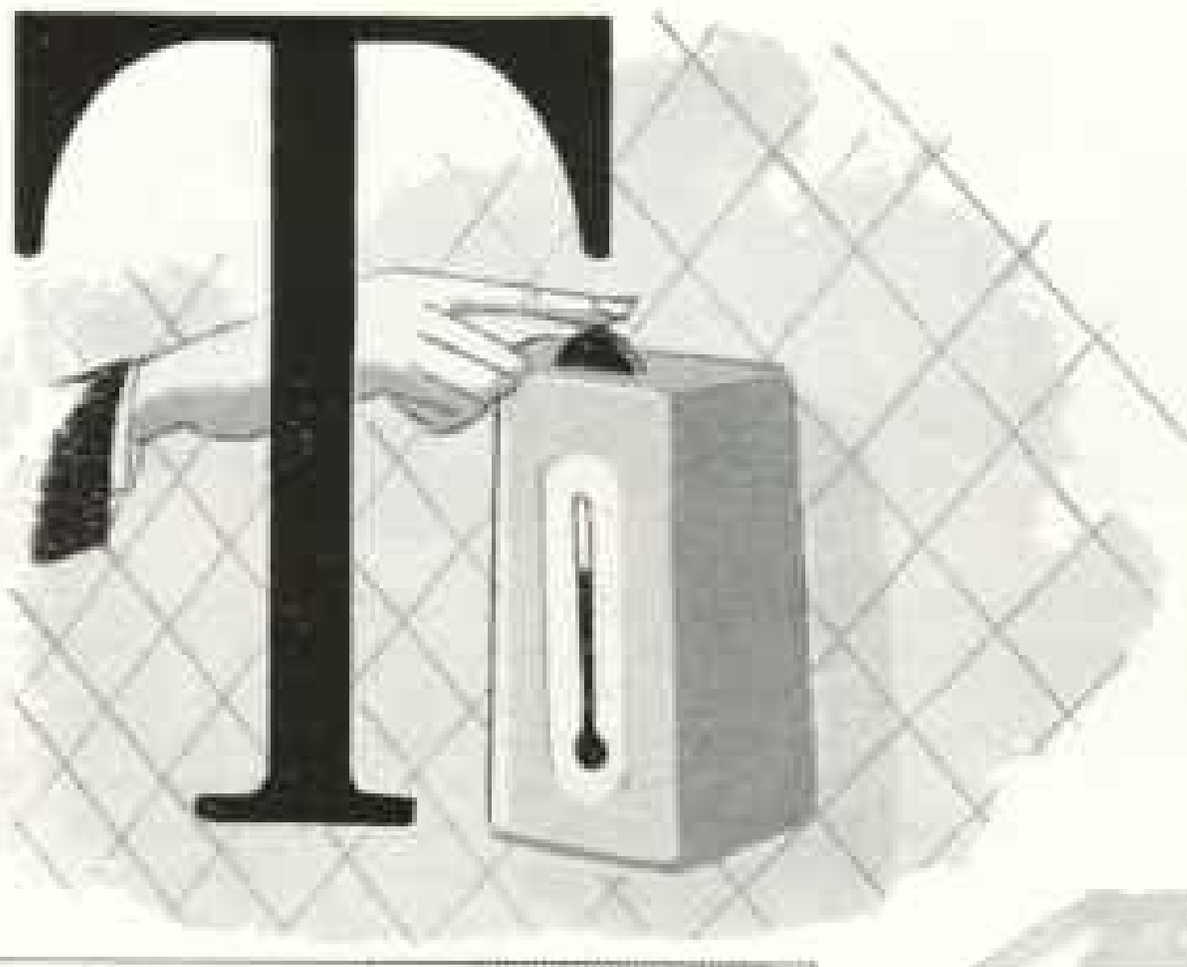

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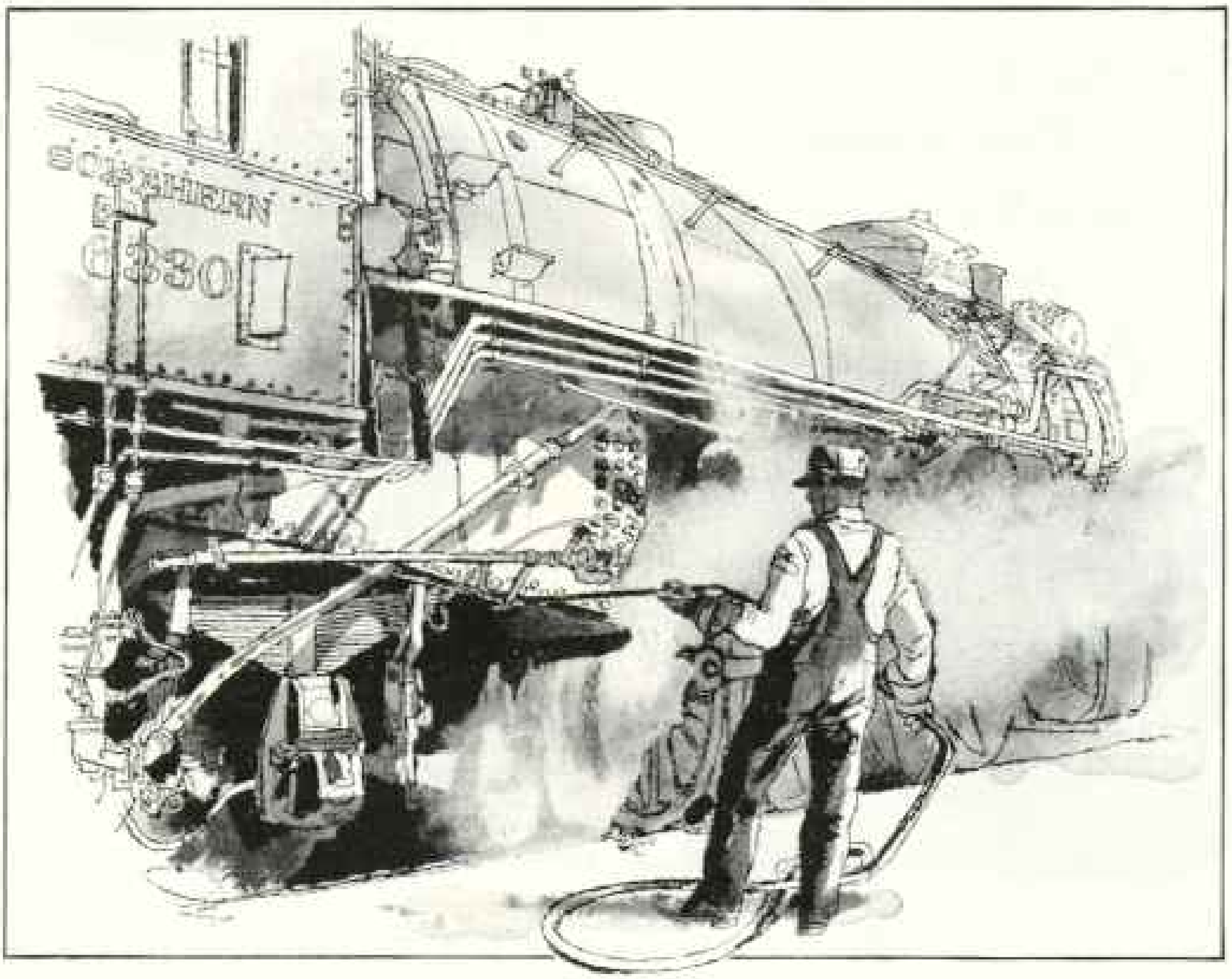


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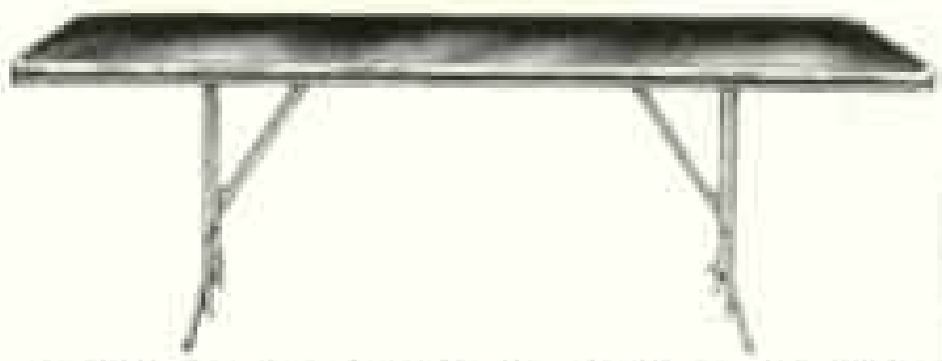

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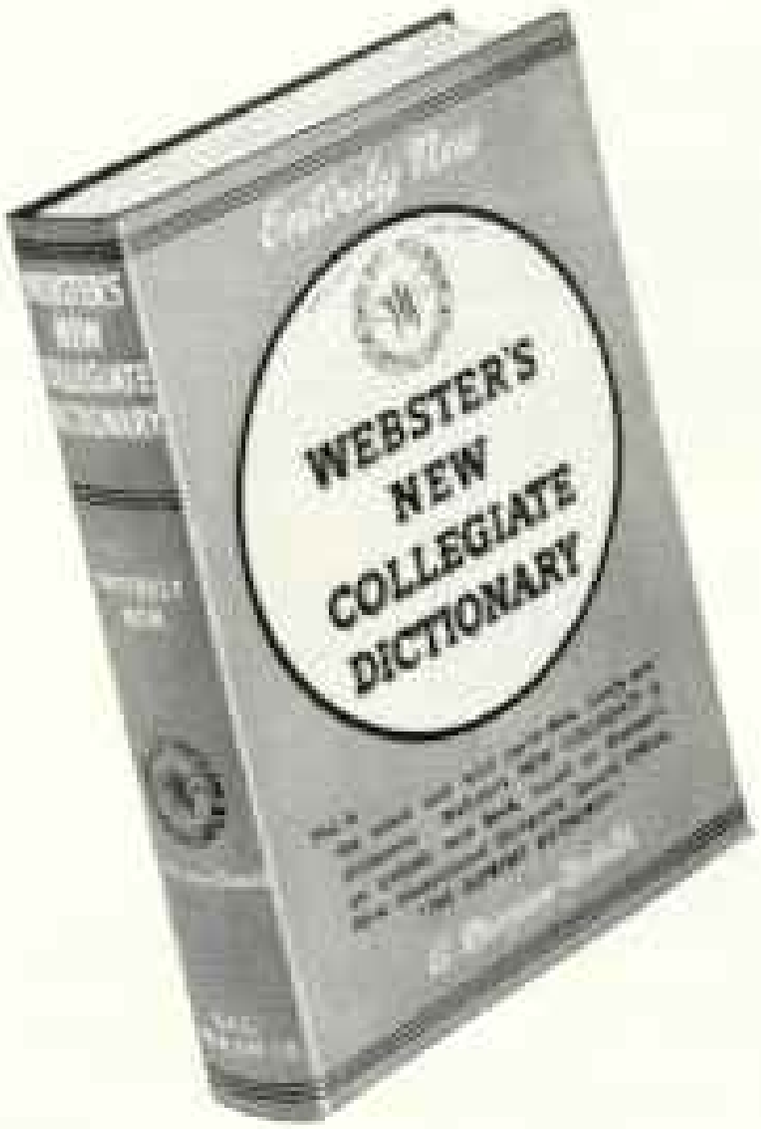


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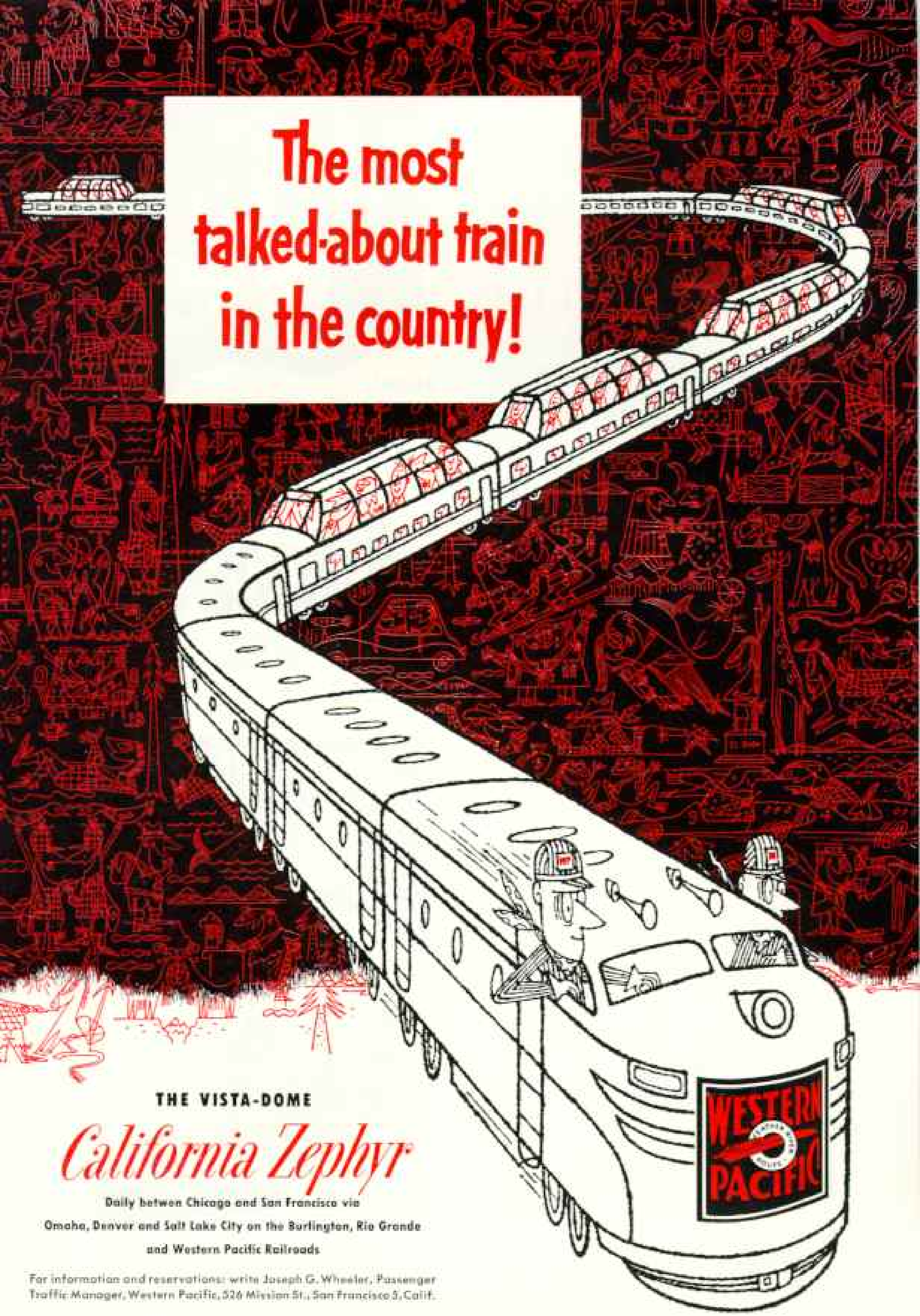


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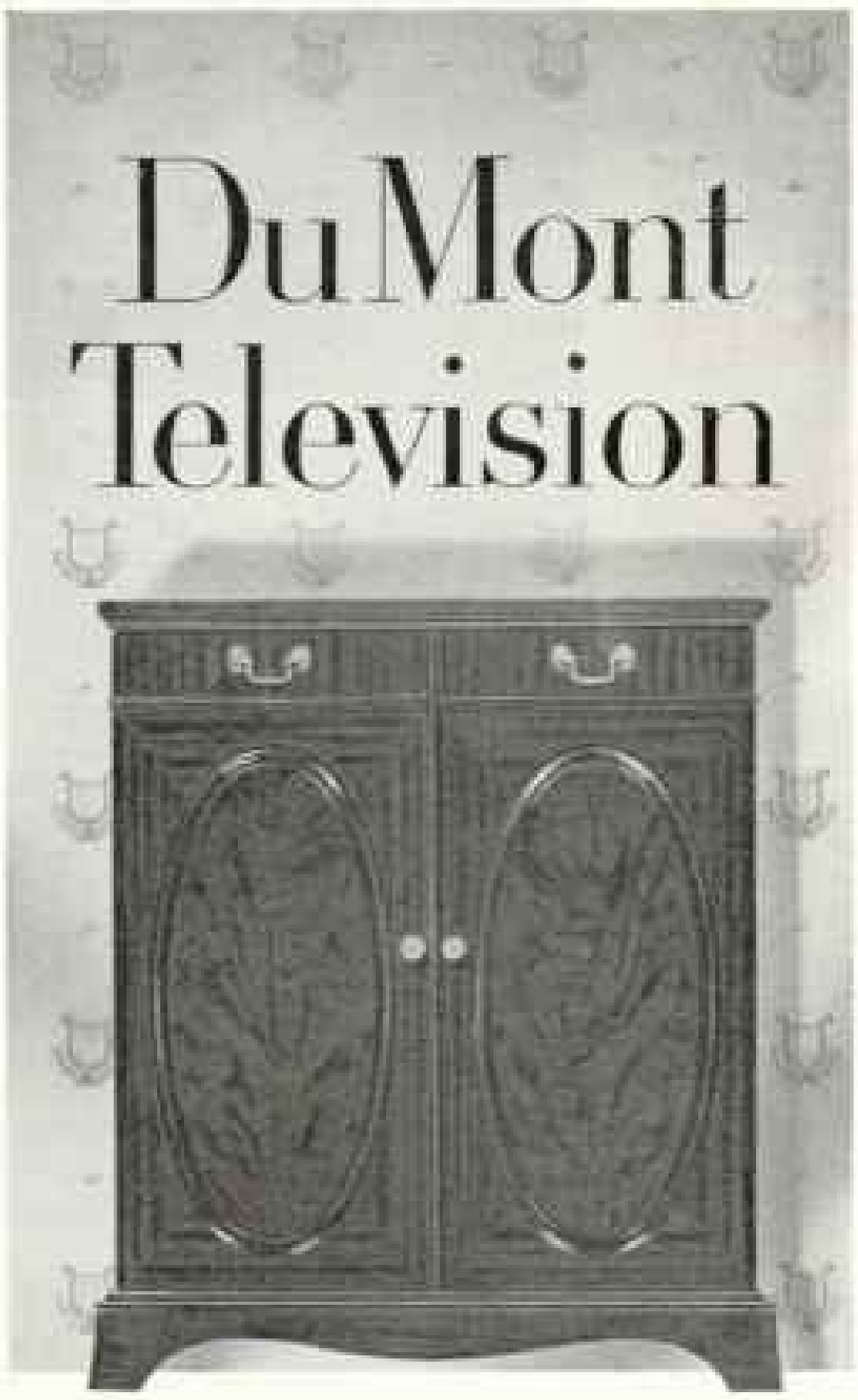

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**ONLY DU MONT INVITES COMPLETE COMPARISON**—Du Mont, first with so much of the best in television . . . now is first with *complete extra-quality features*, at every point in every set at every price. See, hear, prove and compare the difference, at your Authorized Du Mont Dealer's! Ask about Du Mont's optional 82-channel tuning!

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# French Line

**ACCENT ON SERVICE**

*Ah* for *la vie des enfants* aboard France-Afloat where every child is a king or queen! For when you travel on a great French Line ship, the accent is on service . . . par excellence . . . for all.

You long for a deck-side cup of bouillon, a blanket to warm you, a refill for an empty glass, a light for your cigarette . . . and *voilà* . . . your unspoken wish is quickly and politely fulfilled.

Whether you travel on the luxurious 51,840-ton *Liberté*, the celebrated *Ile de France*, or the new, intimate *Flandre*, you'll enjoy the famous cuisine by master chefs, elegant appointments, deck sports, evening entertainment, special amusements for the children. French Line, 610 Fifth Ave., New York 20, N. Y.

**CONSULT YOUR AUTHORIZED FRENCH LINE TRAVEL AGENT**




Minimum thrift-season rates to Plymouth (in-season rates and rates to Le Havre slightly higher): **Liberté** – First Class, $330; Cabin, $215; Tourist, $165. **Ile de France** – First Class, $325; Cabin, $215; Tourist, $165. **Flandre** – First Class, $290; Tourist, $165.

**Children's rates:** 12 years and over—full fare all classes. Over 1 year, under 12—half fare all classes.

**Other French Line offices:** Beverly Hills, Boston, Chicago, Cleveland, Halifax, Montreal, New Orleans, Philadelphia, Portland, San Francisco, Seattle, Toronto, Vancouver, B. C., Washington, D. C., Winnipeg, Man.

## Visit Lovely, Lively

# Louisiana

**during the 150th Anniversary**

**of the Louisiana Purchase**

The spectacle and color of an age gone by recreated for you . . . dark-eyed Creoles in the silks and laces of a century and a half ago, the "clip-clop" of carriages over cobblestones, soft music from lacey iron-work balconies . . . sights and sounds you won't want to miss in a wonderful atmosphere of gaiety and Old World charm.

Plan now to spend your autumn vacation in lovely, historic Louisiana—heart of the Louisiana Purchase; and plan too, to see *all* of Louisiana—fairs and festivals throughout the state will commemorate the Purchase in addition to a gala celebration in New Orleans.

***Write for beautiful free booklet***

Tourist Bureau G-532
Dept. of Commerce and Industry
State Capitol, Baton Rouge 4, La.

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# Keep your composure

## ...it's just your exposure!

DON'T GIVE UP! Take *more* pictures with your camera, but from now on use a WESTON Exposure Meter. You'll have no more picture disappointments, for the WESTON assures sharp, correctly exposed pictures every shot . . . with still or movie cameras, all film including color. Get one today, in time for vacation. At all camera stores.

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**WESTON**

**EXPOSURE METERS**

# why climb stairs ?

HomeLIFT

The SHEPARD HomeLIFT or EscaLIFT is the practical solution for the family interested in eliminating stair climbing drudgery. Safe—easy to install and operate—and priced within the family budget. Representatives in all principal cities. Write for descriptive bulletins.

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# NEW MIRACLE TUBELESS HEARING AID REVEALED

- Costly B-Battery Eliminated
- All Battery Costs Slashed 80%
- Powered by Three Transistors
- Vacuum Tubes Banished Forever

**FREE BOOK!** Write today for authoritative illustrated book describing this new Atomic Age miracle invention, the Transistor, and what it means to the hard of hearing. No obligation whatsoever! A postcard will do.

***Beltone*** **HEARING AID CO.**
2900 W. 36th St., Dept 281E, Chicago 32, Ill.

What has TYRANNOSAURUS REX
got to do with

# ARTHRITIS?

**It may surprise you** to know that doctors . . . in their search for more knowledge about arthritis . . . have made intensive studies of the bones and joints of prehistoric dinosaurs. They have found that dinosaurs, like *Tyrannosaurus rex*, had arthritic joints.

As a result of these studies, medical science has learned much about the origin and history of arthritis, the joints that are most often affected by it, and how the disease damages them.

Arthritis has long been a leading cause of disability. Today about 10 million Americans have the disease in one of its many forms, the two most common of which are *osteoarthritis* and *rheumatoid arthritis*.

Of the two, osteoarthritis occurs most often. In fact, almost everyone who is beyond middle age has a touch of it, probably as a result of normal wear and tear on the joints.

Rheumatoid arthritis is the most severe form of the disease as it affects not only the joints, but the entire body. It usually begins between the ages of 20 and 50.

Not too long ago, arthritis often meant a life of misery or some degree of crippling.

Today, the outlook is far brighter for many arthritics. Under modern treatment, *carefully adjusted to the needs of the individual patient*, doctors can do much to relieve or prevent pain and to lessen or prevent disability.

**Treatment, however,** must be started early for best results. Otherwise, lasting damage may be done to one or more joints.

Arthritis seldom, if ever, strikes suddenly. Any person who complains of a generally "run down" condition, and who has slight but recurring attacks of pain, discomfort or swelling in or about the joints, should be promptly examined by his doctor . . . *before his trouble becomes disabling*.

Authorities emphasize that chronic arthritis is rarely, if ever, controlled by any single measure. They also say that the so-called "sure cures" for arthritis generally do little more than provide temporary relief. Before using any medicine for arthritis, it is wise to have the doctor's advice.

**Metropolitan Life**
**Insurance Company**
1 Madison Avenue, New York 10, N. Y.

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of your booklet, 1033-N.


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Here's how we discovered

# *2 weeks is plenty of time for a vacation in Europe!*

**With TWA's Thrift Season fares and lower prices abroad, you can have a wonderful time on a limited budget**

Like so many folks, Nancy and I had often talked about taking a trip abroad. But first I'd remind her two weeks with pay was all the vacation I got, and then she'd start worrying about money. Our plans always seemed to end right there.

But one day Nancy stopped in at the TWA ticket office downtown. "Just window shopping," she explained that night, "but am I glad I did!" Then she told me how TWA had the answers to our two big questions of time and money, with their 300-mile-per-hour speed and their economical Sky Tourist fares which were even lower during the fall and winter.

Next thing we knew we were Europe-bound on a giant, four-engine TWA Constellation. Our overnight crossing was as pleasant and as comfortable as sitting in our own living room. Those attentive TWA hostesses saw to our every need: brought us magazines and

pillows: served us meals that were out of this world.

We spent fourteen days touring England and France, and every day was perfect. Nancy thought Paris was easily the gayest, most exciting place she'd ever been. As for myself, I preferred London and the historic Shakespeare country.

We soon discovered Thrift Season was an ideal time to be abroad. Prices were lower everywhere; the weather was delightful for traveling; the big cities had come back to life after the summer lull. We went everywhere and did everything, from sipping a demitasse at one of those colorful little sidewalk cafés along the Champs Elysées to watching the changing of the guard at Buckingham Palace.

We've been back almost a year now, and we're still talking about the wonderful holiday we had. In fact, we've started to plan the next

one . . . seeing Italy and Spain this time. You can bet we'll do it, too. For now we know there's no need to put off and dream. We'll just take off and go. The average vacation is plenty of time to see Europe via TWA, and it costs so little when you go in Thrift Season.

**Special Thrift Season Tours® via TWA**

**15 Days** *visiting London, Stratford on Avon, Shakespeare country, Paris, Versailles. Low price of $595 includes hotel accommodations, most meals, sightseeing tours and round-trip TWA ticket from New York.*

**23-Day** *TWA Skyliner Tour of 6 countries $910. See London, Paris, Venice, Florence, Lake Luverne, Rome, Holland. Sightseeing, hotel rooms, most meals and round-trip TWA ticket from New York are included in the low price.*

*For information and reservations, see your local travel agent, call, write or visit your nearest TWA ticket office*

**November 1 through March 31, on Sky Tourist Flights*

***Fly the finest . . . FLY TWA***

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# Campus custom calls for Coke

How naturally a pause for Coke
fits the pattern of busy people.
Take the coed, for instance,
and her jam-packed schedule
of classes, sports and dates.
She has only moments to relax
. . . but that's time enough
for the quick refreshment of Coca-Cola.

# "Movie cameras are really flying high these days"

**"Most travelers carry snapshot cameras. But more and more are bringing movie cameras, too. It's the only way to catch all the color and action of your trip."**

**EVELYNN PICHETTE** . . . airline stewardess whose flights carry her over some of the world's most spectacular scenery

If you're like most vacationers, you'll come back with plenty of snapshots of holiday highlights—probably lots in color. But if you want a picture record that faithfully and *fully* records your trip . . . *just as you lived it* . . . then you must make *moving* pictures, too.

From the moment you lock your door, you'll be caught in a whirl of new faces . . . new places . . . new and thrilling experiences. And you just won't be able to remember it all in "still" pictures, alone. Life just won't stand still!

### So movies are wonderful! But aren't they hard to make?

Not on your life! Movies are as simple as snapshots. There's an exposure guide on every Kodak movie camera. Some models don't even have to be focused. You can focus the others, if you like, or use an all-purpose setting that gives crisp movies at almost any distance.

A fine, fast lens does a perfect job under varying light. It has a built-in sunshade, too, so you can follow action almost right into the sun.

### It's easy then to *make* good movies. But the cost?

Well—the Brownie Movie Camera sells at only $39.75. It uses economical 8mm. roll film . . . $3.95 for full color or $3.25 for black-and-white—*including processing!* And each roll makes 30 to 40 average-length movie scenes . . . just about a dime a scene!

Hard to see how you can afford *not* to make movies . . . a picture record precious above all others because it faithfully, excitingly re-creates the color, the action, the reality of life itself.

But get the story from your Kodak dealer. Or mail coupon to Kodak for free copy of "Let's Make Movies." Learn how easily you can bring the thrills of home movies to *your* house.

From the budget-minded 8mm. **"Brownie"** (left) at $39.75 to the 16mm. **Cine-Kodak Royal** at $176.25, there's a complete line of Kodak personal movie cameras to choose from. See them at your dealer's soon.


See "Photographic Equipment and Supplies"

*Prices include Federal Tax and are subject to change without notice.*


**"LET'S MAKE MOVIES"** Free booklet tells you how to make movies indoors and out, how to choose the right camera for your needs. Use this handy coupon.

**Eastman Kodak Company,** Rochester 4, N. Y.

Dept. 6: Please send me my free copy of "Let's Make Movies."

Name_____

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City_____ Zone_____

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Kodak

TRADE-MARK

# National Geographic Books in Natural Color

▲ Arthur A. Allen Stalked a Barn Owl with Startling Effect on Color Film

© N.G.S.

## *Stalking Birds with Color Camera*

MANY SECRETS of our avian friends are revealed in this unique book. Acclaimed by reviewers and thousands of bird lovers, it represents a revolution in wildlife illustration.

In 189 pages of NATURAL COLOR there are 331 photographs, many in full-page size. Most of them were taken within arm's reach of the wild subjects. They include 1/5000-second flash pictures catching minute details of bird flight.

This beautiful book is a result of Dr. Arthur A. Allen's many years of notable research and expeditions, sponsored in great part by the National Geographic Society. Edited by Dr. Gilbert Grosvenor, it is not just another "bird guide," but a treasure of "inside information" on our feathered neighbors.

As the first cost was borne by the NATIONAL GEOGRAPHIC MAGAZINE, this 328-page book is only $7.50 in U. S. & Poss.; elsewhere, $7.75 in U. S. funds. Postpaid. Rich, green covers, 7" x 10¼".

▼ Landlocked Salmon, Painted by Walter A. Weber for *The Book of Fishes*

## *The Book of Fishes*

IF YOU HAVE NEVER wet a fly or cast a plug, the new 1952 edition of *The Book of Fishes* will open a fascinating new world to you. If you are an ardently addicted rod-and-reel veteran, it will add extra pleasure to your sport.

Its 340 pages are an intensely interesting search into habits and life cycles beneath the waves, where countless hosts of creatures—some incredibly weird—live in a savage realm of eat and be eaten. It is packed with high adventure as well as practical hints on game fishing.

A grand total of 159 FULL-COLOR pages bring you 116 COLOR PAINTINGS and 24 COLOR PHOTOGRAPHS—with biographies—identifying 256 species of game and food fishes and other aquatic life in United States salt and fresh waters.

A delight to read and to own, *The Book of Fishes*, edited by Dr. John Oliver La Gorce, is bound in maroon and gray, 7" x 10¼". Because first cost was borne by The Magazine, it is modestly priced at $6.50 in U. S. & Poss.; elsewhere, $6.75, U. S. funds. Postpaid.

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Enclosed please find $..... for which send me:

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**Obtainable only from NATIONAL GEOGRAPHIC SOCIETY Dept. F-V, Washington 6, D. C.**

**The Lily . . . Its Symbolism:** In symbols and epitaphs, the story of a life can be eloquently told on a monument. In the language of flowers, the lily expresses purity, innocence and heavenly joy. It is the flower of the Resurrection. On your family monument, the lily will be a constant source of inspiration to you, your children . . . and their children.


# *"Our family will always be together . . ."*

"For here we feel her presence so strongly. Her name on our family monument seems in itself so symbolic of her spirit and courage, her classic beauty. And here in the deep peacefulness that is our cemetery, our family monument conveys to us all the good she did and would have us do."

Your family monument expresses, for all to see and revere, the very character of the family it stands for. More than a tradition, it seals the bond between yesteryear and tomorrow . . . it is lasting protection against the fading of memory that can come with time.

Many thoughtful people choose their family monument—as well as their cemetery plot—before the need arises. Before you choose, seek the wise counsel and assistance your Rock of Ages Authorized Dealer can give. And for your lasting satisfaction be sure the Rock of Ages trademark seal is on the monument you select.

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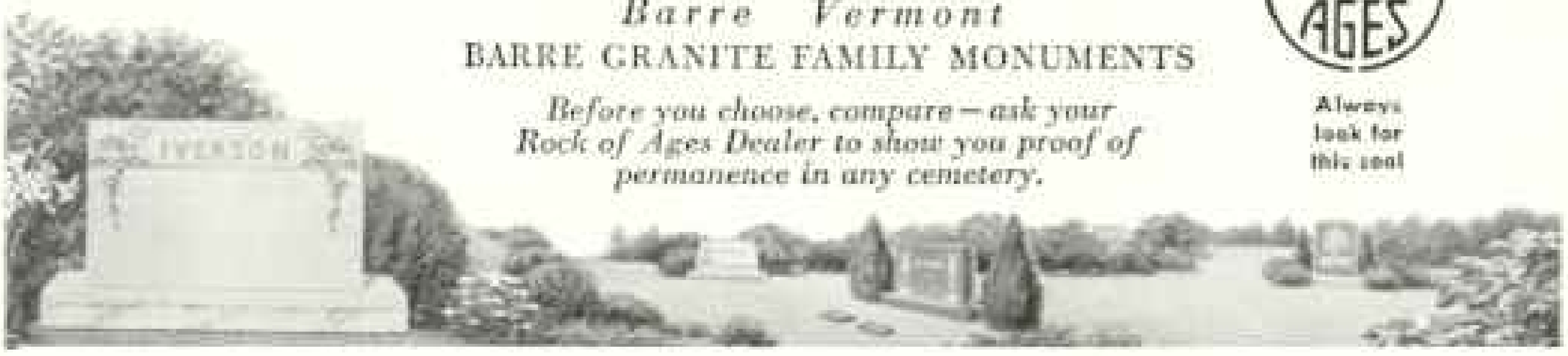
*Before you choose, compare—ask your Rock of Ages Dealer to show you proof of permanence in any cemetery.*

ROCK OF AGES

Always look for this seal



PLEASE FILL IN BLANK BELOW, DETACH AND MAIL TO THE SECRETARY

## Recommendation for Membership

IN THE

# NATIONAL GEOGRAPHIC SOCIETY

* *The Membership Dues, Which Are for the Calendar Year, Include Subscription to the National Geographic Magazine*

*To the Secretary, National Geographic Society,*
*Sixteenth and M Streets Northwest, Washington 6, D. C.:* _____ *1953*

*I nominate* _____
PRINT NAME OF NOMINEE

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(This information is important for the records)

*Address* _____
PRINT ADDRESS OF NOMINEE

_____ *for membership in The Society.*

*Name of nominating member* _____
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* DUES: Annual membership in United States, U. S. Possessions, and Canada, $5.50; countries in the Postal Union of the Americas and Spain, $6.00; British Isles, £2 2s. Od. British sterling; elsewhere abroad, $6.75. Life Membership, $150.00 U. S. funds. Remittances should be payable to National Geographic Society. Remittances from outside of continental United States and Canada should be made by New York draft or international money-order.

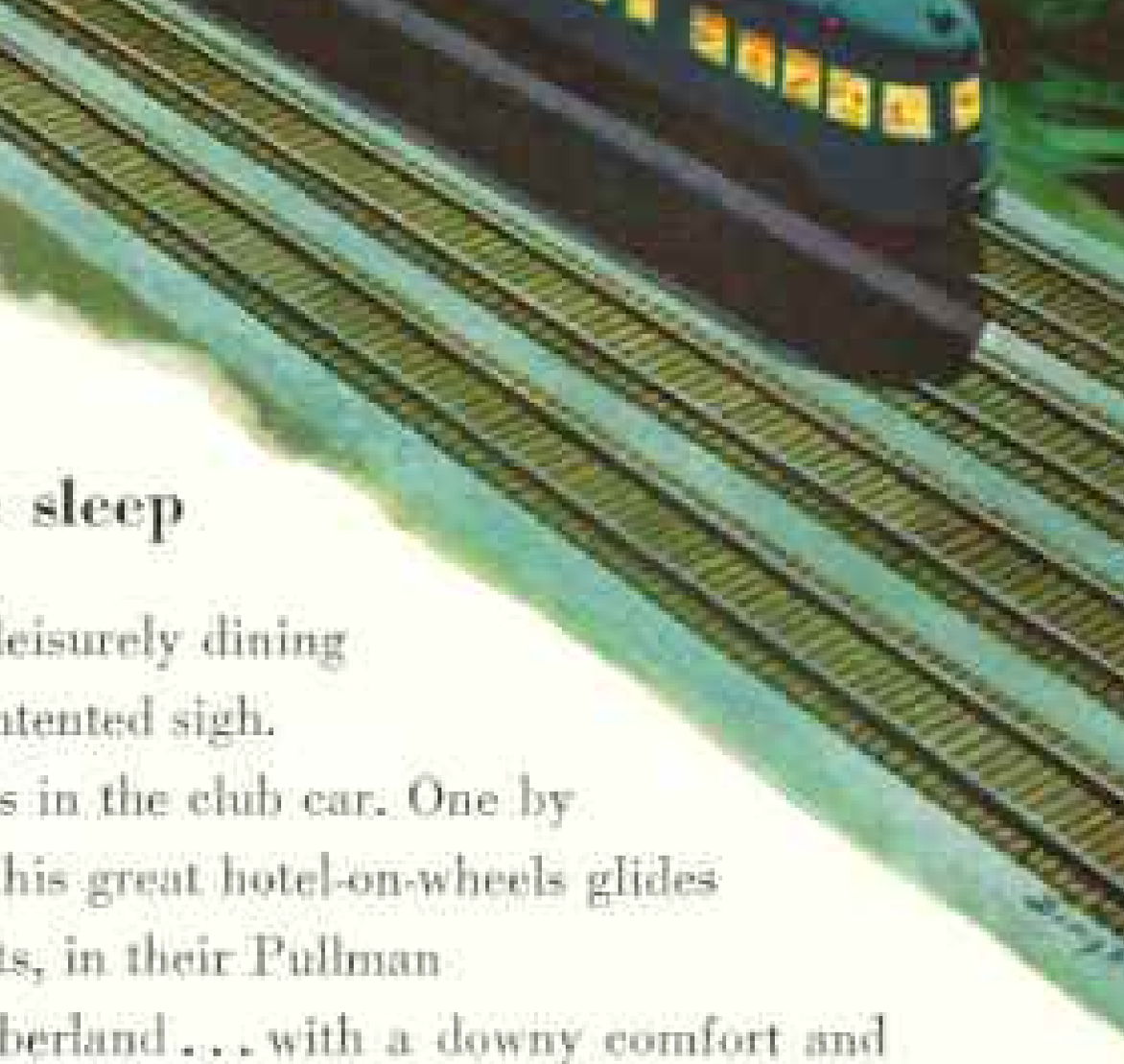
10-53

# One by one, the windows close their eyes

## . . . for a wonderful Water Level Route sleep

Nighttime on New York Central. Long ago, the last, leisurely dining car patron pushed back his chair with a contented sigh. Only a few night owls still chat over refreshments in the club car. One by one, shades come down and lights go out as this great hotel-on-wheels glides along gentle, low-level valleys. The guests, in their Pullman private rooms, drift off to slumberland . . . with a downy comfort and a deep-down sense of all-weather security no skyway or highway can match.

**GOING OUR WAY?** Throughout this area, you'll find New York Central streamliners and dreamliners to make your trips a daylight delight or an overnight vacation.



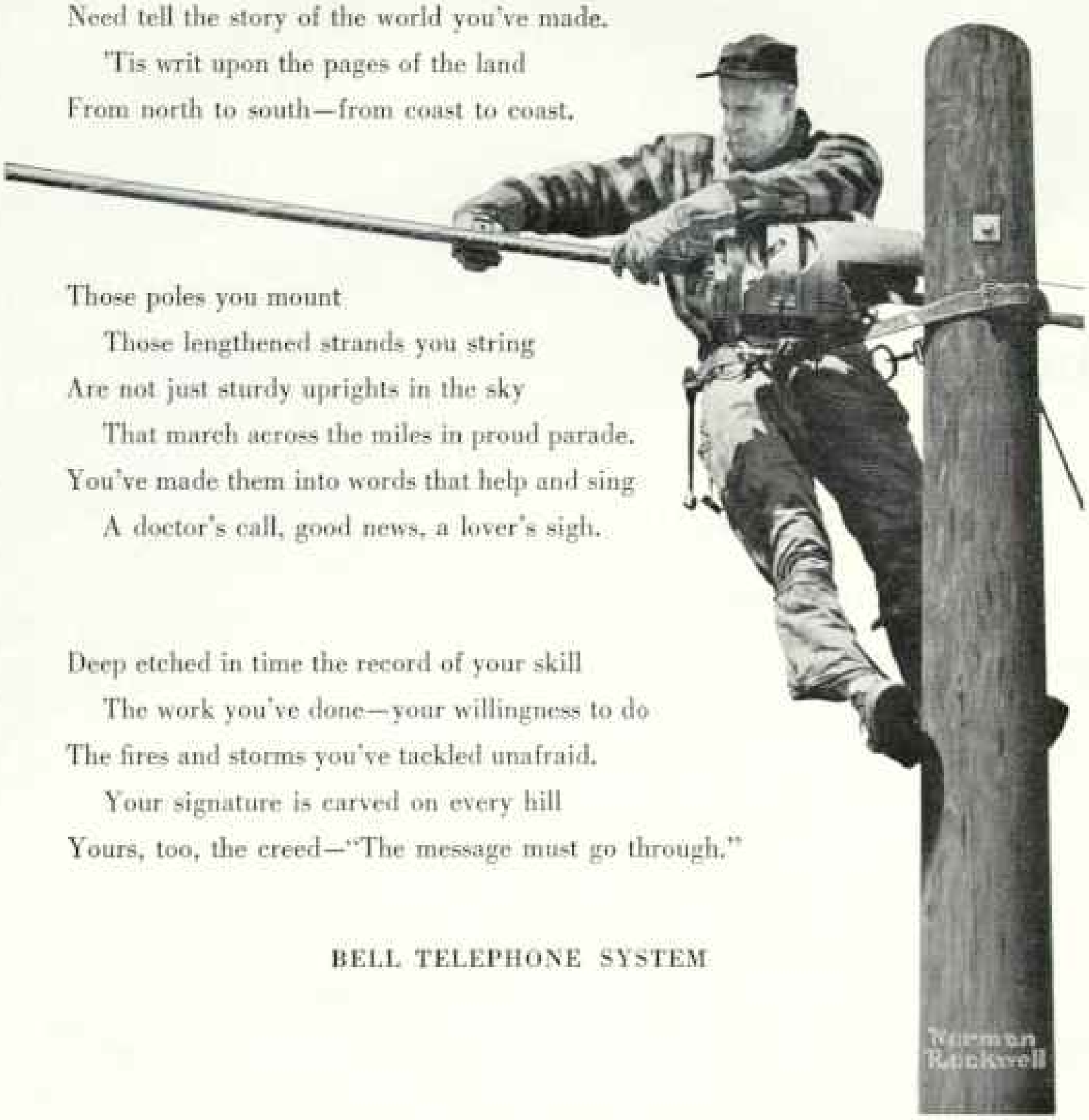

# New York Central

The Water Level Route—You Can Sleep

# LINES TO A LINEMAN

ILLUSTRATED BY NORMAN ROCKWELL

No word of pen or stroke of artist's hand
No flowered phrase or oratory's boast
Need tell the story of the world you've made.
'Tis writ upon the pages of the land
From north to south—from coast to coast.




Those poles you mount
Those lengthened strands you string
Are not just sturdy uprights in the sky
That march across the miles in proud parade.
You've made them into words that help and sing
A doctor's call, good news, a lover's sigh.

Deep etched in time the record of your skill
The work you've done—your willingness to do
The fires and storms you've tackled unafraid.
Your signature is carved on every hill
Yours, too, the creed—"The message must go through."

BELL TELEPHONE SYSTEM

# *The New Haven's 40 RDCs Get Busy and Business*

THE New Haven Railroad now operates 40 Budd rail diesel car RDCs. And the New Haven, RDC, and New Englanders are getting along very well together.

So well, for example, that when the railroad reinstated passenger service between Worcester and New London, after a lapse of twenty-eight years, it carried 82,000 passengers the first year, using one RDC Monday through Friday, and two RDCs Saturdays and Sundays.

Passenger traffic in and out of Boston's South Station has increased by thousands daily.

All over the non-electrified portions of the New Haven's system, scores of new schedules have been added to take full advantage of RDCs ability to provide frequent as well as pleasant service. These include many middle-of-the-day "shoppers" runs, which are proving very popular.

New Englanders take pride in being a little different. But their response to RDC is typical of people everywhere, from Australia to Cuba, from New York to California. The Budd Company, Philadelphia, Detroit, Gary.

**Budd**

**PIONEERS IN BETTER TRANSPORTATION**