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Man's First Winter at the South Pole

Cold Fiercer Than Men Had Ever Faced, Ceaseless Winds, a 6-Month Night—Yet 18 Pioneers of Science Survived, and Thrived

BY PAUL A. SIPLE, Ph.D., D.Sc.

Scientific Leader, Amundsen-Scott IGY South Pole Station

When the United States set out to build and man a scientific station at the South Pole as part of its contribution to the International Geophysical Year, its choice as scientific leader fell naturally upon the broad shoulders of Dr. Paul Siple, the Nation's "Mr. Antarctica." Since 1928, when 19-year-old Eagle Scout Paul Siple went to the Antarctic with Admiral Richard E. Byrd, he has spent 64 months there, more time than any other man.

Dr. Siple directed the IGY program at the Pole for the National Academy of Sciences. He was on loan from the U. S. Army, which he serves as civilian polar expert in the Office, Chief of Research and Development. The U. S. Navy's Operation Deep Freeze, under Rear Adm. George J. Dufek, built and maintains the South Pole Station. We are proud that Dr. Siple, like the late Admiral Byrd, has written his history-making personal narrative exclusively for the National Geographic.—*The Editor.*

TUGGING AT the wolf-fur ruff of my parka hood to give more protection to my face, I stepped through the snow-tunnel exit of our South Pole village.

The familiar sharp feel of the cold was more searing than usual. When I faced the light breeze, the vapor in my breath blew back into my face and condensed instantly on the gray straggles of my 10-month-old beard.

Instinctively I held my hand up to protect my nose and cheek from the fury of the cold; it felt, paradoxically, like the attack of leaping flames. At temperatures such as this a nose can freeze in seconds, with a needle-sharp prick, or "ping," as we called it.

Within a few steps my Army polar boots, made of a special low-temperature rubber composition, froze solid as cast iron.

This eighteenth of September, 1957, was no ordinary day in our lives. The sun, which had been below the horizon for the past half year, was nearly due to rise. Already it was spreading brilliant orange dawn colors across more than half the sky.

But today there was still another reason to venture forth. We had again broken the world's official low-temperature record, and we wanted to see how it felt to walk outside at minus 102° Fahrenheit.*

Jack Tuck and his inseparable companion Bravo were already outside waiting for me. Jack—properly Lt. (jg.) John Tuck, Jr., USNR—headed the military support unit of our station. Bravo, our malemute-husky mascot, romped around us, expressing physically the joy Jack and I felt in a lighted world after months of polar darkness.

I braced myself as he came hurtling full speed at me with puppy exuberance. Though Bravo had celebrated his first birthday only a month ago, he weighed a healthy 106 pounds. I warded off his playful teeth as he snatched at my mitt.

In a flash he bounced back toward Jack and

*At 9:30 p.m. Greenwich Mean Time on September 17, 1957, the official thermometer at the South Pole Station dropped to 102.1° below zero, the coldest weather man has ever felt anywhere. Because the men at the Pole set their clocks by New Zealand time, 12 hours different from Greenwich, their log notes the record low at 9:30 a.m. on September 18.

Kodachrome by Paul A. Siple © National Geographic Society

Low Moon Casts a Wan Glow on the American IGY Station at South Pole, Earth's Coldest Spot

Wind-swept snow buries buildings to roof level. Inside the huts, Antarctic veteran Paul A. Siple and 17 other Americans defy the numbing cold and howling winds above. They have manned the station throughout the sunless months in temperatures averaging 73 below zero.

For the first time in history men have endured a winter at the Pole.

But their ordeal now draws to an end. The first faint light of the unrisen sun illumines the stilted weather dome, radio masts, and frost-sheathed flagpole. Within a month 24-hour daylight will flood the camp.

Ninety-eight below zero—and still falling! After photographing the stark scene at left, Dr. Siple turned his camera on the thermometer and got mute testimony of the record cold. During one four-day period, September 14–17, the vein of colored liquid rose no higher than 91 below. On the evening of September 17 it stood at minus 102.1° F., lowest official reading ever made on the face of the earth.

then, unmindful of the cold, bounded away in a bluish cloud of flying snow, the vapor from his breath forming a white trail 100 yards long behind him. We turned to follow, for he ran in the direction we planned to hike.

Our goal was the geographic South Pole, where the southern end of the earth's axis theoretically emerges. During the starlit winter months Jack and I had determined by careful computations that the site lay about 2,400 feet from our camp, in the direction of the east coast of Australia.

Wind Carves Fantastic Sculptures

Our route lay along a straight row of red flags set at 100-yard intervals. The surface over which we plodded was fascinatingly beautiful, but so rough that we stumbled as we clambered over the high and low sastrugi, the wind-hardened polar snowdrifts.

All winter long the wind had blown with hardly any letup, and with gusts as strong as 54 miles per hour. Sweeping across the featureless plateau, it sculptured the surface into fantastic shapes: graceful, swanlike curves; exquisite etched graining; undercut anvils, all in spotless white and now reflecting the pastel shades of dawn (page 456).

It was too cold to attempt more than the most laconic conversation—though not because of any truth in the old tale that the words would freeze and be inaudible until they thawed. There were more practical reasons. The exertion of walking in bitter cold at an elevation of more than 9,000 feet made talking a chore.

Then there were the parka hoods, which muffled the voice of the speaker and the ears of the listener. Of course, Jack and I had already had nine months to talk on every conceivable subject, so there was no real need to talk now. It sufficed to grunt and point at unusually beautiful sastrugi or colorful changes in the sky.

We were crossing the drop zone, where U. S. Air Force C-124 Globemasters had parachuted the supplies for our South Pole Station the summer before. Here and there lay reminders of those busy days of retrieving. I recalled the windy day we chased a batch of steel girders 25 miles as they skidded across the snow behind a billowing parachute. I remembered, too, a crate coming down that held 47 well-packed eggs—and not one was cracked.

Despite the erosion of the wind, tractor-tread marks and debris from the drops were still plainly visible. Bravo enjoyed pulling corners of snow-covered parachutes loose with his teeth, then dancing about on top of the fabric to relieve his unprotected paws from the cold. If conditions got really tough, Bravo knew enough to dash back to the comfort of our warm buildings. But he seemed to sense that there was something special about this day, and he stayed with us.

As we approached the last flag, its significance set off a chain of memories. I looked about as though I really expected to see some physical manifestation of the earth's axis poking out through the snow. I recalled the hundreds of star shots we had made by theodolite to establish the Pole's location, and glanced up to see if any of the stars were still visible.

Just to the right of a patch of dawn light, I could see Venus shining with undaunted brilliance. But I could not find even the brightest of all stars, Sirius and Canopus.

Canopus was one of the stars Jack and I had used for our location fix. We had had our share of difficulties getting any useful observations at all. In polar weather our theodolite's lubricants had quickly hardened, making moving parts too stiff for use.

Pole Located Within 100 Feet

We solved our problems to some extent by setting up the theodolite in a partly heated loft, protected overhead by a metal dome in which a slot could be opened to the outside. Even so, we had trouble with fast-dropping temperatures when the slot was opened. Also the midwinter sky was not so clear as we had expected. Thin veils of moisture often dimmed the heavens, and at times some aberration between the lenses of our instruments and the outermost atmosphere made the stars appear to flame and lose their sharpness.

Setting Sun Bathes the Polar Station. The Six-month Night Begins

Until March 22, 1957, no man had ever seen the sun disappear below the horizon at the Pole. Dr. Siple and the members of his winter party stood on the rooftops and watched the sinking orange ball. In the darkening twilight they lowered the wind-tattered flag, flown at half-mast for 10 days following Admiral Byrd's death. Bamboo flagpole, capped by a spherical mirror, rises atop garage. Triple-domed aurora tower crowns science building. Bulldozed snow buries camp to the eaves; wind keeps rooftops clear. Column of sunlight, thought due to ice crystals in the air, is seen only rarely above the sun, usually below.

Kodachrome by Paul A. Siple © National Geographic Society

Thomas J. Abercrombie, National Geographic Staff

Station Leaders John Tuck and Paul Siple Tussle with Bravo, the Mascot

Dr. Siple directed scientific studies; Lt. (jg.) John Tuck, Jr., commanded Navy personnel. Here, on a spring morning, they stand beside their weasel near the ring of oil drums encircling the Pole. Black towers on horizon mark the IGY station half a mile beyond.

Nevertheless, we eventually were able to get sufficient observations to plot coordinates and determine the Pole's location within a probable error of 100 feet in any direction. This is the first time either of the earth's poles has been so precisely located. It is not possible to mark the exact axis at the North Pole because it is located on drifting ice.

As soon as the sun came up and we dared use the weasel snow vehicle once more, we planned to put up a flagpole at the site and ring it with empty fuel oil drums (opposite). By setting them in a 200-foot-wide circle, we would enclose not only the geographic South Pole but the wandering theoretical "spin pole" of the earth as well.*

The last time we had tried to take the weasel out of its heated garage, however, the cold had caused its rubber treads and connecting steel cables to part. Now that we had it ready for use again, we would wait until the weather was warm enough for safe operation.

Bravo was first to reach the red trail flag that marked the Pole. In fact, he made three trips around the world before we arrived.

Around the World in Two Minutes

Not to be outdone, Jack and I also strolled around the world, at a 100-foot radius from the flag. We realized that we had crossed the date line. This would, of course, get us out of time with the rest of the camp personnel; so, rather than risk such a hypothetical mix-up, we took another walk around the world, "unwinding" in the opposite direction.

Then we pulled off our outer mitts to take pictures. There was no doubt about the lowness of the temperature. After half a dozen quick snapshots my fingers grew unbearably cold. My thin cotton contact gloves and wristlets offered scant protection against air colder than 100 below. Clumsily I got my throbbing fingers back into my wool liners and then into the warm, pile-backed Army arctic mitts. Jack was banging his hands together to increase circulation.

Even Bravo was cold; he was trying to get all four feet onto a crash pad he had unearthed—looking like a miniature circus lion balancing on a ball. No one needed urging to turn back toward camp.

Half a mile away the blackish rawin dome, the rectangular box of the aurora tower, an orchard of radio masts, windbreaks, and piles of metal drums were all we could see of the snowbound village that had harbored us through the coldest winter man had ever known (page 440).

We sensed more than ever a feeling of isolation. Here we were, in the heart of a vast continent, itself noted for its remoteness from civilization. There was little question as to what lay beyond the gently rolling white plateau that led to the horizon; more of the same, for hundreds of miles in all directions.

"Neighbors" Live 560 Miles Away

There were other inland stations like our own out there. Our closest neighbors were three men living at South Ice, some 560 miles away, the British substation of Dr. Vivian Fuchs's Shackleton base. The U. S. Byrd Station, 700 miles away, was a third again larger than our own. Other men shared the work of the International Geophysical Year in remote inland stations maintained by France and the U.S.S.R. (map, page 475).

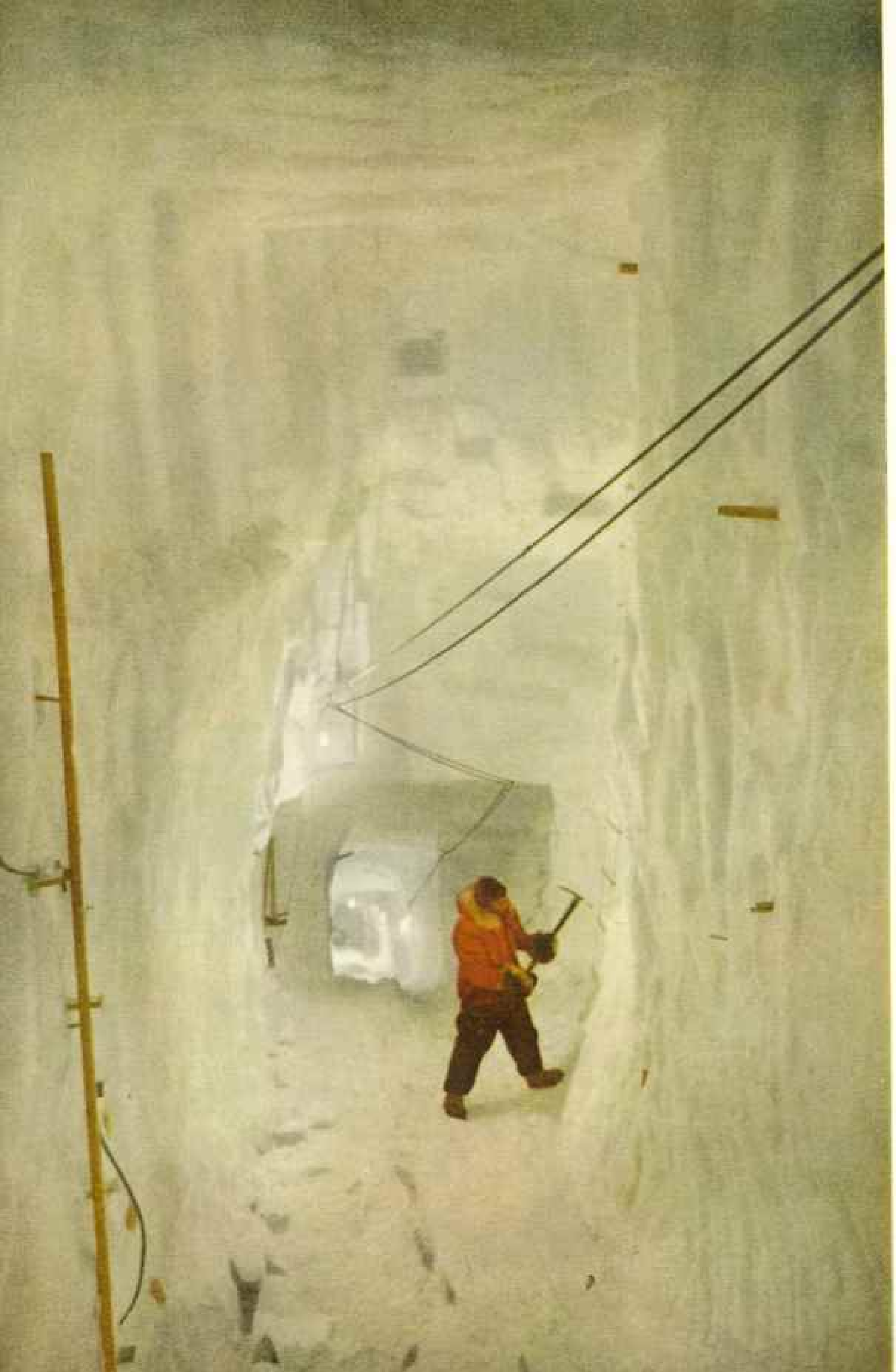
The men at many of these stations must have had an even harder time than we had had at the Pole. Though our isolation, our cold and darkness had lasted longer than theirs, we had had a happy winter, and I doubted that any of us would have chosen another station in preference—not even one of the "metropolises" around the edge of the continent, such as Little America, McMurdo, Ellsworth, Wilkes, Scott, Shackleton, Halley Bay, or Mirny.

And the hundreds who had wintered in Antarctica, I knew, were only part of the story. Thousands of scientists all over the world were engaged in the IGY's international effort to learn more about the earth we live on.† Our own part in the whole was not much more than the tiny spot we made in the center of this great white plain.

As I looked at our vapor-shrouded camp, I became increasingly aware of the beauty of the sky. Directly behind the camp, away from the sun, rose a shallow, slate-blue arc of sky darker than the rest. I recognized it as the last remnant of the earth shadow that had subtly slid back over our heads like a great dark canopy during the past month. To my right there was a long wedge of pink from the unrisen sun.

* See "We Are Living at the South Pole," by Paul A. Siple, NATIONAL GEOGRAPHIC MAGAZINE, July, 1957.

† See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Year of Discovery Opens in Antarctica," by David S. Boyer, September, 1957; and "The International Geophysical Year," by Hugh L. Dryden, February, 1956.



Aquachromes by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Seismometer, sheltered in a snow cave, records earthquakes throughout the world. Aluminum insulation keeps temperatures constant inside the chest. Robert F. Benson inspects the mechanism by lantern light.

History locked in ice: As a tree's rings tell its past, so layers of snow and ice reveal the icecap's. In his workshop, glaciologist E. W. Remington slices blocks of snow with saw and miter box and examines them under light. After laboring in the snow mine, he "warms up" in this room, where temperatures hold around 25 below.

Filtered Sunlight Glows Blue Through an Icy Corridor

Tunnel in the snow stretches a fifth of a mile from camp to seismometer pit; the distance ensures that slamming doors and rattling vehicles do not disturb the delicate instrument.

Snow Mine Burrows 90 Feet Deep into the Icecap

First seismic test at the Pole revealed 8,300 feet of ice and 900 feet of rock above sea level. To study the layers of ice and take samples, the winter party hacked a long tunnel, angling down at 18 degrees from the surface.

The pit served another vital function: clean snow for water. Men took turns in the giant deep freeze, working in temperatures averaging 60 below zero. They chipped the flintlike snow with axes, loaded the clinking pieces into parachute bags, and hauled them uphill on sleds to the melting machine. Two or three hours of chopping, shoveling, and lifting 80-pound sacks exhausted workers.

But the thing that brought us to a standstill was a series of long wisps of white clouds, delicate and tenuous as if they had been applied by the brush of a Japanese water-color artist. Unmindful of the cold, Jack and I both pulled our cameras out once more.

While taking our photos, we turned again toward that bright orange area nearest the sun. The spot had grown noticeably brighter during our walk. It was like a forest fire in the distance, without any smoke. Framing it rose a great fan of cloud streaks, streamers of alto-cumulus clouds that ran parallel to the course of the upper winds, our weathermen said. Today the wind velocity high above us was unusually strong.

Mirage Sparkles Like the Sun

"Did you see what I saw?" asked Jack's muffled voice.

"You mean those flashes of light?"

"Yes! Do you suppose that it could be a mirage of the sun?"

"Maybe so, but it's the strangest one I've ever seen," I replied.

While we watched, the flashes increased. We quickly dubbed them "sparklers," for they were tiny, jewel-like points of light that appeared for a second and then disappeared. Their brilliance was almost blinding. Some were bright green, blue, or blood red, but most were a blazing orange.

The sparklers were in continual motion and clustered about what appeared to be a window in the clouds, a lateral space only a little wider than the sun itself.

We tried a trick we often use in polar regions to test certain types of mirages. We would step up on snow mounds, then seek a low spot and squat. We discovered that any changes in eye level made a temporary difference in the number of sparklers visible, but there was no consistent parallel between height and intensity. We both ran out of film trying to make pictures of the phenomenon, but we were not enthusiastic enough to try to change film with our stiff fingers.

More than an hour had now passed since we began our hike. Bravo had already shown good dog sense and was off to warmer quarters—so we followed.

Back at the camp we spread a general notice over the telephone system that the sun was coming up. Within minutes nearly everyone was outdoors to see for himself. The snowdrifts stretching up to the rooftops of our camp became a forest of camera tripods.

The sparklers we had told everyone about so excitedly were no longer evident, but an even grander mirage began to appear. Though officially the sun was still a couple of degrees below the horizon, there loomed up a distinct arc of its upper limb.

At first, unlike the real sun, it wouldn't stay up. It seemed to be pulsating up and down—struggling to rise, and then subsiding again. These pulses came minutes apart. Men dancing about to try to keep warm between "shows" would shout to draw attention as the light grew stronger; then there would be a scurry to the cameras.

During the next hour or so the whole sun seemed to come up and stay above the horizon. However, if one used a colored filter or squinted, he became aware that the disk was indeed strange in appearance. It was composed of an irregular series of horizontal lines, like stacks of orange neon tubes.

Exactly when the sun mirage set again we were never quite certain, for the weather began to change fast. Ice fog rolled in over the camp, and the temperature began to skyrocket. In fact, by midnight it was all the way up to minus 69°F.—the warmest it had been for days. For 93 hours it had never gone above minus 91°.

Warm Air Layer Reflects Sun's Rays

What had caused these strange apparitions? On this coldest of days there was a temperature inversion of about 72 degrees. That is, at an elevation of 1,400 feet above our heads the air was much warmer—about −30°F.—while for us at the surface it was −102°F.

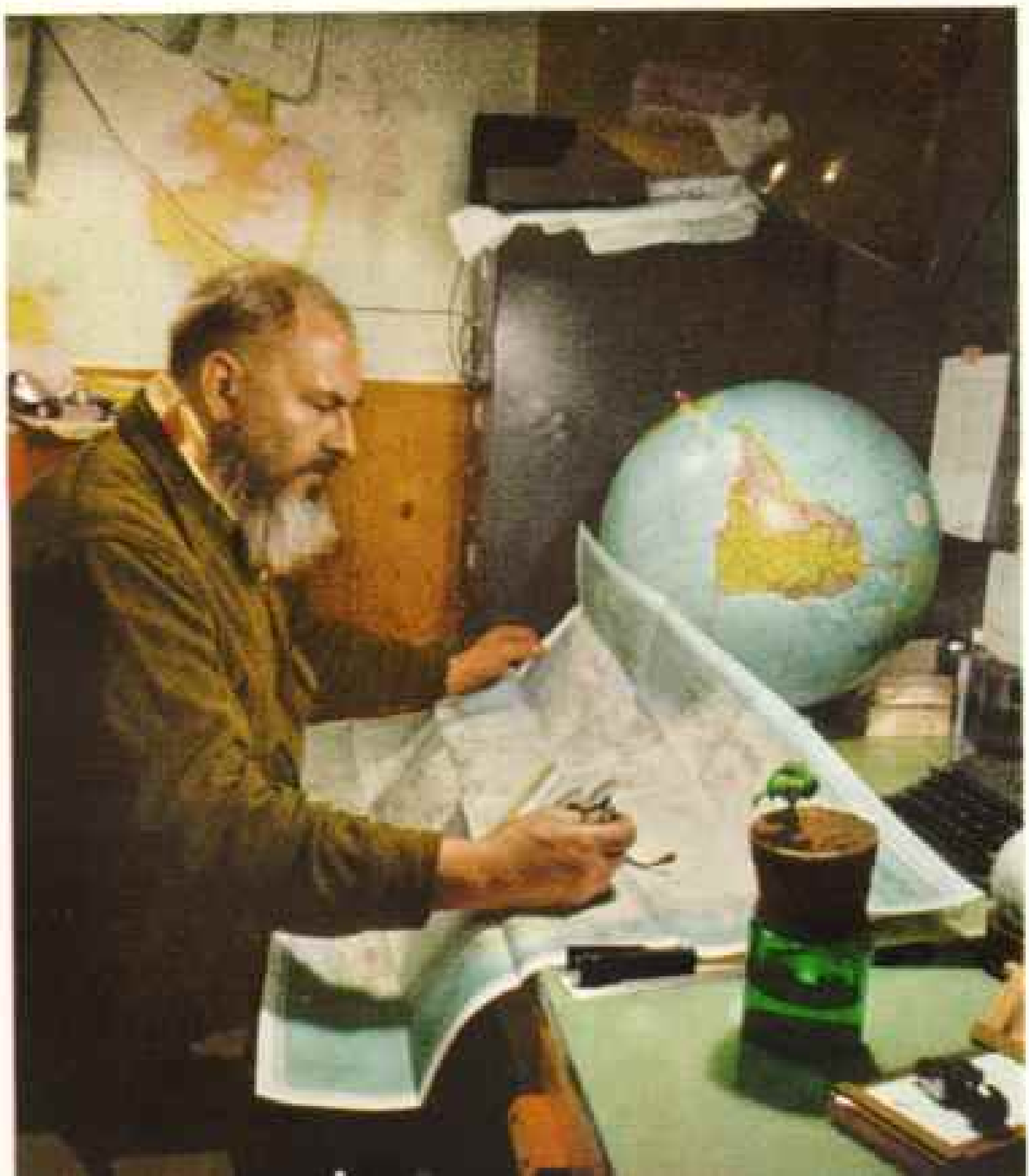
This strong temperature variation produced ideal conditions for a mirage. The warmer air above us formed a mirror, rippled by high winds, that brought us our sun several days before it was due.

During the next few days we saw the sun's reflected image much of the time. Surprisingly, it rose in the Eastern Hemisphere sector

Not Himalayas' Abominable Snowman, but a Scientist in Frozen Mask

The effects of four hours' work in the open at 60° below show on this South Pole volunteer. Condensed breath ices his face covering; only the eye holes reveal the man. Risking frozen noses and cheeks, some preferred bare faces and icy beards to the restrictions of a mask.

Thomas J. Abercrombie, National Geographic Staff



Does weather flowing out of the Antarctic refrigerator affect the climate of southern continents? Of the Northern Hemisphere? Seeking answers, all 46 IGY stations in Antarctica last winter made weather studies.

At the Pole, meteorologists Herbert L. Hansen (left, above) and Edwin C. Flowers plot data from weather balloons, which they launched four times a day. Transmitters beneath some of the gas-filled bags flashed information on temperature, pressure, and humidity at a dozen miles aloft.

In his cramped office, Dr. Siple scans The Society's new Antarctic map, presented to him by staff writer-photographer Abercrombie on arrival last fall. Siple's globe, which appears upside down, sits naturally, according to the scientist: "When you're right side up at the Pole, it's the rest of the world that's upside down."

Potted philodendron, first plant ever grown at the Pole, was nursed with artificial light.

Acknowledgments to Thomas J. Abercrombie, National Geographic Staff © N.G.S.

and set in the Western. At the Pole the rising sun ought to skim in an even circle around the horizon.

One explanation of this false sunrise and sunset could be that the unknown territory toward Asia, deep in the interior of Antarctica, lies considerably higher than the Pole itself. Thus its "sky mirror" would reflect an image of the sun from farther away, causing a mirage to "rise" in that direction.

In 1956 observers in U. S. Navy planes flew over portions of this least-known part of Antarctica and estimated altitudes as high as 14,000 feet, or 5,000 feet higher than our station. Now the sun gave us indirect evidence of the loftiness of this region, much of which is yet to be seen by man.

Turkey Dinner Celebrates Sunrise

Our true sunrise came five days later, September 23, when the sun crossed the celestial equator into the Southern Hemisphere. We celebrated with a banquet: onion soup and shrimp cocktail, two turkeys, dressing, peas, corn, white potatoes, candied sweet potatoes (especially good), gravy, rolls, olives, cranberry sauce, nuts, gumdrops, a makeshift red "wine," and fruit punch.

After the feast—about 7 p.m.—we held a more solemn ceremony outside. While all stood at salute, the flag was raised again for the first time since the sun had set 186 days before.

Toward the end of the winter night I tried to set down some of my reactions to six months without the sun. First of all, I appreciated how different this winter had been from the other three I had spent in Antarctica.

At Little America the sun had disappeared for four months, and for two of those it was light enough to work outside several hours a day. Even in midwinter there was a flush of light to the north at noon, for the sun was only about 11° below the horizon.

At the Pole, when the sun was farthest from us—on June 22—it lay a full 23½° below our horizon, and then we could see no indication of its light at all.

For two of our six sunless months we had some twilight. Our period of virtually complete darkness lasted four months, as compared to two for most previous Arctic and Antarctic stations, including those of Scott, Shackleton, Amundsen, and Byrd.

Cold and the pain caused by cold are relative things. Improperly dressed, one can feel about as much pain at plus 40° as at minus 40°F. This is because the nerves that register pain from rapid heat loss work at their limit as soon as the human body gets into trouble—which it does at about 40°F. The warning system for overchilled bodies is like a fire-alarm bell; it rings just as loudly for a small fire as it does for a big one.

At Little America we hated to go out, even when it was calm, at temperatures much below −40°, and work parties were usually on a voluntary basis below −60°. At the South Pole we had 169 consecutive days with temperatures below −40°, and our coldest month *averaged* −80°.

In most cold areas of the world the coldest days are characterized by calmness. For example, Oimyakon, Siberia, which previously held the official world's record for cold (−89.9°), lies in a valley. Cold air sinks into the basin, and there is virtually no air movement; the average wind velocity during the coldest month at Oimyakon is only about half a mile per hour.

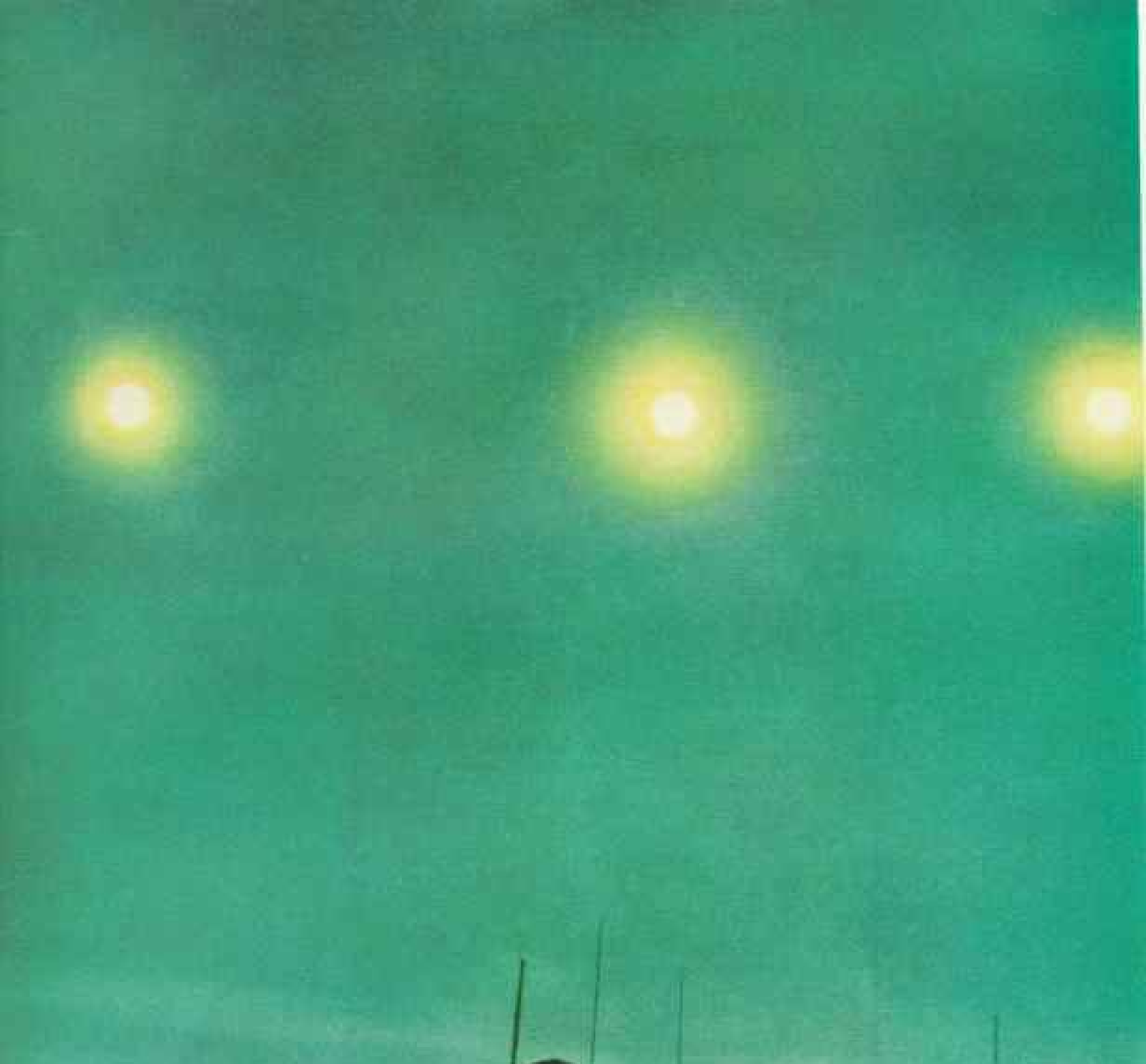
Thus we were surprised to find that at the Pole the wind blew all winter long, averaging between 15 and 20 miles an hour most months. Nevertheless we found that we could work outside, even in the wind, at temperatures below −80°.

One possible reason is the altitude. At 9,200 feet air is thinner and has a lower conductivity, hence less "cooling power." One man stayed outside for four hours without ill effect when the temperature was very close to −100°. It was common for men to work two- to three-hour stretches in the snow mine, where the temperature deep below the surface remained around −60° (page 446).

Cold Causes Headaches, Weight Loss

But if our polar atmosphere was less chilling, it also contained less total oxygen than air at sea level. Newcomers, especially, found themselves quickly out of breath when they engaged in heavy labor.

When our personnel arrived on the heels of the departing construction crew that had built the shell of our camp, there was still a great deal of heavy work to be done. From the first of last year until sundown March 22, arms, legs, and backs were on the strain to push, pull, and wrestle all our possessions into the confines of the camp. We stacked 450-pound fuel drums, moved and constructed buildings, dug tunnels, erected antennas, un-



Like a Scene from Another World: Green-haloed Suns Glow Above the Pole

Staff man Thomas J. Abercrombie, first civilian photographer to reach the South Pole station, took six exposures over a three-hour period last November to make this extraordinary panorama. A filter from a welding mask minimized the sun's intense glare and lent a greenish cast to both sky and landscape.

Kodachrome by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Initial exposure (right) was made without the filter.

Crownlike rawin dome and box-shaped aurora tower stand atop pilings to let wind-driven snow sweep through and thus prevent the structures from being buried by drifts. Parabolic antenna inside the rawin dome picks up messages from high-flying weather balloons. Observers in the aurora tower's plastic bubbles study and photograph spectacular displays of the southern lights.

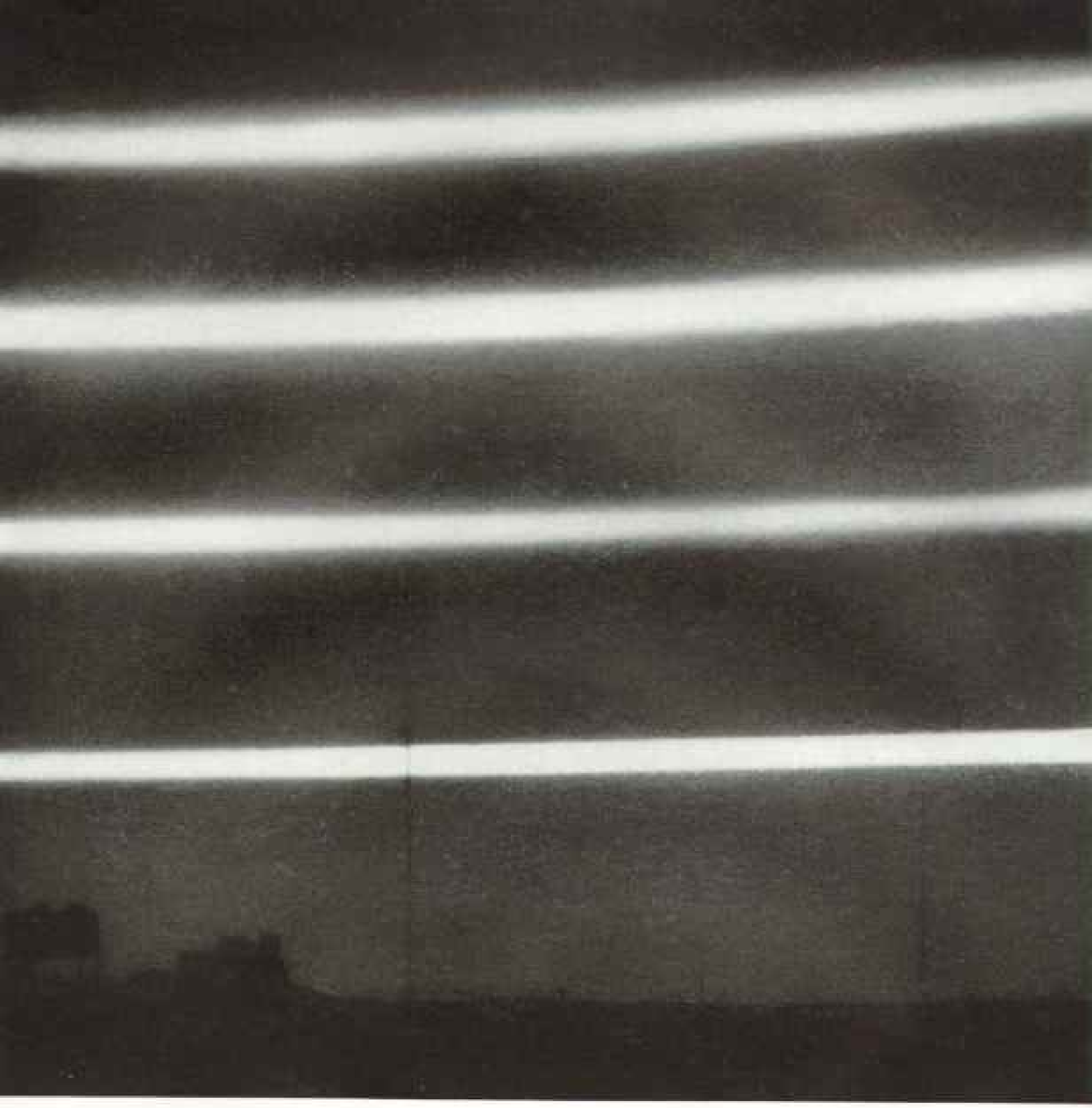
Clouds of steam pour from pipes as exhaust from stoves and generators condenses on contact with the frigid air.

Stars Trace Circles Above the Pole

To a man standing at the bottom of the world, the stars appear to move in concentric rings. Recording the phenomenon, Paul Siple and Arlo Landolt set a camera in the aurora tower and aimed it at the zenith.

Earth made one complete rotation during this 24-hour exposure. A light on a soaring weather balloon registers as a jagged thread at top.

Antarctica lacks a bright pole star corresponding to Polaris over the Arctic.



How the Moon Spirals Above the Pole: a Four-day Time Exposure

For two weeks each winter month the moon is continuously visible from the Pole, swinging around the sky from right to left. Scientist Robert Benson caught its gradual descent with a pinhole camera fashioned from wood scraps and copper foil. On August 9 (top band) the moon rides 13½° above the horizon; it runs into overcast at the extreme left. By August 12 it had dropped to 4½° from the horizon. Station towers show dimly in the gloom.

packed scientific gear, and set up instruments, working at the limit of our physical capabilities. Much of this labor was done at temperatures between −40° and −80°.

There were several noticeable effects. Nearly everyone lost weight. Some who could well afford it lost as much as 30 to 40 pounds, but even the lean workers grew leaner. A few felt a gradual attrition of strength, especially noticeable in loss of ability to lift and to grip. This affliction ended soon after we started our winter hibernation, and our weights then began to return to normal.

Another trouble noticed by some of the men was an arthritis-like aching and stiffness of joints, especially knuckles, elbows, and shoulders. This may have been due to some mild form of anoxia, or oxygen lack, from the altitude and to a reduced rate of blood circulation from the cold. For some, heavy exercise or long exposure to the cold tended to cause headaches.

But gradually we became acclimated, and when visitors and our replacements arrived at winter's end, we yearlings had acquired a reasonable amount of stamina.

One heavy chore that fell equally upon all camp members was digging in the snow mine. This served the combined purpose of getting a water supply and providing a deep pit for glacial study. In eight months we dug a sloping tunnel about 270 feet long, 90 feet deep, 6 to 11 feet wide, and 7 to 20 feet high. Temperature inside stood at a fairly steady 60° F. below zero.

We dug this angled cave mainly with two tools: a spoon-bladed Swiss ice ax and a coal scoop. We scooped the chipped ice into salvaged parachute bags. These we loaded onto plastic toboggans, which we hauled to the surface with an ingenious winch built from odds and ends by Mel Havener, our mechanic, Ken Waldron, our electrician, and Earl Johnson, our utilities expert.

Par for one man picking, shoveling, and lifting the bags onto the sleds was about 600 pounds in an hour, and half a ton at one work period. The pace setters, however, would sometimes stretch the production out to a whole ton.

Working three hours or more at a stretch could be painful. Even quite lightly clad (heavy cotton underwear, a layer of wool, and a thin cotton windbreak suit), a man would sweat for the first hour while he was fresh. As he slowed down later, the chill crept in—toes got cold, nose frosted. Sometimes it would take several hours, after he got back "upstairs" to the heated buildings, to pay back the heat lost from the deep tissues of the body.

Everyone agreed that, as the pit got deeper, the toughest part of the whole stint in the mine was the climb up those stairs at the end.

Pole Camp Had Plenty of Elbow Room

Probably for me more than for any of my companions this base at the Pole seemed to be spacious and luxurious living. The effort to conserve heat has always tended to force men to live closer together under polar conditions than they would in milder climates. The first winter night I spent in the Antarctic, back in 1929, I was one of eight housed in a barracks 10 by 10 feet square.

At the Pole our space *per man* in the sleeping quarters alone was nearly this large. In fact, the total floor space of the Pole camp —6,000 square feet—was about four times larger than that at Little America I, which housed 42 men as compared to our 18 (see diagram, page 458).

This in itself was a great step toward solving the psychological problems of a polar environment. The loosening up in living space gave a measure of privacy to our men. Also, the extra room required more servicing and left less spare time. Busy men are generally

Sastrugi, Waves of Snow, Spread a Frozen Sahara

Furrows as high as two feet take shape in the direction of the prevailing wind. They make walking a torment. Snow has to be smoothed before planes can land safely.

Winds throughout the polar night averaged 15 to 20 miles an hour, the winter party found.

Winter winds compress snow surfaces, then undercut them in such strange shapes as this snow arch.

"There is nothing here but miles and miles of nothing," said one Pole visitor. No wildlife existed here until three skua gulls were sent in by plane, banded, and released to test their homing instinct. At first they refused to fly, then vanished across the wastes.

Thomas J. Abercrombie,
National Geographic staff

Clifford R. Dickey Jr.
Electronics, ET1
California

Wm. C. McPherson Jr.
Radioman, RM1
Rhode Island

Kenneth L. Waldron
Electrician, CE2
Iowa

Thomas M. Osborne
Builder, BU1
Pennsylvania

Earl F. Johnson
Utilities Man, UT1
Ohio

John Tuck, Jr.
Military Leader, Lt. (jg.)
Massachusetts

Howard C. Taylor III
Medical Officer, Lt.
New York

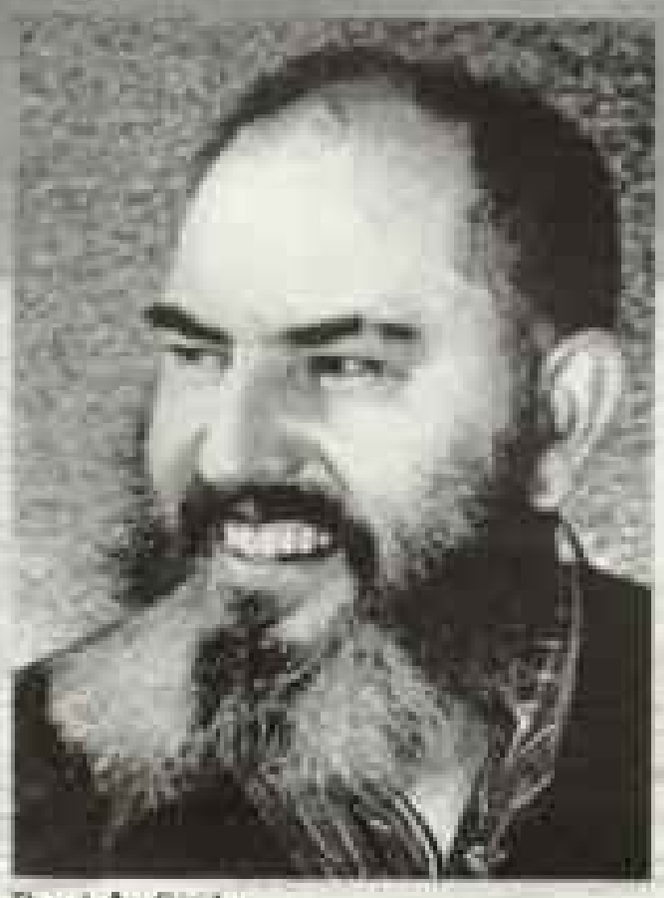
Melvin C. Havener
Mechanic, CM2
Iowa

Chester W. Segers
Cook, CS1
Rhode Island

Modern Pioneers: the 18 Men Who Conquered the Winter Night at the South Pole

Robert F. Benson
Seismology
Minnesota

Edwin C. Flowers
Meteorology
Maryland



Paul A. Siple
Scientific Leader
Virginia

Herbert L. Hansen
Meteorology
Nebraska

South Pole

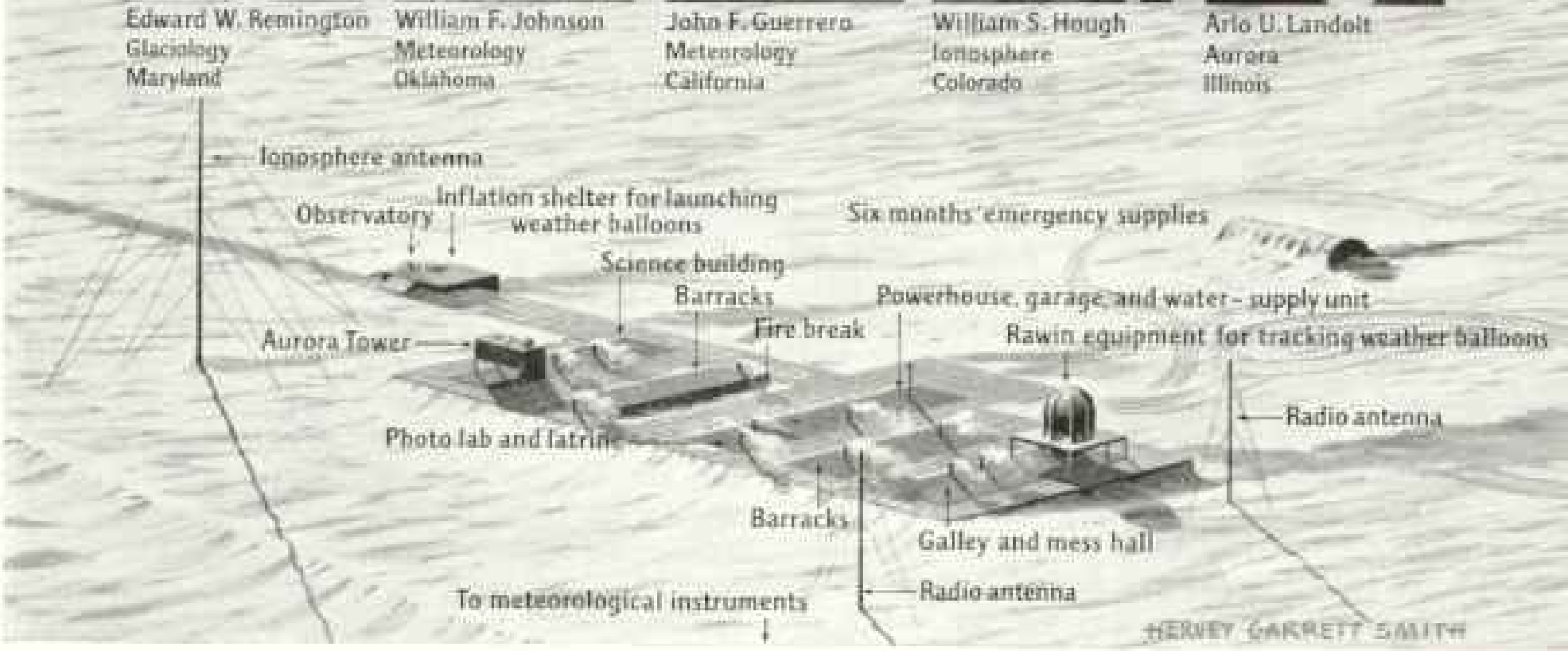
Edward W. Remington
Glaciology
Maryland

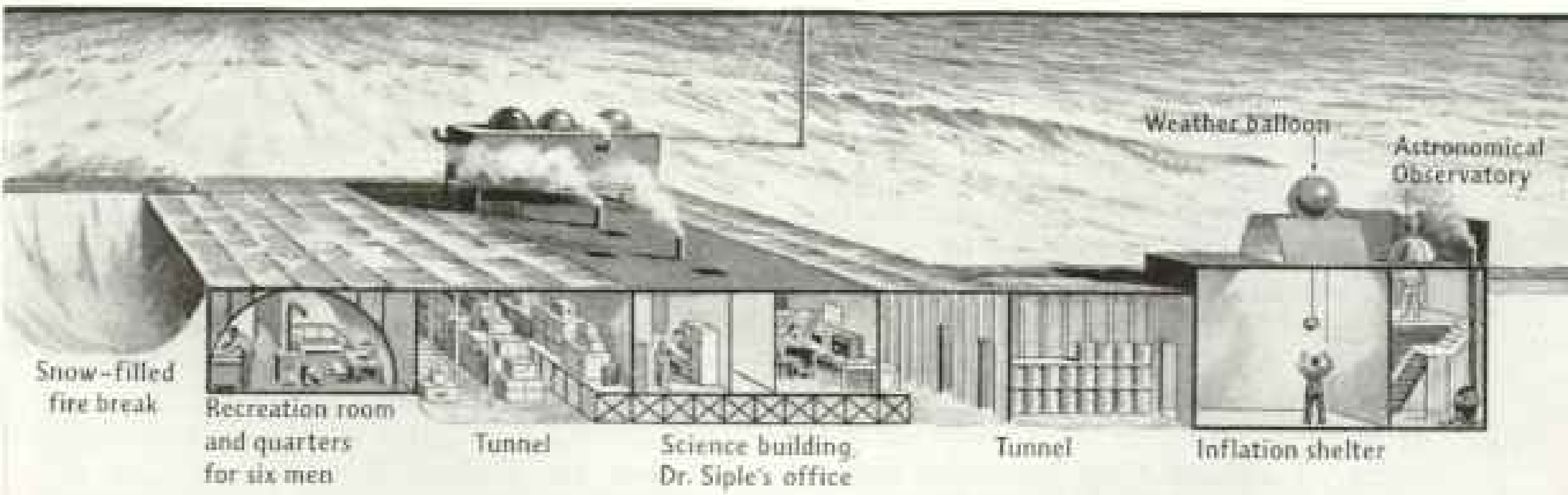
William F. Johnson
Meteorology
Oklahoma

John F. Guerrero
Meteorology
California

William S. Hough
Ionosphere
Colorado

Arlo U. Landolt
Aurora
Illinois





In the tradition of Amundsen and Scott, this small band wrote a new chapter in Antarctic history. Dug in against shrieking winds and stinging snow, they proved that man, if properly equipped and physically fit, can survive earth's coldest temperatures at the South Pole. Nine civilian scientists and nine Navy technicians, they came from 14 States. Drawing shows their midwinter camp lit by the full moon.

happy men, and time speeds by unnoticed.

In theory, all polar camps have a virtually unlimited water supply available. But since it must all be toilsomely shoveled and melted, men keep their requirements to a minimum. In the past, some "knights of the gray underwear" took pride in their ability to go for weeks or longer without baths or laundry sessions.

Hot Showers Help Build Morale

But in this modern age, when the men on expeditions are under salary (I received a dollar a year on each of my first two trips), much better living conditions prevail. More precisely, the U. S. Navy, providing logistic support for our stations, has attempted to supply facilities comparable to its bases elsewhere around the world. So we had hot and cold shower baths, a washing machine, electric clothes drier, vacuum cleaner, a light over each man's bunk, movies three times a week, and linoleum on the floors.

Our intensive and systematic snow mining program provided us with more than 200 gallons of water per day, or about 11 gallons per man. We stayed clean and comfortable, with the camp tidy and morale high.

From the outset Jack Tuck and I agreed that the "split command" was a poorly devised arrangement, but that we had to make it work. We further agreed to eliminate any local distinction between the scientific staff and the naval support group. To have the camp divided nine and nine into some variation of sheep and goats was asking for trouble.

In any case there were many communal chores that had to be shared by all hands: mining snow, bringing in fuel, keeping buildings and passages clean (or, as locally expressed, acting as "house mouse"), and, of course, K.P. duty.

Three Tons of Fresh Meat

I could easily write a chapter, if time and space permitted, about each of the men—Seabee or scientist—who wintered at the Pole. Each man fulfilled an essential job, and each was responsible, in his own way, for the success of our experiment.

Of the various jobs in any expedition, none is more critical—or more thankless—than that of the cook. We were blessed with one of the finest. I admired Chet Segers not only for his excellent meals but also for his approach to his job. He worked hard to please 17 men concurrently. If he knew that an item on the day's menu would not please some of the men, he would prepare a second dish for them.

He got some odd requests for special dishes and cheerfully filled them, or let us try our own hands. For example, some of us developed a fondness for ginger-flavored steaks for breakfast. He brewed quantities of iced tea, strangely enough a favorite beverage at the Pole.

We started the winter with three tons of fresh meat, dropped by parachute. Average food consumption was six to eight pounds a day per man—and Chet prepared almost all of it. He had to plan meals carefully in advance, since most food was stored in the tunnels at −60° F., and before being cooked had to thaw the better part of a week.

Such polar temperatures also complicated the work of Tom Osborne, in charge of station construction. His was the cold, cold job of erecting three buildings, working outdoors—sawing, measuring, driving nails—at temperatures down to minus 65°. Mel Havener, our mechanic and the youngest man in camp (he celebrated his 21st birthday at the Pole), had similar problems keeping our weasel and tractor running until 90-below weather forced a halt.

Sprinkling Can Waters Snow Dust

There would seem to be little need, where we were living, for a rake or a sprinkling can; we were not troubled by falling leaves, nor did we do much gardening. Yet Earl Johnson, our utilities man, was called upon to manufacture both: the rake to level snow and occasionally to look for objects dropped outdoors; the sprinkling can to lay dust—snow dust, fine powdery particles that accumulated in the tunnels.

Ingenuity was the key; we had no other resource to fall back on. Bill McPherson, our radio operator, and Cliff Dickey, the electronics technician, kept us talking to the outside world all winter. But though we could talk, we could not order so much as a paper clip; either we had it, or we made it, or we did without it. When electrician Ken Waldron ran out of equipment, he lighted the snow mine with baling wire and junction boxes made from tin cans.

No one was more adept at such improvisation than Dr. Howard C. Taylor III, our medical officer. Having, happily, few ailments to treat, he delivered weekly medical lectures;

betweentimes he invented some astonishing gadgets.

Perhaps the most fantastic was his "insomniometer"—a device for recording movements men made while they slept. Built principally of tin cans and powered by dripping water, it marked with a stylus on smoked paper the motions of strings running to a sleeper's mattress.

Dr. Taylor worked on this machine for weeks. He finally gave up in disgust when a test graph showed only a monotonous straight line. His subject, Bob Benson, had slept all night without moving a muscle!

Frozen Fungi Bloom in Jars

One of Dr. Taylor's more successful experiments was an attempt to grow plant life from spores and pollen grains dug from the bottom of the snow mine. There is good reason to believe that such minute particles, along with dust, are carried on winds at great heights from faraway parts of the world and preserved, perhaps for centuries, in the polar deep freeze.

Thawing chunks of ice from far below the surface, Dr. Taylor took elaborate precautions to prevent modern spores in the camp from getting into his sterile culture jars. The fungi he cultivated in them resembled typical green and white moulds that grow on stale bread.

37-foot Letter Arrived at Winter's End

Seabee Earl Johnson received the lengthy scroll from his fiancée in Florida. During the winter he talked with her ten times with the help of an amateur radio operator in New Jersey. When Johnson returned last December and married the young lady, his best man was their radio go-between.

Seeking the coveted polar postmark, stamp collectors sent more than a quarter of a million letters to be mailed from the Pole Station. Paul Siple designed and carved the linoleum block that stamped the envelope at top. His penguins frolic off base; not one exists at the Pole.

Thomas J. Abercrombie, National Geographic Staff

Dr. Taylor, a cautious scientist, made no claims for his specimens, but brought them back to civilization at winter's end for further study.

Meteorologists made up the largest group of IGY scientists in the Antarctic. The Pole Station's four-man weather team worked around the clock in two-man shifts.

They kept continuous weather records by remote telemetering from a wide variety of instruments exposed almost 100 yards from camp. It was necessary, however, to check the delicate instruments regularly; so once every three hours a meteorologist would bundle up and stumble over the drifts, lighting his way with a flashlight.

At the instrument exposure site the weatherman does not tarry long at his task. He holds his breath while he reads the thermometer, so that the exhaled vapor will not blur its fine graduations or warm it as much as a tenth of a degree.

Then he checks other instruments which measure wind velocity and direction, and radiometers determining the amount of heat being exchanged between the snow and the sky.

He looks for precipitation—ice crystals which may fall from an almost clear sky—and for clouds or changes in the snow surface due to wind or precipitation. He watches particularly for "snow down," wispy balls of frost so delicate that the slightest touch collapses them into powdery fragments. These appear mysteriously when the air warms faster than the snow surface.

Moon Dons an Icy Halo

In moonlit periods—about half of each month—the weather observer may see a halo around the moon, pale and fanciful compared to the rainbow-hued circles so often visible around the sun in summer. Minute ice crystals in the air cause these beautiful polar spectacles.

But if the weatherman takes time to admire the moon, he is quickly brought back to earth by the brisk and biting breeze; his returning steps quicken, and a sheltering hand goes up to warm his nose.

The meteorologists must also study the atmosphere high overhead. They do this by sending aloft a miniature radio transmitter tied to a large balloon. A maneuverable radio antenna, housed in a plastic dome above the mess hall, tracks the balloon and registers its transmitted data on an array of telemetering recorders. The whole system is called a rawinsonde (pages 449 and 450).

Hydrogen for the balloons is manufactured in a tank-shaped iron monster that devours aluminum chips, caustic soda, and gallons of water. When time comes for launching, the overhead doors of the inflation shelter are pulled open, and instantly the room turns frigid as cold air cascades down. With his fingers crossed, the balloon maker releases his newborn baby into the cruel world outside. Strong winds may snatch it too greedily or dash the delicate transmitter against the coaming on the way out. Before we made windbreaks of plywood and canvas, we often had to inflate two or three balloons before one got off successfully.

Balloons Ride Winds Aloft

Once aloft, the transmitter radios back a series of precisely timed buzzes and rattles which indicate temperature, pressure, and humidity; our radio antenna, meanwhile, tracks the balloon to determine direction and velocity of the wind. Sometimes a tiny battery-powered light rides beneath a balloon to make it visible against the winter night (page 454).

For an hour or so after the balloon has disappeared, the meteorologists plot and interpret the results. Then the data are radioed to the central Antarctic weather station at Little America.

To Weather Central come data from IGY stations all over Antarctica. The resulting weather map is broadcast from Little America.

Chief of our hard-working weather team was Edwin Flowers, a quiet-spoken meteorologist from Kensington, Maryland (page 450). Like the other weathermen, he cheerfully did his share of routine chores—mess duty, house mouse, and snow mining—on top of his almost continuous responsibility for meteorological data.

Two of his colleagues had already had experience with polar climate before they came to Antarctica. Floyd Johnson had spent more than a year as a weather observer at Isachsen, Canada, only 770 miles from the North Pole. John Guerrero, our meteorological electronics expert, had studied at the University of Alaska and worked as a technician on the DEW Line, the Distant Early Warning system that spans arctic North America.

The fourth man of the weather team, Herbert Hansen, became so interested in polar

(*Continued on page 471*)

Men Drag in Supplies Flung from the Sky

With the coming of summer, planes roared over the polar station for the first time in eight months. Flying out of McMurdo Sound, U. S. Air Force C-124 Globemasters dropped hundreds of tons of food, fuel, and equipment. Parachutes saved cargo from smashups in the snow.

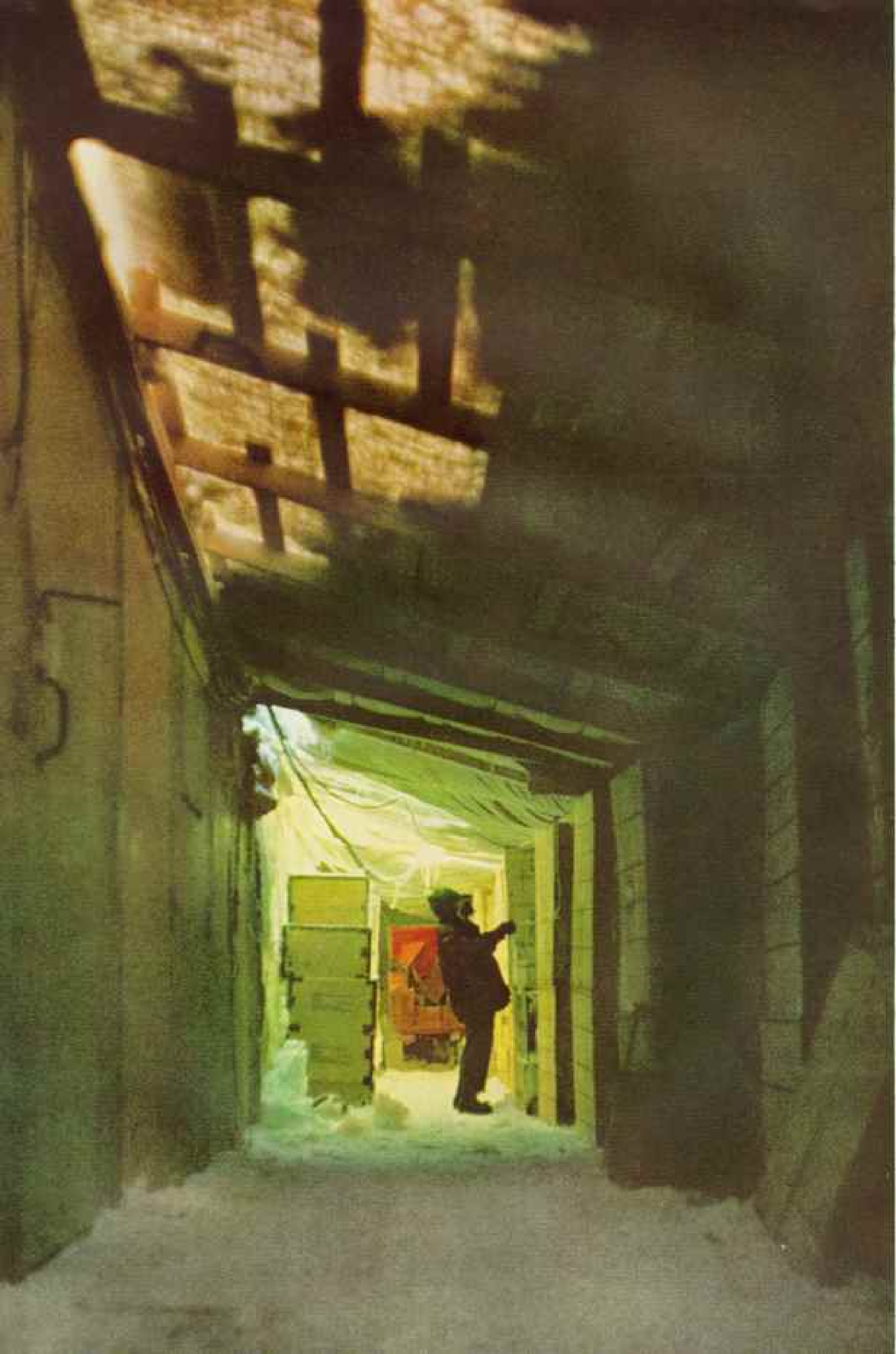
Struggling across dunelike drifts, these men haul in a 300-pound heater to warm up planes taking off from the polar airstrip. Clouds of condensed steam shroud the camp.

An Exhausted Worker Collapses in the Snow

Fifty-below-zero cold and the thin air of the 9,200-foot-high plateau made even the strongest men gasp for breath while retrieving air-drop cargoes. Puffing and panting, this man dragged a load of bamboo marker poles half a mile before he sank to the snow, utterly spent. Fur hood and home-made nose guard hide his face from knifing winds; icicles coat mustache and beard.

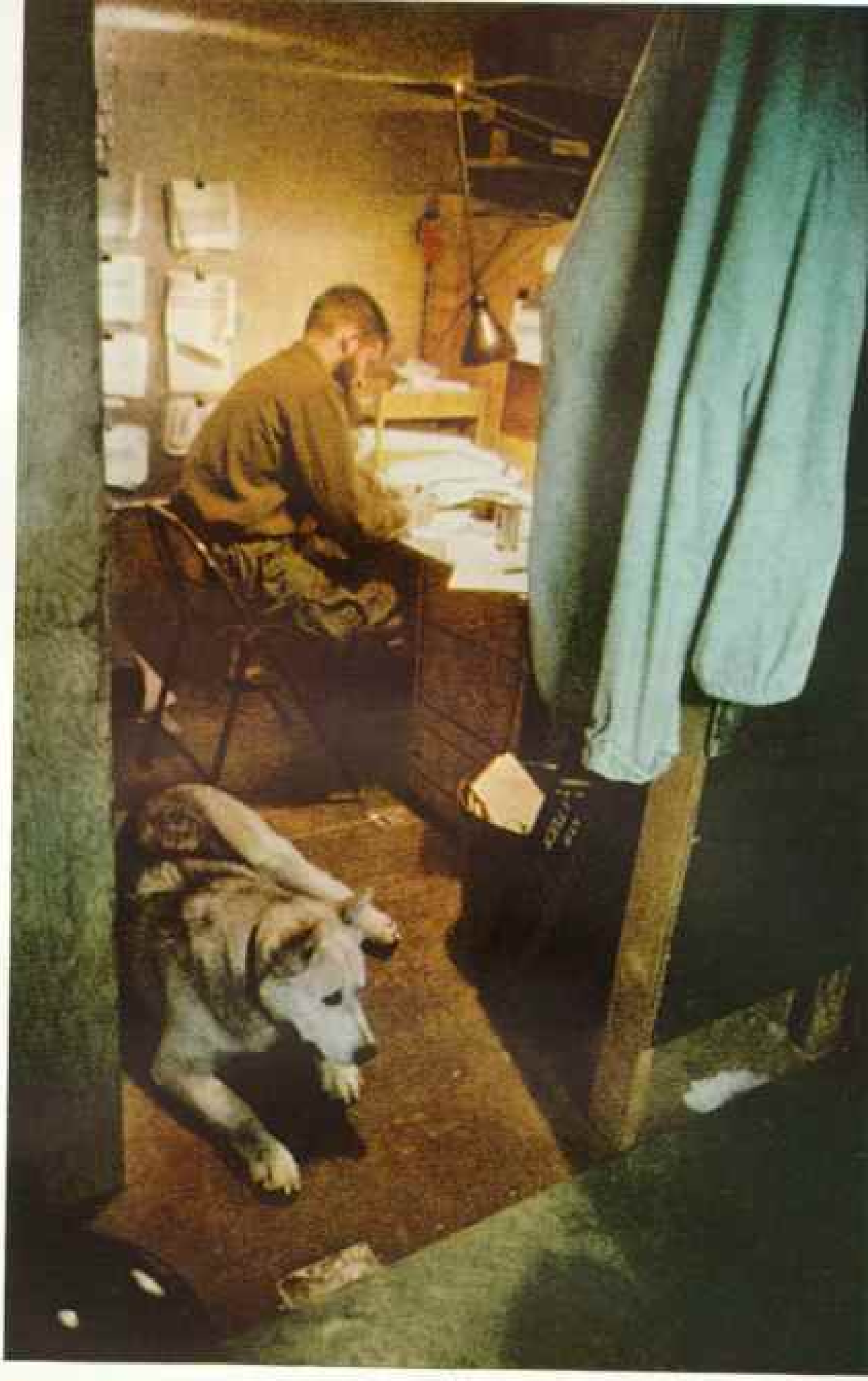
"Once I became exhausted from pulling," reports photographer Abercrombie. "My lungs did not seem to draw enough air into my chilled body, and my legs folded under me. The others, plodding head down into the wind, pulled the heavy sled over me before I could protest."

Kodachromes by Thomas J. Abercrombie, National Geographic Staff © N.G.S.



Dark Corridors Through the Snow Link Polar Huts

Even in the bitterest storms, inhabitants of the base can follow passageways from building to building. These icy aisles also serve as storehouses for goods and equipment not affected by the cold. Burlap and chicken wire, later reinforced by parachutes, cover the two-by-four framework. Snow drifts across the roof.



Antarctica challenges men's minds. Many of the 18 men who spent the first winter night at the Pole reported later that the perpetual darkness did not bother them so much as a gnawing desire to be alone. Crowded into cramped quarters, seeing the same faces week after week, they longed for solitude.

Paul Siple, who has spent more time in Antarctica than any other man, recalls that each night, in the lonely hour before sleep came, he concentrated on the world outside. "All day long there were other people. Then bedtime came and you were absolutely alone. It was like pulling down a window shade, separating the two parts of the day."

Here, alone in his small office, Lieutenant Tuck works late into the night. Bravo sprawls beside him.

Beneath the cross, Seabee Earl F. Johnson reads his prayer book. Followers of all faiths joined in weekly religious services.

Polar Shut-ins Celebrate Midwinter Day with Food and Fun

In festive mood, the group observes June 22, the halfway mark of its tour of duty. Balloons and streamers dress the mess hall. Shutterbugs have lined up their cameras

Romping with Dr. Howard C. Taylor, Bravo demonstrates his talent for sleeve stretching. The only animal to winter at the Pole, the malemute-husky became the most spoiled sledge dog alive. "So much one of us that he doesn't even know he's a dog," reports John Tuck, his master. "Tie a sled on him, and he would be insulted." Born at McMurdo Sound, Bravo is a native Antarctican. Salvaged parachutes brighten this Jamesway hut.

"Back home we always have a wiener roast about this time of year," one of the scientists remarked. Not to be outdone, Robert F. Benson, John F. Guerrero, and Arlo U. Landolt (left to right) braved a temperature of 70 below and built a fire in the snow. So intense was the cold that flames did not melt the ice.

Kodachromes by Paul A. Rinfo and E. W. Remington (below) © N. G. S.

(foreground) to film the banquet. Dr. Siple sits at the head of the table, John Tuck at the foot. The red tablecloth came from a parachute.

Vapor Trails Streak the Sky as Cargo Tumbles: Summer's First Airdrop

The October sun rode well above the horizon. To the men at the Pole it signaled not only the close of the long winter night but also the end of their job.

One noon all hands lunched hurriedly and trudged outdoors, for the radio at McMurdo Sound had reported a plane en route. Eagerly the men scanned the sky; finally a speck appeared far to the north. The black dot grew larger and larger—it was the plane!

The Globemaster roared overhead, spilling long-awaited mail, and the eyes of the men below reflected their joy.

The first plane brought only mail and supplies, but soon smaller ski craft landed and discharged a new band of volunteers. And 13 veterans of nearly a year at the Pole bundled their belongings, boarded the planes, and headed home.

Dr. Siple photographed this momentous flight through his parka's porthole of wolf fur, which registers in the picture.

Here fuel drums cascade from the transport. Plunging through the frosty air, the warm containers exude wisps of steam. Cargo parachutes slow the descent and land them upright.

Aware that the retrieving of airdrop cargoes was a wearying task, Globemaster pilots tried to drop supplies as close as possible to the camp. Sometimes the men on the ground watched huge boxes drift directly toward them, then at the last second swing past and land in the snow fields beyond the base.

Occasionally a parachute failed to open, and the load streamed straight down (see following pages).

Kodachrome by Paul A. Siple © N.G.S.

Parachuted Tractor Fell like a Rock and Dug Its Grave in 30 Feet of Snow

"We stood at the edge of the station and watched a Globemaster roar over at 2,000 feet," recalls Dr. Siple. "We saw the belly doors open and a huge orange object tumble out. Its chutes billowed briefly, then collapsed.

"Helpless, we watched the seven-ton tractor hurtling down upon us, spinning as it fell. Momentum carried it over our heads into the open snow fields. Heavy canvas crash pads landed among the onlookers, hitting one man."

Crashing like a bomb, the tractor kicks up a fountain of snow beyond the flag and oil drums marking the Pole. Mr. Abercrombie, standing about 500 feet away, says the icecap shook as if from an earthquake. The shock registered sharply on the base seismometer.

Damaged beyond repair, the tractor was left where it fell (opposite). A second vehicle was dropped successfully later.

meteorology that he asked to be permitted to stay another year. For various reasons, however, it was ruled that no Pole personnel could stay over.

Radio Pulses Plumb the Ionosphere

The tallest structure at the South Pole was a 75-foot antenna designed to send radio signals into the rarefied layer of upper air known as the ionosphere.

Every 15 minutes of every day the automatic ionospheric sounder—the "C-3"—hurled straight upward into the sky radio pulses at successively higher frequencies, like a pianist running up the musical scale. A recorder listened for any echoes bouncing back and reproduced them on movie-film graphs called "ionograms."

The ionosphere is the electrically charged

Thomas J. Abercrombie, National Geographic staff © N.G.S.

Thomas J. Abercrombie, National Geographic Staff

Season's First Ski Plane Touches Down at the Polar Airstrip

Winging in from McMurdo Sound, the Navy Neptune brought in scientific instruments too delicate to be parachuted. Three passengers rode in to replace members of the polar winter party. The same flight carried the photographer. JATO booster bottles ride the plane's belly.

region of the atmosphere 50 to 250 miles high. It acts as a giant mirror for long-range radio communications, reflecting radio waves back downward and thus enabling messages to be sent far beyond the horizon.

Scientists have long known that the sun's radiation energizes the ionosphere. Yet over the Pole, for several months each year, sunlight never reaches the lower levels of the ionosphere; on our Midwinter Day, June 22, the boundary between constant darkness and constant sunlight lay 330 miles straight above us. Thus our signals sent into the ionosphere were expected to produce unique results.

To our surprise ionization seemed to remain high all winter. Moreover, a small daily fluctuation occurred in the ionosphere. These variations give evidence of a secondary ionizing agent, other than direct radiation from the sun, perhaps related to the earth's magnetic field.

Willi Hough, physicist from the National Bureau of Standards, had charge of the ionosphere program. In addition to keeping his machine firing every 15 minutes, he also had to develop and interpret the ionogram films each day. This, combined with his studies of earth magnetism and other geophysical phenomena, made him one of the busiest men in the station.

Equally busy was Bob Benson, who, in addition to helping when he could with the ionosphere and aurora research, also ran our seismology program.

To keep his delicate seismometer from detecting camp vibrations as well as earthquakes, he had it set up in a pit 1,000 feet away from the station. A long tunnel through the snow connected it with the main buildings (page 447). Bob's biggest problem, however, was not the long trek through the tunnel, but keeping his delicate equipment working. I remember marveling at his patience as I watched him work a full week repairing a galvanometer. One of the broken parts was a frail gold strip less than 1/1000 of an inch thick!

Yet, despite technical difficulties, he kept a recorder going and even found time for amateur photography. He took his most unusual picture with a pinhole camera that he made himself: a four-day time exposure of the polar moon as it circled us (page 455).

Aurora Illuminates Antarctic Sky

Throughout the dark winter night we had frequent displays of the aurora australis, or southern lights. Our aurora specialist, Arlo Landolt, kept a continuous record of these with spectrograph and all-sky camera; he also made hourly visual observations.

Arlo worked in a dark boxlike tower atop the science building (page 443), and when the aurora was especially active, setting the sky ablaze with greenish-white light, he virtually lived there. Often he got as little as two or three hours of sleep a night.

His biggest problem, however, was not loss of sleep but frost. His observation domes were made of transparent plastic less than a quarter of an inch thick; yet the difference in temperature between inside and outside was often more than 150 degrees. Frost built up on the inside of the plastic bubbles.

To keep them clear, we finally had to use two large oil heaters and several powerful fans to blast hot air against the domes. Eventually, Arlo was using more heat in his tiny building than we needed to warm the whole big science building down below.

While Arlo worked above the camp, Edward Remington worked below it. He was our glaciologist, and his was the coldest job of all. When he was not digging in the snow and ice outside, he dug in the snow mine. When he had removed a block of ice for study, he could retire to his laboratory (page 447). But even here, to keep his specimens from melting, he maintained a temperature of about 25° below zero.

Basically his job was to try to learn through the study of snow as much as possible about climate in years gone by. Ed photographed inch-thick blocks of ice sliced from the walls of the snow mine, then took water samples from each block. Sent home from Antarctica for analysis and study, they may conceivably show differences in the chemistry of snows that fell in summer and in winter, making it possible to read yearly layers like tree rings.

Thus we may be able to tell precisely how much the polar icecap grows in an average year, and how much it has actually grown, layer by layer, over past centuries.

The arrival of the sun sparked a new spirit of anticipation in the camp. Our siege was almost over. In not too many days, we would hear the hum of a plane coming over the horizon, and there would be mail, supplies, and then, eventually, a return to civilization.

Still, it was almost a month after sunrise—October 17—before we got word that the first Air Force C-124 was on its way at last. This big, heavy plane could not land, of course, but it carried our mail. Half an hour before its scheduled arrival time the men began drifting outside to watch for it, and at last there was not a man in camp who was not scanning the horizon in the direction we knew it would appear.

At last it came: a black speck at first, then a glint of sunlight on the wings.

"You look nice and big and beautiful!" shouted Jack Tuck over the radio.

First Mail Arrives After Eight Months

The plane circled the station, dropping fuel drums beneath billowing parachutes (page 468). Finally our first mail in eight months came drifting down. Before it reached the snow, the weasel, which had been shoveled out of the garage the day before, was on its way to retrieve the precious cargo.

This was the beginning of the end. The men retreated into corners with faraway looks in their eyes to read letters from home, from parents, wives, or sweethearts, news headlines screaming of sputniks, advertisements flashing new auto designs, and other reminders of things we had missed for months.

There was also less happy news. One envelope held an eight-month-old Valentine, mailed the preceding February by a girl who

had since sent word by ham radio that she had married another man. Saddest of all, for me at least, were the obituaries of Admiral Byrd, of whose death we had heard by radio the preceding March.

After the mail arrived, the camp never seemed quite the same again. Planes flew over with increasing frequency; more and more supplies were dropped, and the sense of isolation disappeared.

Nine days later came the first summer visitors and replacements. Now again the atmosphere of the camp changed completely. It is hard to explain the feeling that comes over you when, after so many months of isolation, strangers suddenly appear. It is particularly difficult to fight down a feeling of annoyance when a "foreigner" fails to show proper respect for some cherished trophy of the winter's toil. A new esprit de corps develops and forms a barrier between the veterans and the newcomers.

To complicate things, the newcomers brought with them a variety of colds and allied ailments. For the first week most of them were laid low by their diseases and the effects of the altitude. Then their germs struck the veterans. The colds we caught were worse by far than any I had ever seen before in my years in Antarctica.

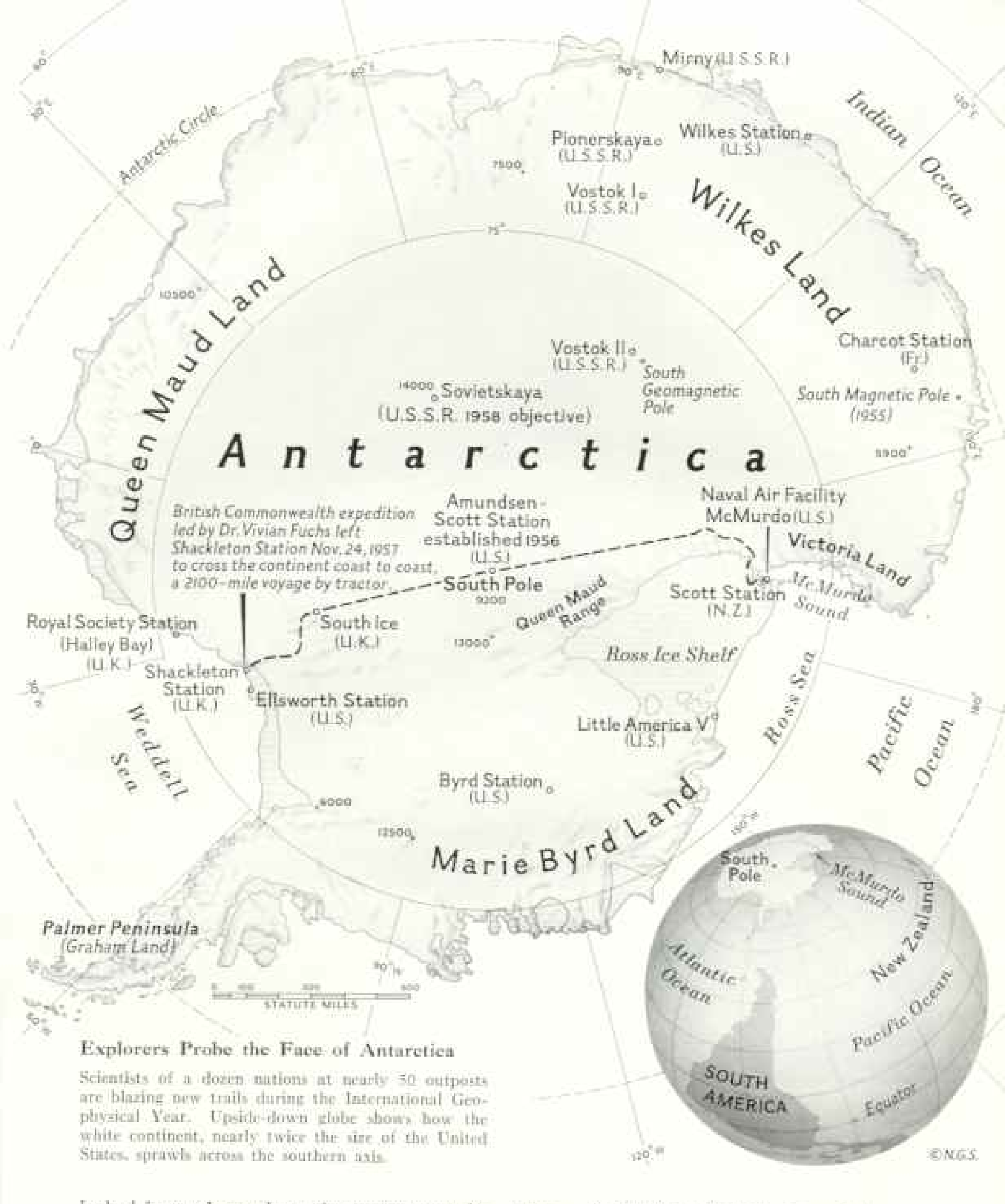
Our time was up; those of us who had wintered over began moving out, a few at a time. The prospect of getting home for Christmas was enticing; yet many of the scientific staff were sincerely disappointed at having to leave so soon.

Some of the programs on which we had worked all winter were still incomplete. It had been too cold most of the past six months to work outside with instruments, and we had

Dr. Vivian Fuchs Reaches the Pole on His Great Trans-Antarctic Trek

The bearded leader of the British party making the first overland crossing of the continent receives the greetings of Sir Edmund Hillary (left) and Rear Adm. George Dufek, U. S. Deep Freeze chief, at South Pole Station. Dr. Fuchs and his men rested briefly after their grueling 900-mile struggle over forbidding snow and ice never before traversed. Then, bent on achieving a long-cherished dream of Antarctic explorers, they pushed on for McMurdo Sound.

U. S. Navy



Explorers Probe the Face of Antarctica

Scientists of a dozen nations at nearly 50 outposts are blazing new trails during the International Geophysical Year. Upside-down globe shows how the white continent, nearly twice the size of the United States, sprawls across the southern axis.

looked forward eagerly to the warmer months of December and January. But all we could do was to turn over our cherished unfinished projects to our replacements and hope for the best. The Navy, of course, had to make sure that we were gotten out safely and that a double Pole party was not marooned there.

I left South Pole Station on the eve of December 1, 1957, a year to the day after I arrived with the construction crew. As always in the past, I left Antarctica with mixed emotions. Naturally I looked forward to returning to civilization, to family, friends, fresh foods, and myriad other things I had left behind so long before.

Still, it is sad to leave a home where you have been surrounded by fine companions, knowing you can never again return to live with that same group. Then, too, there is Antarctica itself. The polar plateau is not just a cold, white, lifeless space. For anyone with an eye for color and an appreciation for

natural form, there is a unique kind of beauty to be found here.

Now that I am back home in a Virginia suburb of Washington, D. C., the one question most often asked me is: "How cold *was* it down there?"

Did the Pole Have a "Warm" Winter?

Our −102.1° reading set a new official record for the coldest weather ever felt by man. Yet, strangely, we may have had a relatively warm winter at the Pole.

During the first complete year of temperature readings, an odd lack of balance appeared. We know from the temperature deep in our snow mine that the average annual temperature at the Pole is very close to −60° F. The warmest day so far recorded stood at 5.5° above zero.

Climatologists have found in some parts of the world that the lowest temperature of the year usually is as far below the average annual reading as the highest is above it—in this case, 65 degrees. That means we might have expected the coldest day of our year to have been between 120° and 130° below zero.

Instead, we scarcely exceeded 100° below, once early in the winter and again just before the sun rose. A similar lack of balance has been noted previously in polar regions.

Pole-bound, Hillary's Tractor Train Grinds Across the Ross Ice Shelf

Led by Sir Edmund Hillary, conqueror of Mount Everest, a five-man New Zealand party made the first overland trip to the Pole since Capt. Robert F. Scott's journey in 1912.

Pushing off from Scott Station on McMurdo Sound, the group began the 1,800-mile trek last October 14. Riding three farm tractors and a weasel (later abandoned), the men established depots along the trail for the Fuchs expedition, which was attempting the first land crossing of Antarctica from coast to coast. Light aircraft flew in food and fuel.

Driving the last 70 miles in 24 hours, Hillary and his companions reached the Pole on January 3, with only one remaining drum of fuel, enough for 20 miles. On the 10th Hillary welcomed Dr. Vivian Fuchs and 11 other members of his Commonwealth Trans-Antarctic Expedition, who arrived at the Pole after a 57-day march from the Weddell Sea.

Photographer Abercrombie made the picture from a Navy Neptune, whose shadow races past the trail caravan.

One possible reason for this apparently unseasonable "warmth" may have been the unexpected strength of the winds that swept the Pole all winter. Extreme cold usually comes only on the calmest days, and we had few that even approached calm except during summer.

Only Six Inches of Snow All Winter

Another question often asked is: "How much snow did you have?"

One of the chief problems of weathermen in polar regions, not yet solved, is how to catch and measure snowfall. How much actually fell in a day or a year, and how much blew in?

We were surprised at how little total accumulation of snow there seemed to be. Tread tracks left by our weasel and tractor before darkness set in at the Pole were still visible, some nearly snow free, in midwinter.

To supplement our precipitation gauges, we had set out snow-measuring stakes in a three-mile-long straight line. After the sun rose, we checked the stakes. Despite the hummocks and ripples of the sastrugi, they showed remarkable agreement; snow accumulation in the 10 months from February to November seemed to total only about six inches.

Whether this represents an accurate indication of annual snowfall at the South Pole, only more years of measurements will tell. We may have had an unusual year for snow as well as for temperature.

Yet through the ages the snow here has accumulated to a depth measurable in miles, since none of it ever melts.

Just six days after I left the South Pole, the Rev. Daniel Linehan of Boston College landed by plane to make seismic echo soundings. He found an ice depth of 8,300 feet. Since the approximate elevation of the Pole is 9,200 feet, a foundation of solid rock 900 feet above sea level appears to lie beneath that point on the ice dome. We were living a mile and a half above the land.

No one knew before the Pole Station was established whether the ice beneath us might not cushion or entirely absorb earthquake tremors from other parts of the world. Bob Benson's lonely treks through his 1,000-foot tunnel to check his seismometer produced

records of many, as well as some tremors not traceable to known earthquakes. These may have been major ice shifts, avalanches, or other disturbances peculiar to Antarctica.

Fire Was the Biggest Danger

"Weren't you afraid," I am sometimes asked, "away down there in the constant darkness where no help could possibly reach you?"

The dangers were not inconsiderable, even though we did our best to minimize them. Fire might have swept the camp, set off by a spark in our hydrogen generator, a frozen wire shedding its insulation, a clogged stovepipe.

We guarded against this in part by leaving a thick snow firebreak running right through the camp about midway, separating the main buildings, and we split our food, fuel, and vital equipment between the two sections. Thus if half the camp had burned, we could have lived in the other half.

If both sides had gone, we could have retreated to an emergency Jamesway hut erected 200 feet from the closest part of the main camp. We stocked this shelter with enough food, fuel, and clothing to last 18 men for six months. It wouldn't have been fun, but we could have survived until help came in spring.

Of course there was also the danger of serious accident or epidemic. Dr. Taylor brought enough medical supplies to care for a regiment, and he could have performed surgical operations if required. But the simple fact that there was no escape from the Pole, absolutely no way for others to reach us until the sun rose again, made us doubly thankful that no serious medical emergency arose.

We who actually lived at the South Pole felt a very real responsibility to guarantee that the efforts of the other thousands who worked with us should not be in vain. These included scientists of the National Academy of Sciences, whose IGY program we were pursuing; men in the Army, Navy, and Air Force; and, of course, the personnel at the other Antarctic IGY stations, whose work in some cases was more dangerous and trying than ours. In truth the establishment of the South Pole Station was a great national achievement, and we played only a small part in it.

Whatever our scientific accomplishments the first year, the really significant fact to me is that we proved it could be done—that men *could* live and work at the South Pole.

Ice Rimes the Face of a Writer Stranded at the South Pole

On the heels of a National Geographic assignment in sunny Lebanon, staff writer-photographer Thomas J. Abercrombie, 27, found himself en route to Antarctica to cover Operation Deep Freeze III. He finished his report on Lebanon (opposite) aboard a plane to New Zealand and mailed it from the Fiji Islands.

Drawing lots at McMurdo Sound, he won one of two press places aboard the first plane to fly to the Pole Station after the long winter night and became the first correspondent to stand at the South Pole (pages 444, 471).

The Navy plane was to stay but an hour. Tom begged to remain. "If I can stay," he told Dr. Siple, "I'll work 12 hours a day in the snow mine." But all was in vain; Navy orders were orders. Then the plane, warming up, blew an oil gasket, and a smiling Abercrombie emerged. Dr. Siple greeted him with a sardonic grin—and an ice ax. Here is how the volunteer looked after wielding it for four hours.

A new engine was needed, and the one-hour stay stretched to three weeks, during which Tom supplemented Dr. Siple's remarkable photographs of life at the South Pole.

Young-old Lebanon Lives by Trade

The Land of Cedars, Phoenician Sea Cities, and Crusader Castles Thrives Again as Middleman of the Mediterranean

By Thomas J. Abercrombie

National Geographic Foreign Editorial Staff

With Photographs by the Author

WHAT happens when an irresistible force meets an immovable object? One might reply: an indescribable collision! But after a recent trip to the Near East, I have my own answer.

Lebanon.

Here, where irresistible Westernism collides head on with the deep-set traditions of the Near East, one finds pleasantly contrasting mixtures of people, geography, and history all rolled up into one small country nestled on the Mediterranean's busy eastern shores. Thousands of years of conquests have left a multitude of races and cultures woven together in a pattern as complex and beautiful as an Oriental rug hanging in a Beirut shop.

The Whole World Is Lebanon's Mart

In a country where raw materials are practically nonexistent, Lebanon has found its greatest asset in its traditionally shrewd sense of a good bargain. Trade flourishes in a cosmopolitan atmosphere of high and low finance, world-wide buying and selling, and willingness to bet many a Lebanese pound on the country's progress.

Prosperity is the result. More and more business comes to teeming Beirut, the bustling, hodgepodge Lebanese capital that today rightfully calls itself the center of commerce for the whole Near East (map, page 488).

Seated comfortably at one of the many little outdoor restaurants that overlook Beirut from the mountainside resort of Bayt Mirī, I talked about the boom with Harry Naltchyan, a Lebanese employee of the United States Operations Mission to Lebanon. Harry seemed to know everybody.

"Take the merchant who heard of a customer for wheat in western Europe," he said. "He bought a shipload of grain en route from Australia to Hong Kong—sight unseen, ship and all. He diverted the vessel to Europe, where he sold both cargo and ship at a fat profit, all without leaving his Beirut office."

That businessman's sea-roving Phoenician ancestors would have been proud of him, I thought.

Two thousand feet below us lay the city, thrusting its proud promontory nearly five miles into the blue of the Mediterranean. In the thriving capital live a third of Lebanon's 1,500,000 people (page 484).

The northern curve of this thumb harbors a bustling nautical potpourri of cargo liners and old Levantine sailing ships. Past mammoth warehouses of the free port area glides a drab little bark headed for Latakia, loaded to the gunwales with sports cars from France and oranges from near-by Anṭilyās. Passing it, coming in, looms a luxury liner from the United States with a load of tourists.

Wide boulevards stab into Beirut from north and south and skirt it on all sides. In between, narrow, helter-skelter streets spiderweb the city from the sunny hillsides of Al Ashrafīyah to the promontory's tip at Ra's Beirut.

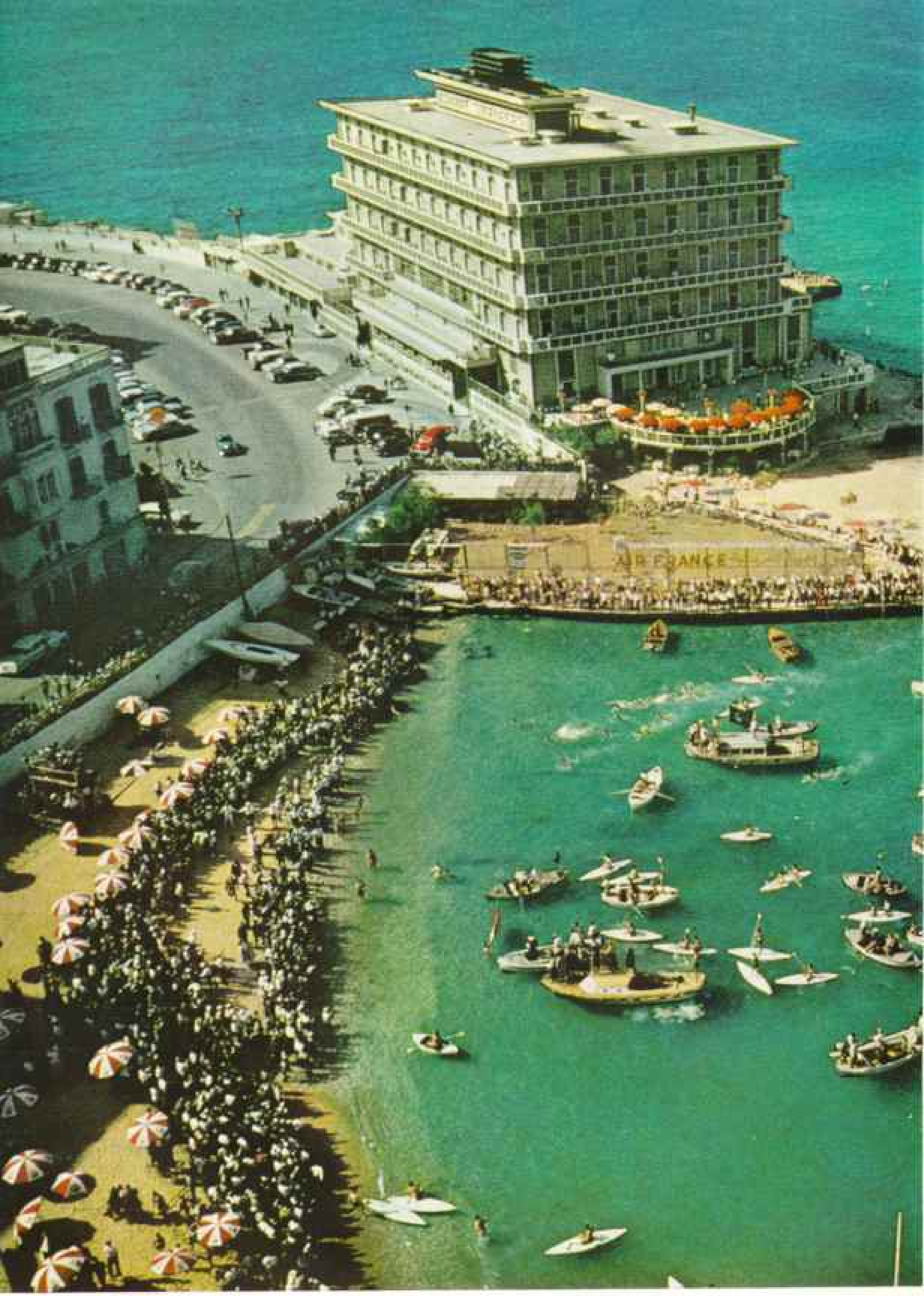
Students from Forty-four Nations

On the peninsula next morning, I stepped through the arabesque gate of the American University of Beirut, busy since 1866 spreading understanding as well as knowledge throughout the Near East. Here, amid acres of bristling date palms and lazy lavender jacaranda trees, more than 3,000 students gather from 44 different countries and 20 different religious groups to exchange ideas.*

In the crowded milk bar in West Hall or at Uncle Sam's across the street, undergraduates drink Coca-Cola, eat hot dogs, and talk about the latest rock-and-roll music. But in classrooms and laboratories they are serious and attentive (page 482). They all have an important role to play in the future of their part of the world, and they know it.

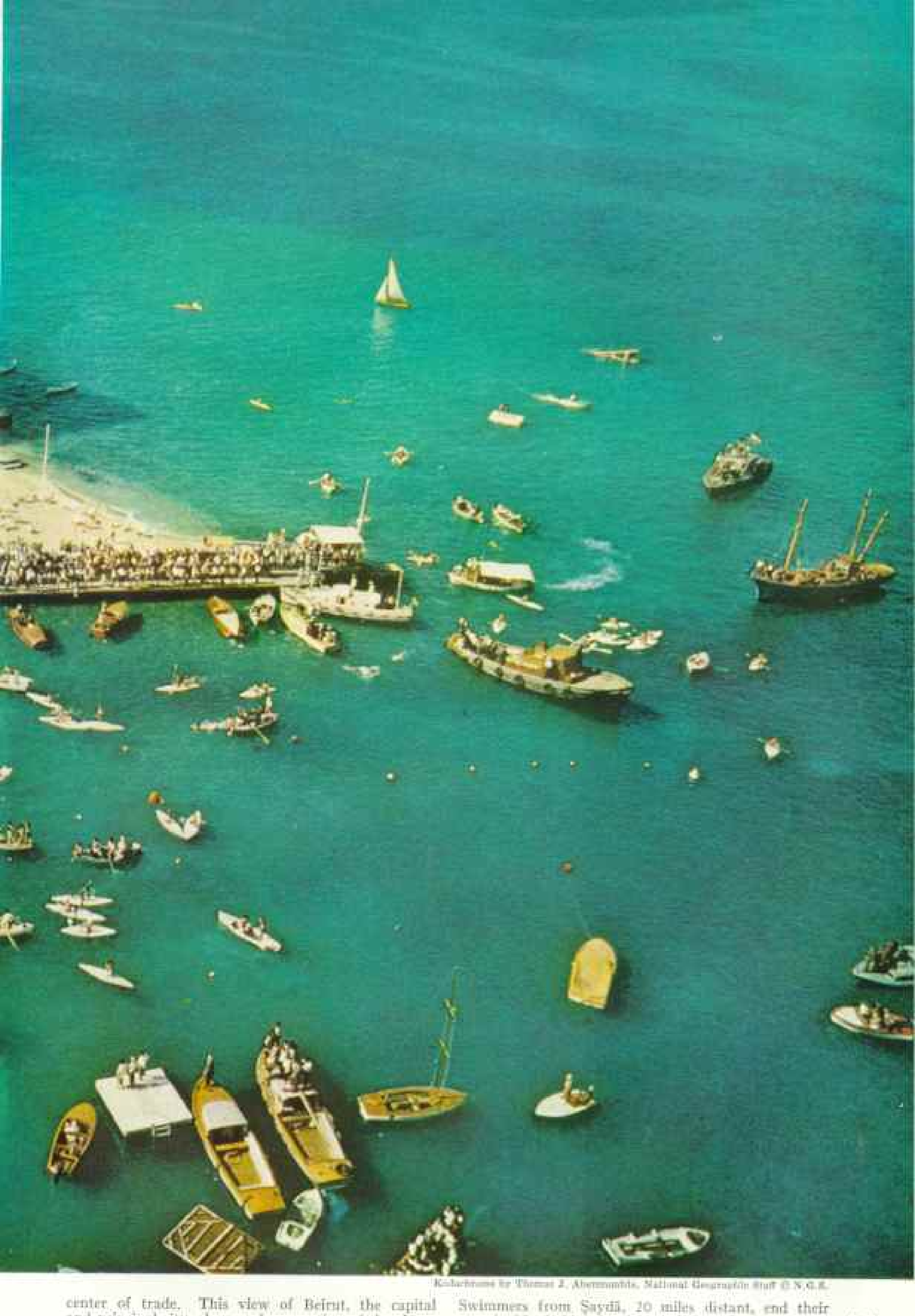
I strolled past students studying in the shade of modern Jafet Memorial Library looking over the red roofs of the city and its harbor

* See "American Alma Maters in the Near East," by Maynard Owen Williams, National Geographic Magazine, August, 1945.



Lebanese on Pier, Boats, and Rafts Cheer Swimmers to the Finish Line in Beirut

A nation of 1,500,000, Lebanon serves the eastern Mediterranean as an incomparable playground and a



Kodachrome by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

center of trade. This view of Beirut, the capital and principal city, shows a busy section of the shore. Swimmers from Şayda, 20 miles distant, end their race beside fashionable Hotel Saint Georges.

to the white-capped mountains beyond. In the aura of intellectual quiet that prevailed, it seemed that more than a wall of mere stone separated us from the din of traffic rattling around the campus on Avenue Bliss.

"But we are not an island here," assured Elias Khoury, a young medical instructor who had studied at the University of Chicago. "Our aim is to train the student for a full life. Our science and medical students are helping the city clean up slums, build sewers, and drain malarial pools; they often go on 'intern' trips to rural areas to nurse the sick and instruct villagers in hygiene and group sanitation. Sociology 201 and Public Health are not mere classroom courses. Our laboratory is the world itself."

Back on Avenue Bliss, I boarded a little red tram to get a closer look at this amazing metropolis. For a fare of 5 piasters, about 1½ cents, one can ride from the western tip of the city, through its heart, and out to the suburb called Furn ash Shubbāk.

Tram Ride Feels the City's Pulse

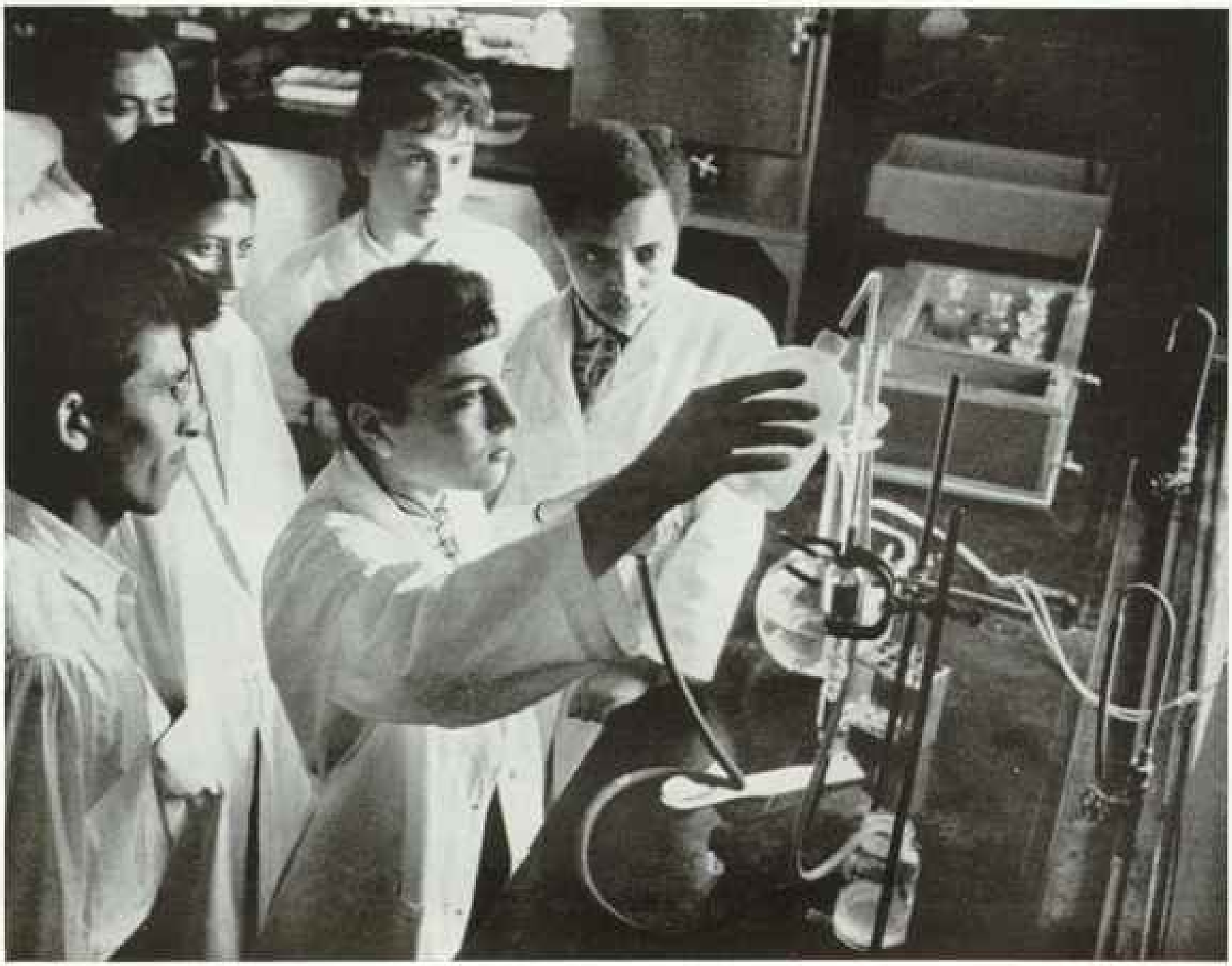
We screeched and groaned down narrow Rue Georges Picot into a jumble of modern store fronts and busy bazaars (page 486). Here a shoemaker was stitching a sandal in his open-air shop; there two well-dressed men were bargaining with a third for a bolt of English woolen, stepping off the sidewalk momentarily to let a flock of sheep go by.

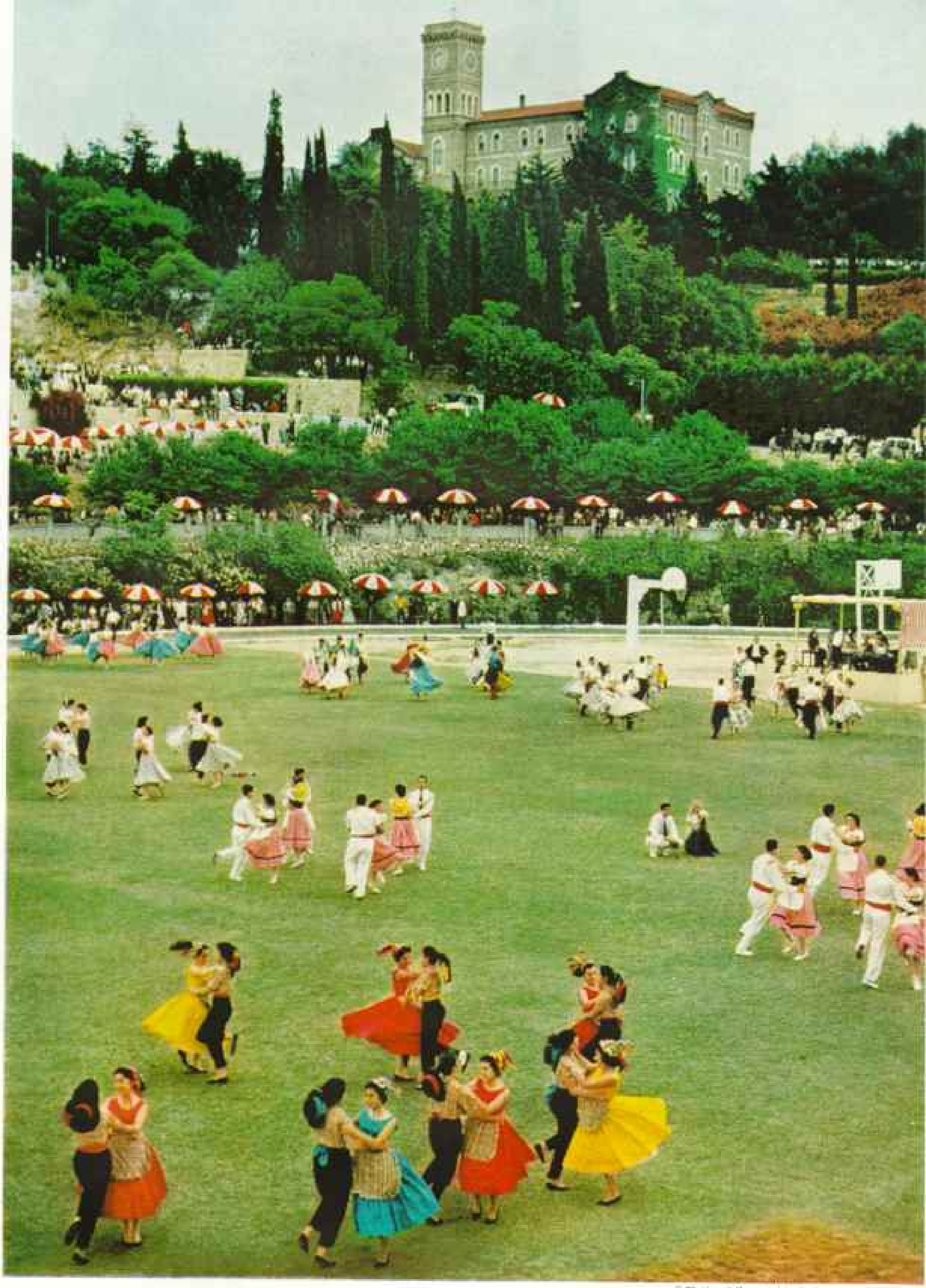
Everywhere porters scampered to and fro, dwarfed by impossible burdens of dripping cakes of ice, live chickens, cement sacks, or china cupboards.

We ground slowly through the Bāb Idrīs

Medical Experiment Absorbs a Class at the American University of Beirut

Lebanon's schools and colleges give the country the highest literacy rate in the Arab world. American University of Beirut trains more than 5,000 coeducational students from 44 nations in its schools of agriculture, arts and sciences, engineering, pharmacy, nursing, public health, and medicine. This coed examines blood serum for traces of carbon dioxide.





Gay Costumes Enliven a Western Reel at American University of Beirut

American missionaries founded the college in 1866; it has had tremendous influence in spreading the Western way of life throughout the Near East. Each year students join amateur groups in producing the folk-dance festival. College Hall overlooks this pageant.

Luxury Hotels Line the Corniche, Beirut's Sea-front Boulevard

Visitors approaching by sea might mistake the skyline for that of Miami Beach. Since World War II waterfront land has increased astronomically in price.

Beirutis, proud of their unspoiled beaches, permit no one to build at the water's edge. To give guests access to the water, one hotel has built a tunnel under the Corniche.

This view looks east across the city to the Lebanon Mountains. Trees dot the campus of the American University of Beirut at left.

intersection, framed with flower shops displaying bright stocks of roses, lilies, irises, and carnations that overflowed onto the teeming sidewalks. Then we swayed into the Place des Martyrs, Beirut's largest and busiest square. As our little streetcar began to empty its cargo, we were invaded by another frantic mob of commuters trying to board.

We rumbled past Arabic movie theaters showing American films with French subtitles, and on toward Furn ash Shubbāk. I began to study my fellow passengers.

Prosperous-looking young Arabs in French-tailored suits mingled with tattered porters. Across the aisle sat a student wearing a flowing white headcloth, the Arab kaffiyeh. He chatted with an aged priest and a pretty Pakistani girl in a bright-red sari.

Opposite me rode a Moslem woman, anonymous in her black gown and a flowing veil not quite opaque enough to hide her indulgence in Western rouge and lipstick.

"*Marhaba*," I ventured to the man in Arab dress sharing my cramped seat. "Hello."

"*Marhaba! Kif hallak?*"—"Hello! How are you?" he shot back in a ringing mountain accent, a little surprised to hear Arabic from an obvious foreigner.

"*Mabsoot, wo inta?*"—"Fine, and you?"

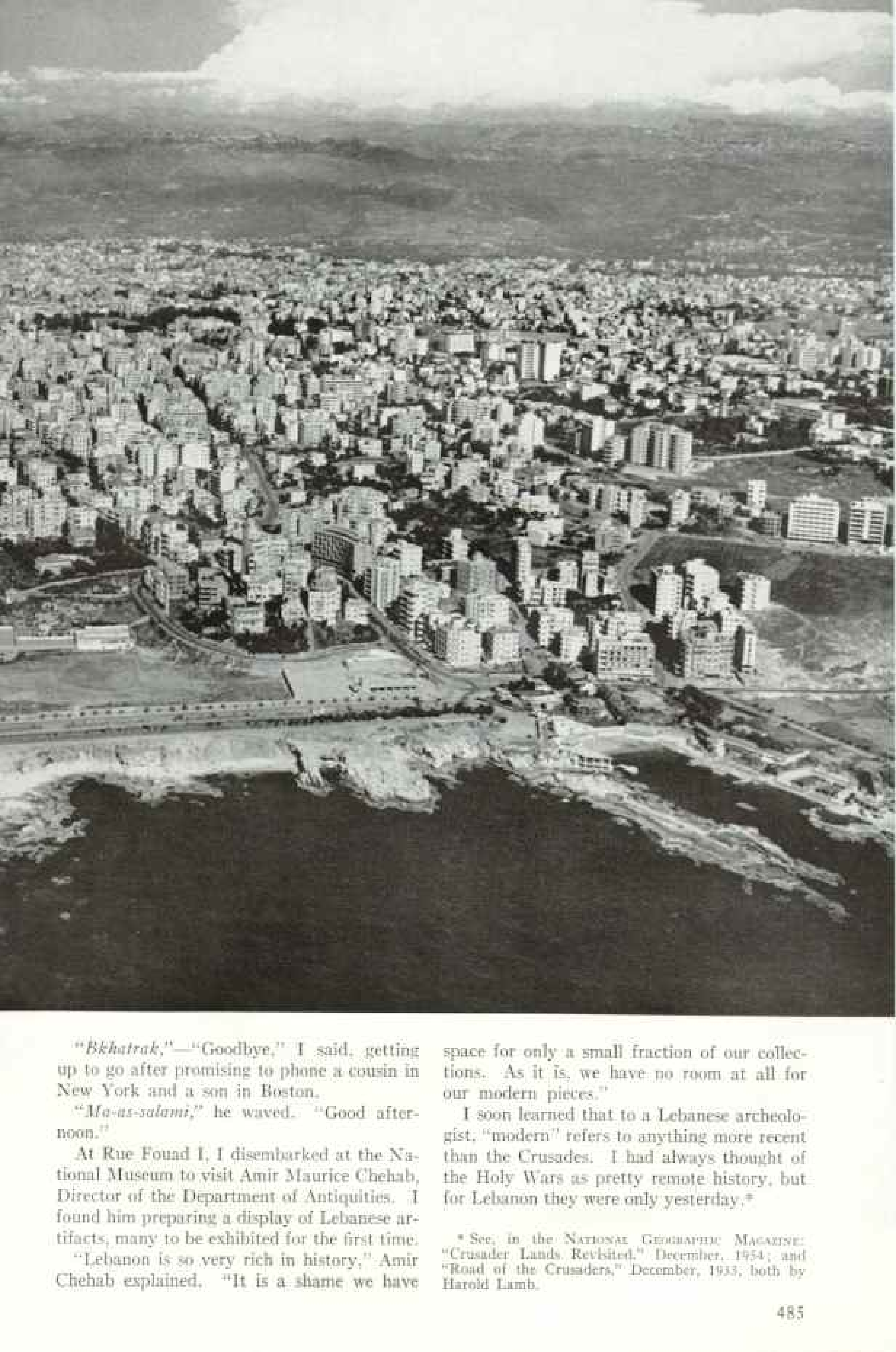
"*Kuayis*"—"Very well."

"*El yom fi shamis—jamil ktir*," I tried: "It certainly is a nice sunny day." I was answered with an outpouring of confusing though obviously friendly sounds.

A book-laden student, seeing my plight, smiled and offered help.

"He says he has many friends and relatives in America, and he wants to go there too someday," he translated.

Hardly a family in all Lebanon is without at least one member in the United States or South America.



"*Bkhatrak,*"—"Goodbye," I said, getting up to go after promising to phone a cousin in New York and a son in Boston.

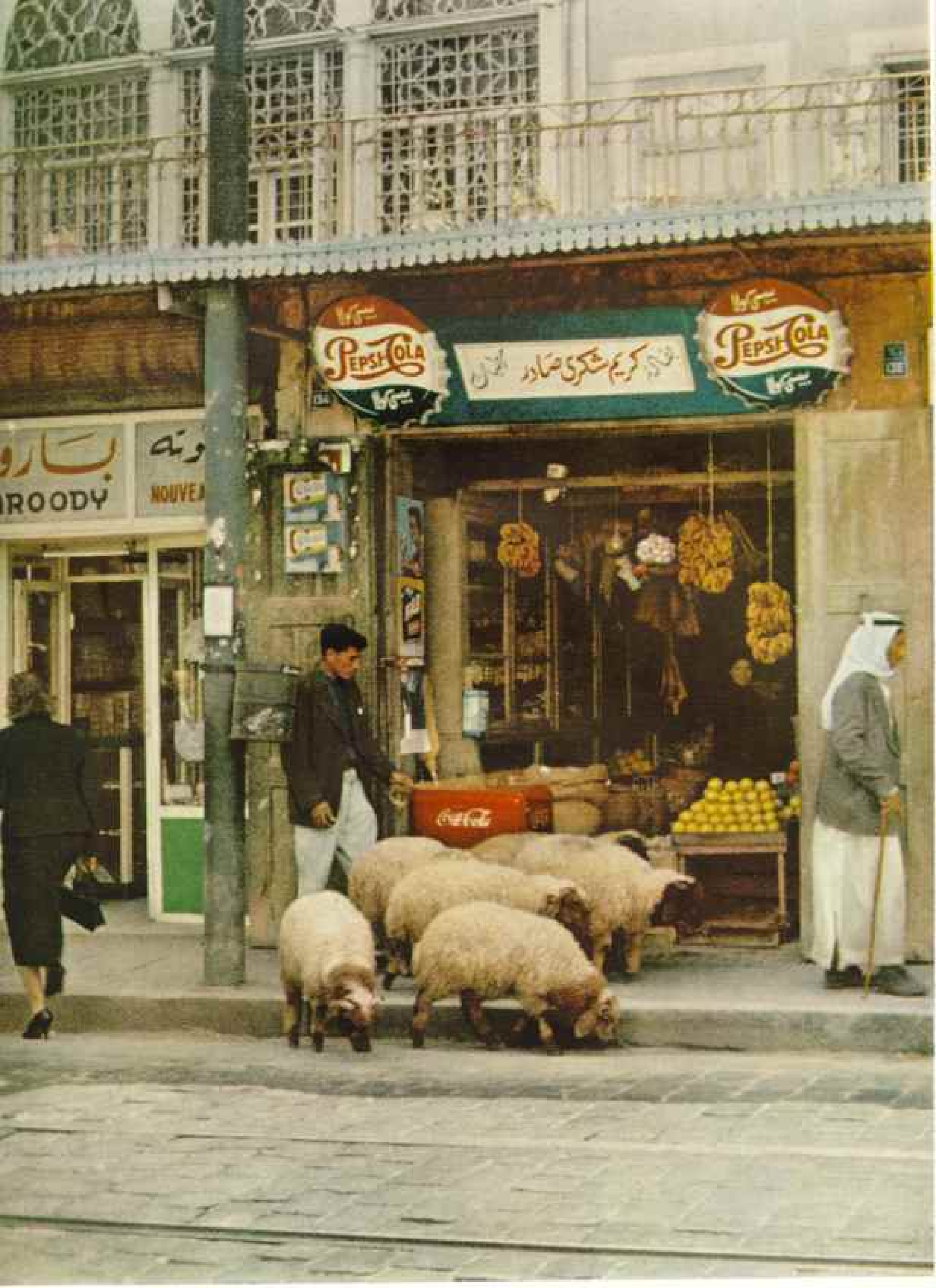
"*Ma-as-salami,*" he waved. "Good afternoon."

At Rue Fouad I, I disembarked at the National Museum to visit Amir Maurice Chehab, Director of the Department of Antiquities. I found him preparing a display of Lebanese artifacts, many to be exhibited for the first time.

"Lebanon is so very rich in history," Amir Chehab explained. "It is a shame we have space for only a small fraction of our collections. As it is, we have no room at all for our modern pieces."

I soon learned that to a Lebanese archeologist, "modern" refers to anything more recent than the Crusades. I had always thought of the Holy Wars as pretty remote history, but for Lebanon they were only yesterday.*

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Crusader Lands Revisited," December, 1954; and "Road of the Crusaders," December, 1933, both by Harold Lamb.



Sidewalk Traffic Yields to Sheep in the Heart of Downtown Beirut

For variety, few cities can match Lebanon's bustling capital. Part Christian, part Moslem, Beirut combines East and West, ancient and modern. Contrasts stand out vividly in street scenes such as this on the

Aquachrome by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Rue Georges Picot. Shops beneath iron-grill balconies advertise in English, French, Arabic, and Armenian. Coca-Cola, Pepsi-Cola, Fab, and Chiclets demonstrate their world travels. A sign over the blouse shop shows the cedar, Lebanon's national symbol. The market-bound shepherd in Near Eastern headdress and Western jacket lolly ignores the latest European fashions.

Sea and mountains hem Lebanon. Since ancient times its people have used the sea as a highway and the mountains as a citadel. They gained independence from France in 1943.

Lebanon's fertile Al Biqā' Valley knew Stone Age cultures antedating Phoenician civilization. Tyre, Sidon, and Byblos, Phoenicia's chief cities, endure under modern names.

Amir Chehab unlocked a steel door and showed me exquisite pieces of gold, silver, and obsidian, funeral gifts from the tombs of ancient Phoenician kings.

"But my greatest treasure is neither gold nor jewels," beamed my host. He led me into a dimly lighted basement past an eerie row of white-marble sarcophagi, each adorned with a portrait of its occupant staring blankly at the ceiling. We stopped before a huge stone coffin dating from 1000 B. C., richly decorated with Egyptian-flavored art depicting the funeral procession of its owner, one King Ahiram of Byblos.

"This row of characters along the lid is one of the best known evidences of what is probably man's first alphabet," said the amir.

Alphabet Came West via Lebanon

With paper and pencil the amir traced for me the transition of some of the 22 original consonants of that ancient alphabet into the Roman letters and Arabic script of today, a fascinating lesson in etymology (opposite).

But it was the Lebanon of today I wanted most to see. Though only four-fifths the size of Connecticut, this amazing little country offers a blend of scenery and history that rivals any larger nation.

An excellent road network crisscrosses much of the country's gnarled geography. In a single day one can drive from Beirut past the cabanas and bananas of the Mediterranean up to high mountain snow fields, down the inland slope into the broad green plain called Al Biqā', and before nightfall see nomadic Bedouin tribes on the semidesert of the Syrian frontier.

I was discussing this "vacationland of the Near East" with Mr. Michel Touma, Director of the Bureau of Tourism, in his Beirut office. Plump and jolly, Mr. Touma speaks three languages fluently—and sometimes simultaneously.

"Tourists brought Lebanon $30,000,000 last year," he said in English. "But more important, I think, is the fact that each tourist is a potential ambassador of good will."

King Ahiram's Stone Coffin Pictures Phoenician Times

History remembers the Phoenicians, Semitic dwellers in ancient Lebanon, for their prowess as navigators and their founding of Carthage, rival to republican Rome. Equally impressive were Phoenician contributions to Western culture. The Greeks borrowed heavily from the Phoenicians in the fields of colonization, religion, literature, and decorative art.

This carved sarcophagus, discovered at Byblos, stands in the National Museum in Beirut (page 483). Ahiram of Byblos (not the King Hiram known to Solomon of Jerusalem) occupied the tomb about 1000 B. C. His remains were removed by grave robbers long ago in disregard of a chiseled warning (below).

A royal epitaph warns intruders against disturbing the vault: "And if any king . . . exposes this coffin, let his judicial scepter be broken, let his royal throne be overthrown, and let peace flee from Byblos. . . ."

These Phoenician letters represent a form of the North Semitic alphabet, the basis of all alphabetical systems, including Arabic, Latin, Greek, Hebrew, Russian, and even Mongolian.

President Camille Chamoun Attends Easter Mass in Beirut

The people of Lebanon are about evenly divided between Christians and Moslems. Unwritten law provides for a Maronite Christian president, a Sunni Moslem prime minister, and a legislature apportioned among the various sects.

Picnic lunch in Al Biqā' Valley: Mr. and Mrs. Chamoun are accompanied by their dog Dash. Fluent in English, French, Turkish, and Arabic, the President has represented his country in the United Nations, New York. He is an ardent huntsman.

Amateurbilder (oft) und Kollektivbilder © N. G. S.

He motioned to the photographs and posters that covered his office walls.

"Even though we are a small country, we have much to offer. You must see the famed Cedars of Lebanon, the Crusader castles, the ageless acropolis at Ba'albek. Ah, but you must begin at Byblos; for that is where Lebanon began."

Conquerors Left Their Calling Cards

On the way to Byblos, Harry Naltchyan and I stopped at a small outdoor restaurant on the poplar-shaded banks of a rushing stream. The old restaurateur whetted our archeological appetites with tales of the conquering armies that once marched past this steep and narrow valley, which cuts through hills that press down against the Mediterranean shore like giant earthworks.

"More than one famous general left his mark here in stone or bronze," he said. "Many of their monuments can still be seen."

We scrambled up the rocky hillside and inspected some of the steles cut into the cliffs. Many were weather-beaten into illegibility. The oldest dates from Rameses II, whose troops marched past this very spot 13 centuries before Christ.

Rameses' inscription began a custom followed by Babylonians, Assyrians, Greeks, Romans, an Ottoman Sultan, troops of Napoleon III, and the British Army of General Allenby in World War I. Newest of the markers is a marble tablet, beside the modern highway, commemorating the removal of all foreign troops from Lebanese soil in 1946.

Byblos Gave Its Name to the Bible

We continued along the rocky coast, through red-roofed Jūniyah and past fishermen stretching seines along the sandy crescent of Jūniyah Bay. Everywhere highway crews were working feverishly to keep up with the ever-increasing traffic burden. Laborers plodded back and forth through the stream of trucks, camels, overloaded buses, donkeys, impatient taxis, and brand-new private cars, which Lebanon has in amazing numbers.

Soon we were squeezing our outsize American-built taxicab through the narrow, arched bazaars of one of the oldest inhabited towns in the world: Its Phoenician name was—and is—Jubayl, but Greeks and Romans called it Byblos because of the scrolls of papyrus (*biblos*) made there. From this name comes our word "Bible."

Byblos seems a mere village now, certainly a far cry from the onetime capital of the ancient trading world. We followed two small boys rolling hoops down a cobblestone street and passed through the Crusader-built chapel of Notre Dame de la Porte, which forms the East Gate into the old city.

We parked inside the gate and walked a short distance to the sea (page 504). Battered stone ramparts still surround the small harbor, now silted and strewn with broken Roman columns. Here, where once the wakes of Phoenician galleys washed the sandy shores, now only a few fishermen cast off in tiny boats, sailing lazily past the tumbledown guard tower at the mouth of the harbor.

I walked back past the beautiful Crusader church of St. John the Baptist, crossing an Arab bridge to the gate of an imposing castle. There I met a handsome young Jubayli, who offered to show me through the ruins.

In the Footsteps of Crusader Knights

"This is the castle of the Crusader Lords of Gibelet from 1104 to 1291," my guide told me. "It was one of the last footholds in the Holy Land of the knights of the Cross." He led me through the great hall, dark and vaulted, and up through the central tower to the top of the castle and an unmatched view of the town and its surroundings.

In the shadow of this remarkably preserved stronghold, which uses ancient Roman pillars in its thick walls, I saw Lebanese archeologists peeling away layers of earth like the pages of some gigantic history book. Pottery, bric-a-brac, and the outlines of ancient buildings were their paragraphs, punctuated by an occasional bronze or silver coin bearing the likeness of Roman emperor or Phoenician ship.

Not far away, past the Temple of the Obelisks, where Phoenicians offered gifts to the god Reshef, men were methodically uncovering hundreds of late Neolithic burials dating back 6,000 years. Each skeleton was curled up in a prenatal posture inside a huge pottery burial jar.

Before the next morning's sun had climbed above the mountains, Harry and I were on our way to see the largest and best known grove of Lebanon's famous cedars.

Turning away from the sea at Shikkā, we climbed through green olive groves and along the rocky valley of Qādishā, past cliffside shrines and monasteries that seemed held to the vertical canyon walls by sheer faith. We

Sun-tanned water skier, 21-year-old Claudette el Khoury, ranks among the masters of a favorite sport in Lebanon. She is a member of the national water ski team. A countryman, Simon Khoury, won the All-American men's water ski championship in 1956. He has also held several European titles.

Skiers Trace a Foaming Crescent Through Tunneled Pigeons' Grotto

This maneuver calls for flawless timing and nerves of steel. Daredevils shoot the 50-foot-wide tunnel even when waves are running.

These giant limestone rocks, gouged and bored by wind and sea, lie west of Beirut and St. George's Bay, traditional scene of the dragon-slaying by England's patron saint.

The twin rocks take their name from pigeons that visit crag and ledge. Monk seals, the Mediterranean's only seal species, inhabit the grottoes, rocky air chambers with entrances as much as 40 feet below the surface.

Lebanese, at home beneath the water as well as on it, fish the depths and caverns with spear and Aqua-Lung.

wound through beautiful farming villages perched on the shoulder of the valley, where terraced wheat fields climbed like giant stairsteps.

At Basharrī, often called the prettiest mountain town in Lebanon (page 500), we hiked up the precarious path to where Kahlil Gibran, famed Lebanese poet who lived 20 years in the United States, lies in a cliffside tomb overlooking his beloved birthplace.

It is not difficult to understand why Gibran's masterpiece, *The Prophet*, was conceived here in Lebanon's beautiful mountains.

Watching farmers toiling in the fields, I recalled a few of the poet's lines:

"Work is love made visible," he wrote, and "... in keeping yourself with labour you are in truth loving life."

Among Lebanon's Famous Cedars

Zigzagging still higher, we finally reached the "Old Grove," most famous of Lebanon's remaining cedars (page 496).

We parked near the "Cedar of the Flag," whose outline appears on the Republic's flag and on its currency. Some of these majestic trees stretch fragrant branches 80 feet in the air. Their trunks, gnarled and wizened with the burden of a thousand years, measure as much as 40 feet around. When I saw them, they were softly draped in freshly fallen snow and looked a little as if they were huddling together to protect themselves from the chill of the late Lebanese spring.

We climbed higher into the winter of the mountain until the cedars were a mere Christmas-card scene far below. From a modern chalet a ski lift whisked us up a mile of mountainside. Beneath our dangling feet pretty Lebanese girls in bright-hued ski costumes mingled with others of more unorthodox garb. I spotted one skier navigating the steep slopes dressed like a desert chieftain, his long gown billowing in the breeze and a white kaffiyeh flowing stiffly behind, held in place by a large pair of goggles.

Behind him glided a squad of crack ski troopers in battle whites. They stem-turned in neat formation and disappeared over a rise.

The view from the top of Qurnat as Sawdā' was well worth the long climb from the lift. We left our skis and went by foot to reach Lebanon's highest spot, just over 10,000 feet above sea level. Below us the cedars and Basharrī appeared as mere specks on the vast landscape of the Lebanon range, whose name —given now to the country—meant in ancient Aramaic "white as milk."

The English historian A. W. Kinglake considered these mountains the boundary between the Occident and the Orient. In *Eothen* he wrote: "My place upon this dividing barrier was as a man's puzzling station in eternity, between the birthless Past and the Future that has no end."

Ba'albek, Garden of the Ancient Past

We skied down to the road we intended to take across the mountains to Ba'albek. It was completely snowbound, a mere dip in the white expanse. We would have to take the long way round, via the Beirut-Damascus road.

Ba'albek, however, is well worth any detour. A town of 7,000 and an important agricultural center, it has existed as an inhabited crossroads of caravan routes and human migrations since the dawn of history.

But its crowning glory is a spectacular complex of majestic ruins, an acropolis of time-tumbled stone columns, pediments, friezes, and massive walls. Here, during the days of Imperial Rome, stood one of the great religious centers of the eastern empire.

Ancient Greeks and Romans called Ba'albek "Heliopolis"—City of the Sun. Rome built three magnificent monumental temples here on the site of an even more ancient Phoenician temple.

Ornate Temple Honors Bacchus

No trace of this original temple remains, but the Roman structures are still much in evidence. The Temples of Jupiter Heliopolitanus and of Bacchus retain their original herculean dimensions, though ravaged by earthquakes, human destruction, and the centuries (pages 508 and 513).

Lotfi S. Haidar, who introduced himself as "Guide No. 1 of Ba'albek," took us in tow. Though no youngster, he proved a hard man to keep up with as he led us, springing from one relic to the next, over piles of massive, beautifully carved stonework. Stopping occasionally, Lotfi rattled off facts with scarcely a pause for breath, explaining every detail of broken column or crumbling arch.

We tarried the entire afternoon in this garden of the past, wandering through the echoing dimness of the Temple of Bacchus with its ornate decoration, then walking

(Continued on page 503)

Harvesters Pause for Rest and Water

Lebanese farmers, crowded into a country only slightly larger than Yellowstone National Park, cultivate about one quarter of the total land area.

These workers on Mount Şannin (page 522) plow up potatoes with a sharpened pole hitched to a yoke of oxen. Ancient methods prevail on mountainsides, where rocky soil and narrow fields prohibit use of machinery.

Man at left uses a clay water jug as a drinking fountain.

Sisters Carry Greens in a Gasoline Can

Lebanese, famed for their handsome features, trace their ancestry back 50 centuries to the ancient Phoenicians, the Canaanites of the Bible. Their blood includes the strains of countless conquerors: Egyptians, Babylonians, Assyrians, Hittites, Persians, Greeks, Romans, Crusaders, Arabs, and Turks. These girls live in Al Biqā' Valley (pages 518-519).

Color frames by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Mighty "Cedars of the Lord" Endure Below the Snow-clad Lebanon Range

Since Biblical times the Lebanon cedar has served as a symbol of majesty. Isaiah (35:2) referred to the cedar as "the glory of Lebanon." Phoenicians cut the wood for their roving galleys. King Solomon

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built his Temple and an entire fleet of cedar. Egyptian pharaohs sought the timber for solar boats to transport their souls. Invaders felled whole forests, until dense stands dwindled to isolated groves. Today some 400 trees—called by the Lebanese *arz al-Rabb*, cedars of the Lord—are preserved as a national treasure. Several may be more than 1,000 years old. A stone wall protects this grove from goats.

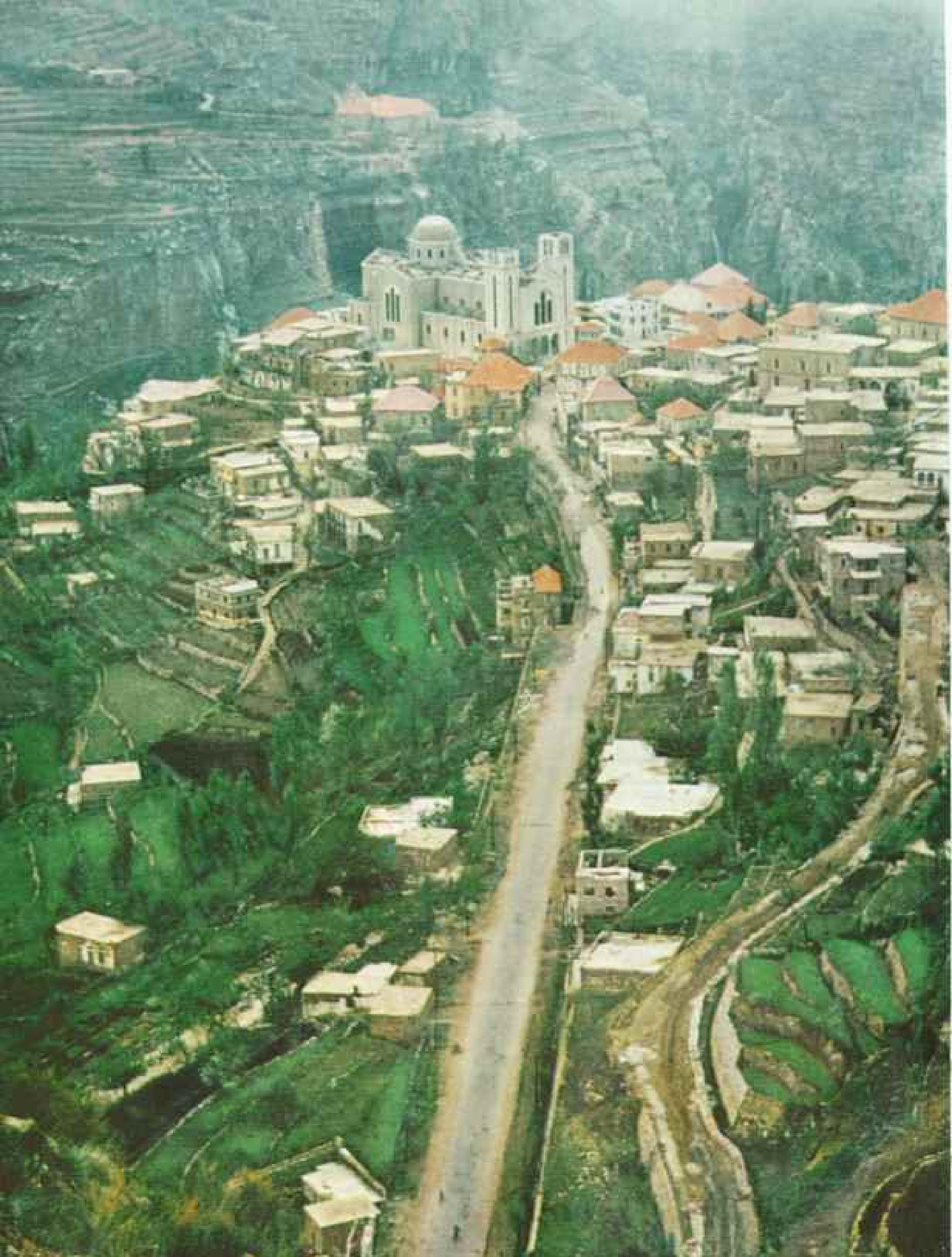
Ansichtsrose (left) and Kehrtsrose by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Brocade maker winds brilliant silk on a spindle in his shop near Beirut. Lebanese weavers produce the rich gold, silver, and silk cloth that was once a Syrian specialty. Two or three yards may take weeks to weave on the foot-powered loom in the background.

Counters in a Beirut Bazaar Groan with Bargains

Trade, lifeblood of Lebanon, earned for the country the title "Middleman of the Near East." Commerce thrives in a free market whose only laws seemingly are supply and demand.

This shop, owned by the Terzis brothers in the Sūq al Jamil, dazzles customers with displays of furniture, yard goods, clothes, jewelry, ship models, and brassware. The shopper sampling brocade wears the tasseled tarboosh common in the cities. Star and crescent of Islam crown the brazier at left.



Stepladder Fields Climb a Mountainside to the Town of Basharrī

Fleeing successive invasions of their fertile plains, the early inhabitants of Lebanon sought security in the mountains. There they terraced and irrigated the

Kodachrome by Thomas J. Abercrombie, National Geographic Staff © N.G.S.

slopes for crops of grain and fruit. Aqueducts and retaining walls built thousands of years ago remain in use. Basharri, largely inhabited by Maronite Christians, overlooks the steep gorge of the Qādīshā River. Church and distant monastery stand on opposite walls of the canyon.

Melville Bell Grosvenor (above) and Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Farmers load the last straw on an indignant camel in Al Biqā' Valley. This long plain, once the granary of Roman Syria, divides the country north and south. Romans built its irrigation canals.

Camels take part in a political campaign, carrying photographs of a candidate through the streets of Beirut. Although a common sight in Al Biqā', camels are an oddity in Lebanese business districts.

through whispering poplars to the small, circular Temple of Venus, some 300 yards away. Here it was easy to imagine the nymphs of ancient Heliopolis paying court to their goddess of beauty.

By the time Harry and I started back to the 20th century, the sun had dropped out of sight behind the town and bright beams of the full moon were glancing off the walls of old Bacchus's temple. As we started to leave, I thought I heard the time-muffled call of some high priest from the past. It was only the muezzin calling the faithful to prayer from the mosque next door.

A short way from Ba'albek next day, near the quarry that supplied its huge stones, we found a Bedouin tribe in camp, their goat-hair tents stretched between sun-scorched crags.

"These desert people are not really Lebanese," injected Hany Haidar, Lotfi's cousin and owner of the land on which the Bedouin were camped. "They come over the Anti-Lebanon Mountains from Syria each spring to work on the larger farms and graze their sheep and goats."

Bedouin Offer a Strong Pipe

One old man sat cross-legged in the shadow of his many-peaked tent. He puffed slowly on a gurgling water pipe, letting the smoke curl around his sun-reddened face and ashen beard. Recognizing Hany Haidar, his steel-gray eyes sparkled as he smiled and beckoned us into his home.

We offered gifts of cigarettes and green coffee, and a younger Bedouin roasted the beans in a brass skillet. He then pulverized them in a wooden mortar. We sat on huge satin cushions around the open fire, as a crowd of curious neighbors filled the tent.

I was passed a pipe and, though the smoke was filtered and cooled by traveling through the water, a few puffs made me dizzy. I set the pipe aside in favor of coffee.

Later I walked around the camp. Women were carding and weaving goat's wool into rugs and tent material, while others winnowed wheat to take to a mill for grinding. Children —dirty, barefoot, but as handsome as my own—followed me from tent to tent, intrigued by my cameras and odd speech.

Harry finally interrupted my rambling. "We must hurry if we are to keep our date with President Chamoun," he warned.

We sped back across Al Biqā' and later, on the Damascus road, turned south toward 'Ammiq, finally pulling off the highway down a dirt road to a beautiful elm-lined stream.

A few words with the captain of the guard, who met us there, and we walked on to find the President. Birds sang among the reeds and were echoed by a distant chorus from farm workers marching out to potato fields with long hoes over their shoulders.

A Picnic with Lebanon's President

Then coming toward us appeared His Excellency, President Camille Chamoun, flanked by companions. The President wore boots and a duck-bill cap: His graying hair and tanned complexion accentuated the distinguished bearing of his tall, erect frame. A single game bird hung from his belt.

"It's not the best day for hunting—a little too late in the season, I think," he admitted ruefully as we walked farther along the bank. "But it is a perfect day for an outing. I really know of no better way to get away from it all than a tramp through the woods."

Just ahead, the hunters' wives were unpacking a picnic basket beneath the flickering leaves of a wind-blown poplar.

"You must be hungry after your walk. Won't you join us for lunch?" asked Mrs. Chamoun. She is a small woman of delicate features, with a charm that is part beauty, part friendliness, and part dignity. Her English is as flawless as her husband's (page 490).

"Just where in the United States are you from?" asked the President.

"Minnesota."

"Land of Ten Thousand Lakes!" he exclaimed, and seemed pleased by the surprised expression on my face. "I have been there. Some of the best duck hunting in the world."

I was handed a glass of arak. Crystal clear as it comes from the bottle, it turns milky with the customary addition of water. We toasted Lebanon and Minnesota in turn and then attacked the cold chicken, mutton, and delicacies such as *birma*, a spiral pastry stuffed with nuts.

Invitation to the Summer Palace

"Have you seen Bayt ad Dīn?" asked Mrs. Chamoun. I told her that although I had heard of it wherever I went, I had yet to visit the fabulous palace of Lebanon's princes, now the summer home of the President.

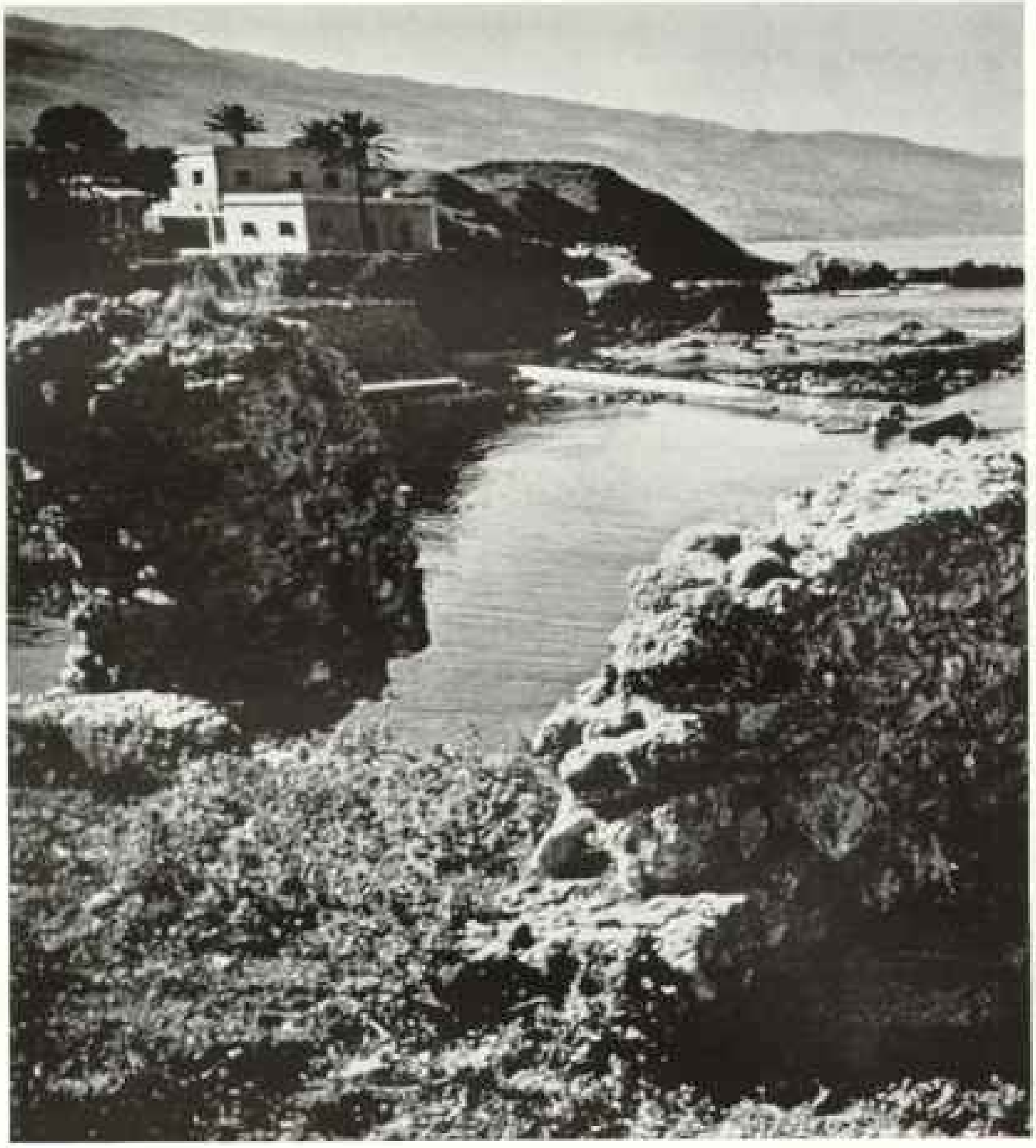
"You should see the harem and our arcaded patios and gardens. They are fine examples of Arabic architecture. I am going there day

Byblos: a Home Port of Phoenicia's Galley Fleet

Archeologists rank Byblos (modern Jubayl) among the world's oldest inhabited cities. Artifacts unearthed at the site suggest that Stone Age man built the first settlement.

Byblos reached the pinnacle of its power around the 14th century B. C. as a Phoenician city-state. Greek merchants named the port for its trade in papyrus (*biblos*), root of our word "Bible."

A ruined fort (right) shelters a fishermen's basin, silt-clogged relic of the ancient harbor.



Phoenician anchor was dredged from Byblos harbor. Stonecutters chiseled a hole and groove for the anchor line.

after tomorrow to attend to some remodeling. Would you like to come along?"

A tour guided by Mrs. Chamoun herself? I would indeed!

Midmorning of the appointed day found us gliding south along the coast in the executive Cadillac, past the vast olive groves of Ash Shuwayfāt and the dunes of Khaldah. Fifteen miles from Beirut we turned up the Dāmūr Valley, stopping to pick pink and white oleanders growing wild along the roadside.

In the Land of the Druses

We climbed to the town of Dayr al Qamar, a sprinkling of cream-colored houses with red tile roofs snuggled against a wall of dark-green pines. This is the country of the Druses, members of a religious sect founded in the 11th century, who venerate the sixth Egyptian Fatimid Caliph Hakim. With beliefs still strong and shrouded in secrecy, the Druses today constitute a large and important segment of Lebanon's population.

"We hope to rebuild this town as it was in the 17th century, as you have done with your

Williamsburg, Virginia," said Mrs. Chamoun. "This was the capital of al-Amīr Fakhr-al-Dīn's domain, which embraced Lebanon, western Syria, and Galilee. His mosque is being restored."

Soon our car passed between two stiffly saluting guards and into the inner court of Bayt ad Dīn. Pastel shades of stone woven into tiers of courtyards, arcades, and balconies, and cypress-lined gardens and gushing fountains, all made me think of the Moorish Alhambra in Granada, Spain.

"Al-Amīr Bashīr al-Shihābi brought master builders from Damascus in the early 1800's to erect this palace," Mrs. Chamoun said, as our footsteps echoed back and forth. "It has seen feasts for as many as 500 guests, and its stables once housed hundreds of fine Arabian horses."

Now Bayt ad Dīn plays host to tourists who come from all over the world to admire its beauty and visit its museum. They wander amid richly carved stone work and regal mottoes set in lavish mosaics, mottoes such as "One hour of justice is superior to a thousand months of devotion."

Mrs. Chamoun led me through the amir's reception salon, the harem, and the luxurious Turkish baths, into a secluded garden. There we sipped coffee near a high, delicately arched aqueduct that once brought water from distant Nab' aṣ Ṣafā'.

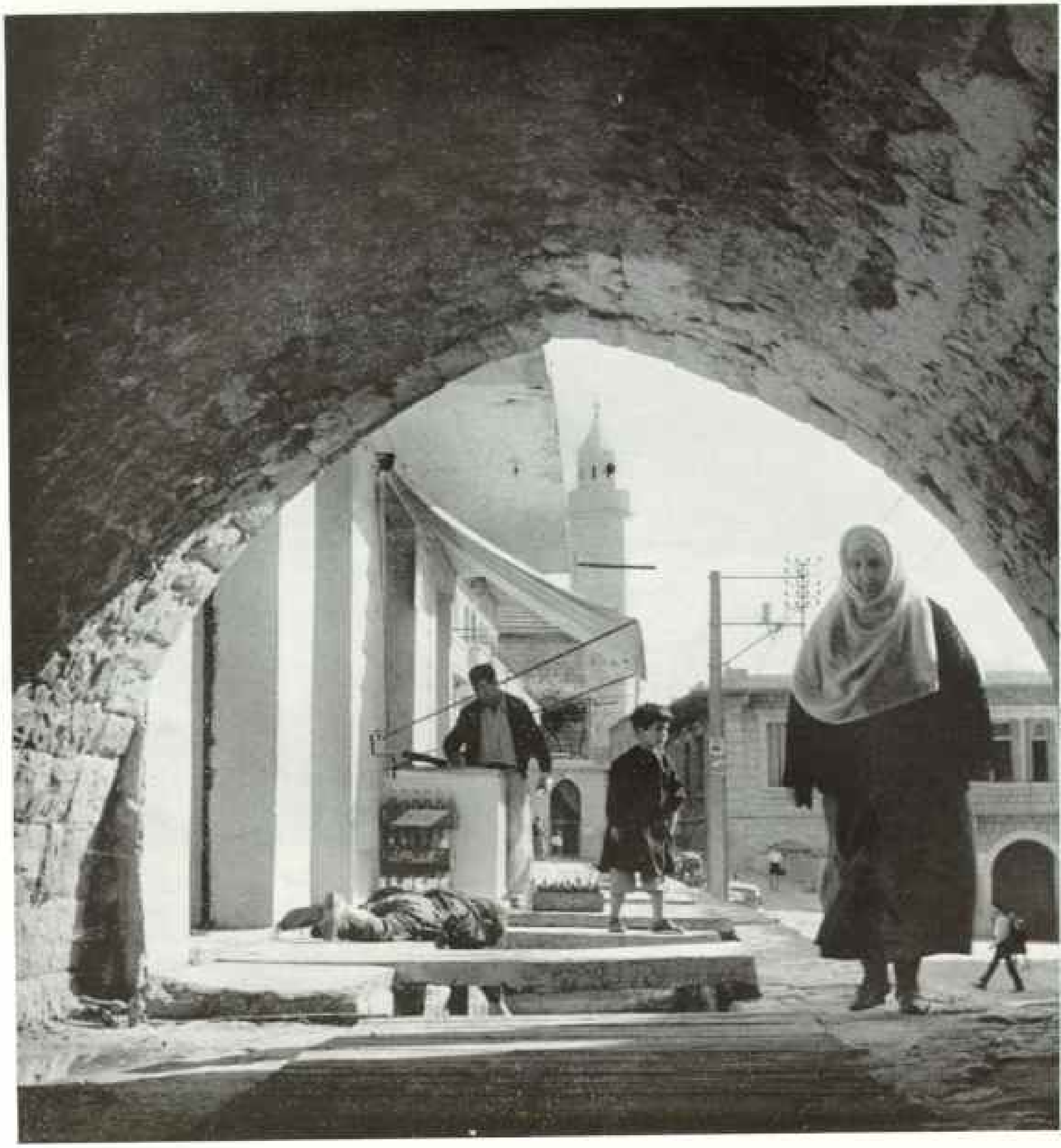
"There has been so much to do since the earthquake," she said. She referred to the quake that in March, 1956, destroyed houses by the hundreds in southern Lebanon and damaged Bayt ad Dīn extensively.

"But of course it gave us a chance to do some things that have waited for years. When we finish repairing and restoring, the palace will look like new."

With Friends, Anything Is Possible

Back in the horn-honking pace of 20th-century Beirut, Harry and I planned a more extensive tour of southern Lebanon.

"It is impossible to travel near the Israel border without an army pass, but we will talk to a high-ranking officer in the Defense Ministry. He is my friend." Again Harry's amazing breadth of acquaintanceship came through; we got our passes.



Next day we climbed the mountains as the sun was rising. With not a billboard to mar the view in any direction, I could see blooming rhododendrons already signaling the coming of summer, when heat and humidity drive many Beirutis up the mountainside to their summer homes.

We pulled into the town of Qabb Ilyās before breakfast (above). I felt compelled to linger in this friendly little hillside town; it seemed to typify all of the Lebanese towns I had seen so far.

Walking up the steep, crooked streets, I felt very much a part of the mountains. The stone and mud-brick houses huddled close together on the steep pitch of the slope; one man's roof was another's front porch. Yet it was really a town of the valley, for already men were streaming out to work their fields far out in the broad Biqā' valley.

Like Lebanon as a whole, the 2,500 inhabitants of Qabb Ilyās are divided about evenly between Christians and Moslems.

"It is this balance between the faiths that maintains peace and thereby promotes understanding here," remarked Miss Amal Halaby, a pretty young Lebanese teacher in the town's National Evangelical School. Her grandfather and an American, Henry H. Jessup, founded the school in 1867. Since then it has

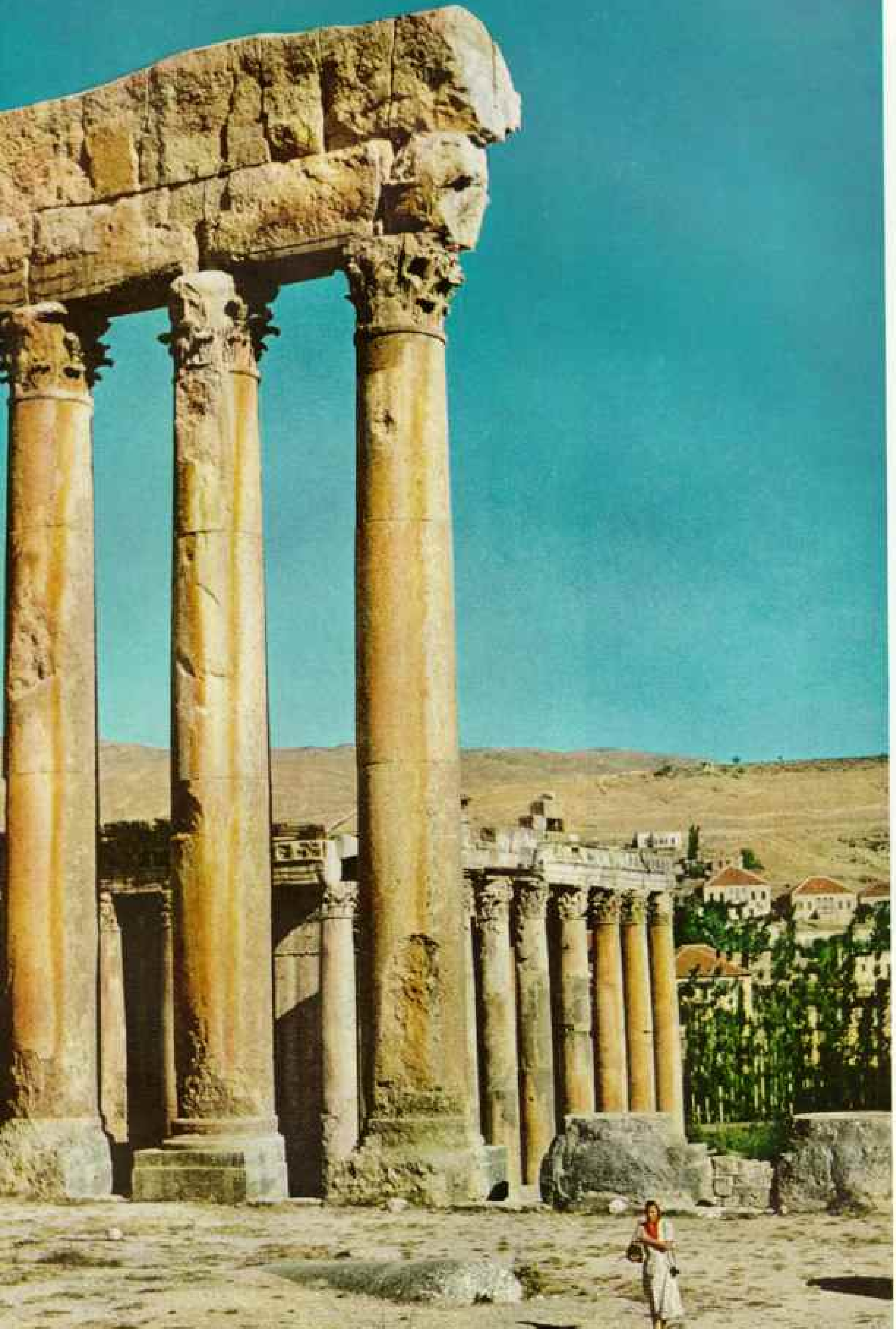
Cobbled Walk in Qabb Ilyās Dips Under a House

Few streets boast separate sidewalks; most thoroughfares serve pedestrians and automobiles alike.

A loudspeaker on the distant minaret calls Moslems to prayer five times a day.

Boys play above a bridged drain; a delivery man unloads bottled sodas; the woman drops her veil.

Child tosses a ball in front of an advertising sign in Qabb Ilyās. Arabic letters call attention to a resort in Al Biqā'.



played a big role in raising Qabb Ilyās's literacy rate to better than 90 percent.

I watched grade-school youngsters learning their three R's in three languages—Arabic, English, and French. Students of both faiths, they were growing up together in tolerance and friendship.

A few doors from the school we hesitated in front of a house where a wisp of smoke told us *khubis al-Jebel* was being made. This "mountain bread," as it is sometimes called, is a sort of flapjack not unlike a huge, round piece of parchment (page 520).

Khubis had intrigued me from my very first encounter with it: fooled by its appearance, folded up beside my dinner plate, I had almost tucked it under my chin as a napkin.

"*Ahlan w' sahlan*"—"Welcome," said a well-tanned farmer standing in the doorway and offering us his callused hand. He was a Moslem, and dressed in his Friday best. His striped silk gown flowed out from under a French-cut jacket, and he was crowned with a dazzling white kaffiyeh wrapped in a precise, yet seemingly casual, manner over his broad shoulder. With hands behind his back fingering a string of orange beads, he led us hospitably into his home.

"The women have been up since daybreak mixing batter," he said, motioning us to follow him to the back of the house. It was a typical village house of mud brick, with a

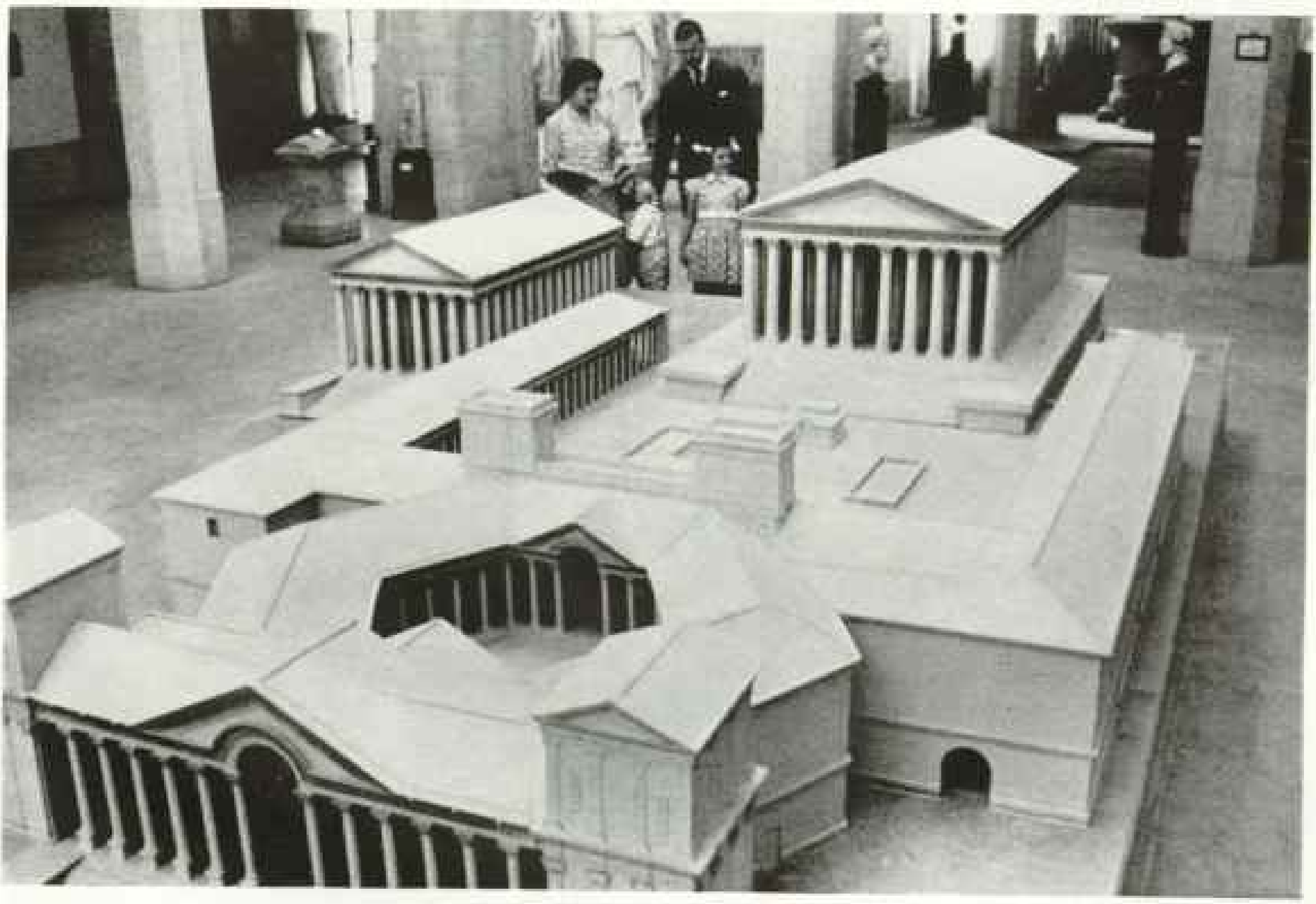
Colossal Ruins of Ba'albek Rival Those of Imperial Rome

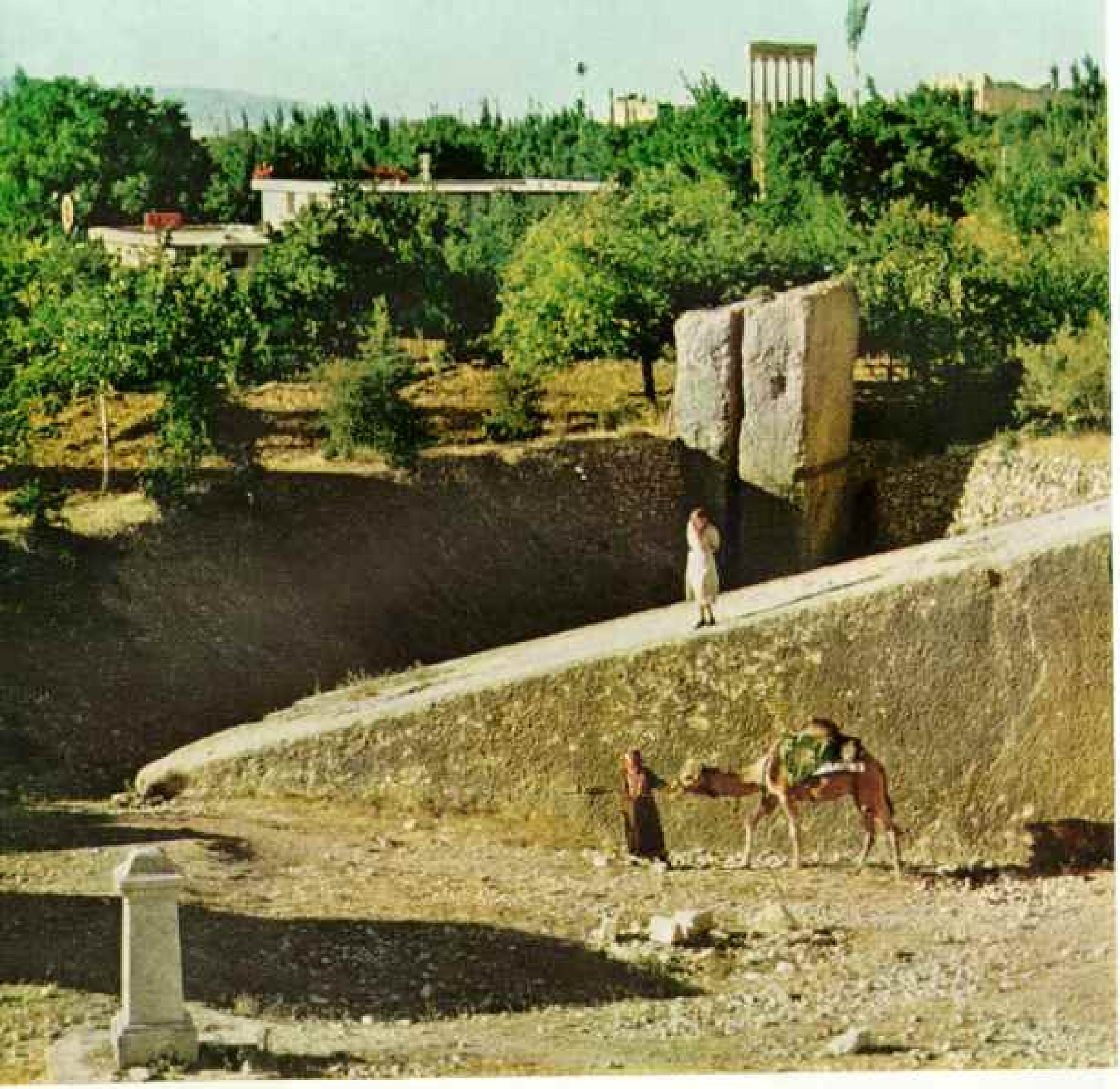
Phoenicians built the original temple to a local god, or Ba'al. Greeks called the place Heliopolis (City of the Sun). Romans erected a complex of temples, including this one to Jupiter. Christian emperors converted the shrine to a basilica. Legend says that Justinian the Great of Constantinople carried off eight porphyry columns for his cathedral, Aya Sofya. Invading Moslems used the temple as a fortress for many centuries.

These columns are three of six surviving out of the original 54. Standing more than 60 feet high and 7½ in diameter, they are among the largest ever erected. Ancients included the acropolis among the wonders of the world. Temple of Bacchus and modern Ba'albek lie beyond.

Kodachrome by Melville Bell Grosvenor © National Geographic Society

Scale model of Ba'albek stands in the National Museum. Hexagonal foyer in foreground admitted worshipers to the sacrificial court. Temples of Jupiter (right) and Bacchus





Massive Limestone Monolith, Abandoned by Its Creators, Lies in the Ba'albek Quarry

Mystery surrounds the method by which the giant blocks were mounted in the walls of the acropolis. Sixty-foot, 750-ton sections rest as much as 20 feet above the ground.

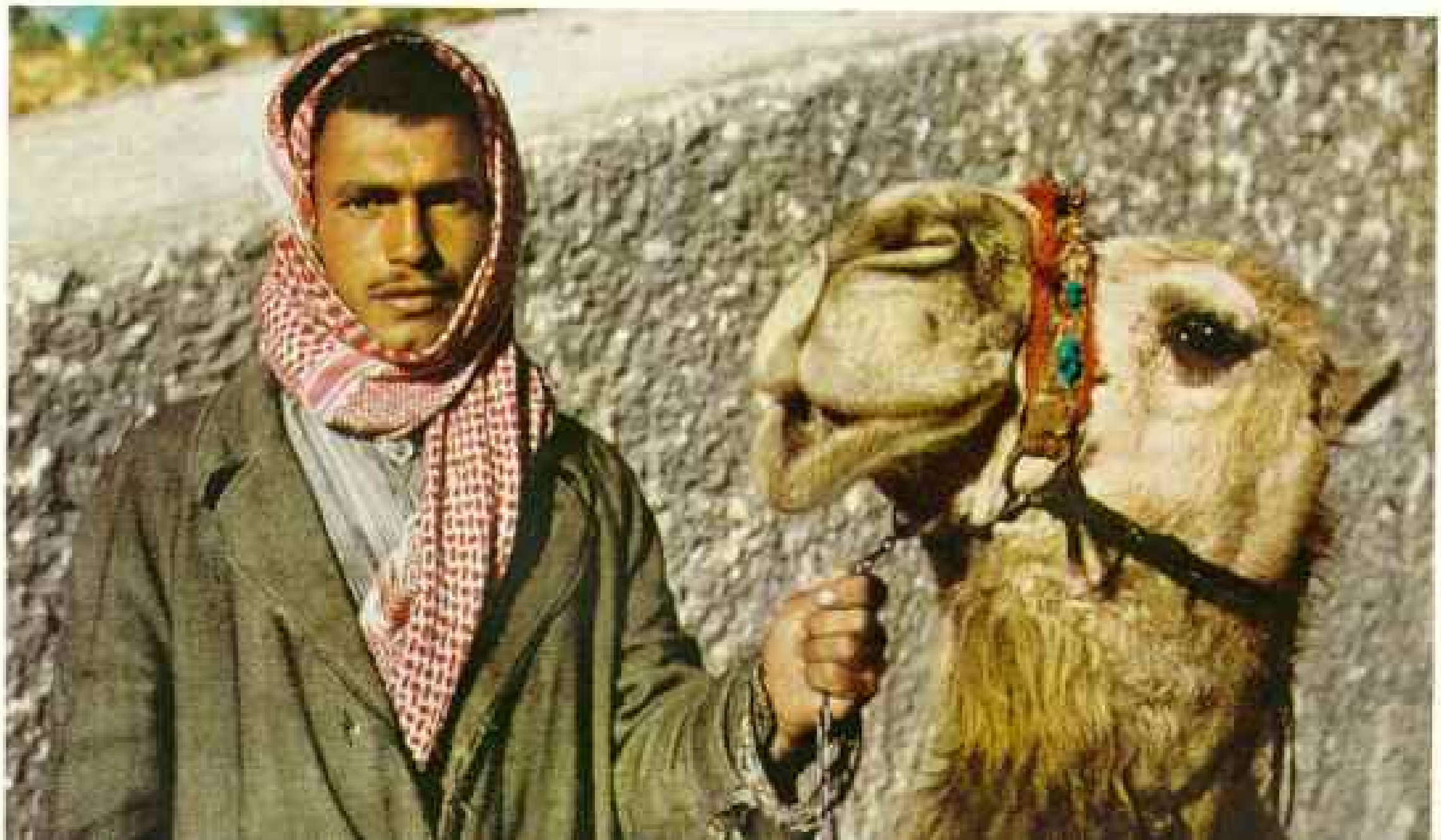
This slab, thought to be the largest single block ever quarried, dwarfs a visitor standing on its tilted surface. Archeologists estimate the stone could provide more than two obelisks the size of Cleopatra's Needle in Central Park, New York City.

Inhabitants call the block *Hajar al-hubla* (Stone of the Pregnant Woman) after an ancient belief that it cured infertility. Distant columns mark the Temple of Jupiter.

Roaring lion fell from the cornice of the temple (opposite, below). Gaping jaws spouted rain water from the gutters. A boy peers through the mouth.

Dragoman and camel pause beside the great monolith. Ancient caravans crossing the Near East passed through Ba'albek.

Kodachromes by Melville Bell Grosvenor (left and below) and Thomas J. Abercrombie, © National Geographic Society



mud-and-straw roof, but whitewashed inside and out and spotlessly clean. Its ceilings stood high, and the salon was elegantly carpeted. On one wall hung pictures cut from calendars and magazines, as well as family photographs, all dominated by a small plaque with Arabic script reading *Allah Akbar;* "God is the greatest of all."

Mountain Bread, a National Institution

In a little lean-to between kitchen and stable sat the farmer's wife and daughter, their faces aglow with laughter and firelight, making sombrero-sized khubis. They pounded small round balls of hardy dough flat on a breadboard, then stretched them to paper thinness by tossing them deftly back and forth over their forearms. Finally they plastered the dough on a dome-shaped griddle. The young girl fed straw into the crackling fire beneath, and by the time one pancake was cooked another was ready for the fire.

I tried some, warm off the fire, rolled up and dipped in *hummus,* a mashed chick-pea and sesame oil combination.

"Delicious," I pronounced, reaching for a second piece.

"It's more than that," added Harry. "It's a national institution."

Later that morning, aboard a donkey, I followed our host through apple and cherry orchards and poplar-lined fields of potatoes, onions, beans, and wheat to his little plot of land.

Although the larger farms employ machinery to spray orchards and plow fields, the most common sight in Al Biqā' is still the farmer plodding behind a yoke of oxen and a crude wooden plow (page 522).

Where Time Is Plentiful

"My farm is small," gesticulated Mahmoud. "It would not pay me to buy machines and gasoline for my few furrows. Of course the old methods take longer, but time is one thing with which we are well stocked."

Then with a sharp prod from a long goad, and a loud "Heeyeh! Heeyeh!" the farmer turned his grunting oxen. Man, beasts, and plow moved as one.

I walked back to Qabb Ilyās alone, a peaceful hour's stroll I shall never forget. At the foot of the town mosque's gleaming white minaret, which rose from a cemetery courtyard, I talked with a young sheik. Had I not had a translator to help us converse, the sincerity and warm friendliness in his manner would have been sufficiently eloquent.

"Won't you visit our services this morning?" he asked. Then, anticipating my next question, he added, "Of course you may bring your camera."

The interior of the mosque was beautiful in its simplicity, reminding me of village churches back home. No pictures or statues decorated the walls, for Moslems consider this a heathen practice. Instead, subtly colorful arabesque designs were interspersed with proverbs from the Koran in sweeping golden script. I left my shoes at the door and found a space on the carpet near the front of the crowd.

After the service I mingled with the people, drifting with the human current out the door past a long line of beggars and down the narrow street. Walking and talking with them, I had a warm feeling of belonging; they seemed to accept me as one of their own.

I had to pull myself away from this friendly town, but as Qabb Ilyās faded to a speck in our rear-view mirror, I had already begun looking forward to Beaufort, or Belfort, the most talked-about Crusader castle in Lebanon.

Dam Harnesses a Mountain River

Our road followed the Līṭānī River past Al Qar'awn, where work was already under way to build a huge dam to harness this brawling mountain stream. This is part of the ambitious Līṭānī River Project, which will triple the country's electric power output and also irrigate 8,500 acres of farmland.

Soon we swung abruptly up into the mountains. Climbing higher, we could look out over Al Biqā' to mountainside villages of Syria and the Jordan River in Israel.

Suddenly we were surprised by a small group of soldiers. They stopped our car and ordered us out at gun point. A poker-faced corporal carrying a submachine gun searched me. Though he found not so much as a pocketknife, the soldiers seemed upset by my cameras. Fortunately my letter from the Ministry of Defense allayed their suspicions.

Several times more we had to cope with the tense atmosphere of the Lebanon-Israel border country. Lebanon stood with the other Arab states in the bitter conflicts of 1948-49, and in abiding strictly by the United Nations truce agreement she maintains a constant watchfulness.

"Look up there!" Harry said a few minutes later. "There is the castle!"

Leaf-crowned Columns Lift a Richly Carved Ceiling in the Temple of Bacchus

For grandeur of ornamentation, few monuments match the Temple of Bacchus, the god of wine.

Visitors to the shrine, which stands beside the Temple of Jupiter, are overwhelmed by massive stone ceiling tapestries and panels depicting emperors, gods, cupids, genii, dragons, and dolphins in a seemingly endless pageant. A sculptured doorway 43 feet high and 21 feet wide ranks among the greatest feats of Roman architecture.

This view looks up along the Corinthian columns to the lavishly adorned ceiling, whose carving (below) gives the appearance of an intricate mosaic.

A tumbled section of the ceiling stands on edge. Stylized leaves and flowers frame the figure.

Across the winding Līṭānī and a thousand feet above us stood the Château de Beaufort, rising out of the very stone of the mountainside and now, in its ruined state, seeming almost a part of it. The late afternoon sun, hazy behind a veil of drifting clouds, added a touch of drama to the scene.

We plunged into the gorge and up the other side until the gushing river was a mere silver thread below. At Arnūn we picked up the required military escort, a young soldier who squeezed into the back seat; then we drove slowly up the gravel road to the château.

Starvation Conquered Beaufort

Beaufort more than any of Lebanon's dozen or more Crusader castles boasts an incomparable mixture of scenic grandeur and history. The knights of the Cross rebuilt it from a small Arab castle captured from al-Amīr Shihāb-al-Dīn in 1139; fifty years later Saladin captured it by starving out the defenders. The Crusaders regained the castle in 1240, only to lose it after less than 30 years.

We left our Volkswagen near the main gate, on the very spot where, so the story goes, Saladin, in an attempt to force the Crusaders to surrender, had tortured the captive Lord Reginald of Sidon in full view of the castle.

The day was nearly over when we picked our way through the ruins under the watchful eyes of our escort and photographed the partly rebuilt southwest tower. Just then the setting sun broke through the clouds, briefly spotlighting the masonry and warming the limestone of the escarpment before plunging into the sea in the direction of Sidon.

From the very first I was fascinated with Sidon (Ṣaydā). Merely to step from the highway took me back 1,900 years through dark, narrow streets where the captive St. Paul was permitted to visit friends on his way to Rome.* In coffee houses redolent with smoke and spice, storytellers still ply their art to attentive audiences, substituting for books and newspapers.

"*Tayib! Tayib!*" shouts the pastryman, balancing a tray of his wares on his head. He is drowned out by a discordant chorus of hawkers manning cramped stalls along the way. Here and there herds of sheep, pushcarts loaded with fresh fish or ripe fruits, or an occasional foolish automobile battle the human current.

After the darkness of the bazaar, the whiteness of the sun-bleached harbor dazzled me. Fishermen were stretching out long, delicate nets to dry along the breakwater, while others hoisted pointed sails and glided silently out past the Castle of the Sea (page 516).

Old as it seems, the Crusader fort is only a newcomer to Sidon's sea front. More than 2,000 years before it was built, galleys brought the wealth of the known world to this harbor, making Sidon the most important city of early Phoenicia. It remained so until eclipsed by the rise of Tyre.

I met an old fisherman named Ahmed, busy mending his net in the hot noon sun. He offered to take me with him and his sons on a midnight run to the fishing grounds.

"Maybe you will bring us luck," he said.

"Let us hope so," I replied.

Late that night, under a moonless sky, we cast off from the docks without so much as a lantern aboard. How old Ahmed navigated the pitch-black harbor, I'll never know.

To make matters worse, my interpreter became seasick. The knock-knock-knock of Ahmed's stick on the deck to attract fish began to rattle me too, and I was saved only by the dawn, which gave us a horizon to grasp.

Daybreak afforded me plenty of picture opportunities as the fishermen, dressed in turbans and baggy pants, hauled in their nets. The catch was meager, two bushels of small fish and a few eels, but as we came in around the castle, ablaze in the sunrise, my own photographic nets were full.

Elections Stir Stormy City

Back in Beirut once more, I settled down on the veranda of the Hotel Saint Georges (page 480) to catch up on the newspapers. In the *Daily Star*, *L'Orient*, and *As Sayad*, one of many Arabic dailies published in Lebanon, politics had monopolized page one as national elections drew near.

The city itself was stirring with election activity (page 502). Campaign posters with portraits of candidates and red squiggles of Arabic type covered every available wall and even obscured traffic signs. In the streets people talked and argued about the candidates and the issues.

Rumors were circulating that the opposition party planned a demonstration against police orders in Al Bastah, a thickly settled Moslem

(*Continued on page 523*)

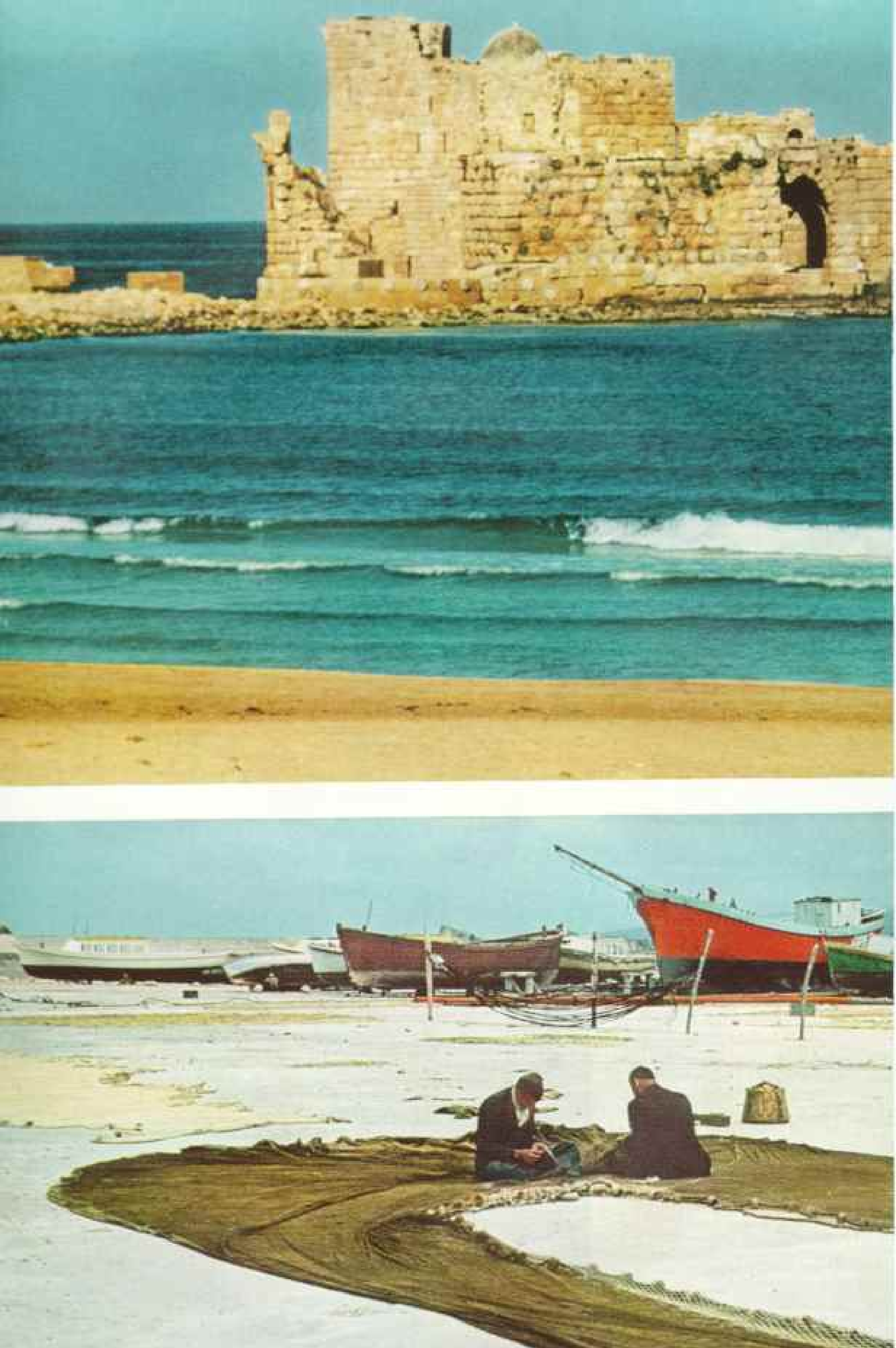
* See "Jerusalem to Rome in the Path of St. Paul," by David S. Boyer, National Geographic Magazine, December, 1956.

Skilled Hands Create Dazzling Tableware

Craftsmen of the Haddad cutlery workshop in the village of Jazzin have produced fine implements for nearly two centuries. Said Haddad, a fourth-generation owner, files the handle of a ladle.

Haddad's nightingale pattern: horn handles are trimmed with brass and inlaid with silver and dyed camel bone.

Kodachromes by Thomas J. Abercrombie, National Geographic Staff © N.G.S.



Castle of the Sea Stands Melancholy Guard at Ṣaydā

So great was the power of ancient Sidon (modern Ṣaydā) that Homer referred to the Phoenicians as Sidonians. Long before Greek and Roman armadas ventured into the Mediterranean, Sidon and her sister city, Tyre, sent high-decked galleys beyond the Pillars of Hercules into the Atlantic. Sidonian merchantmen roamed the known world carrying purple cloth and exquisite glass.

Qal'at al Bahr overlooks the entrance to the port. Crusaders in the 13th century occupied the city and built this castle as a link in their chain of sea defenses against the Moslems.

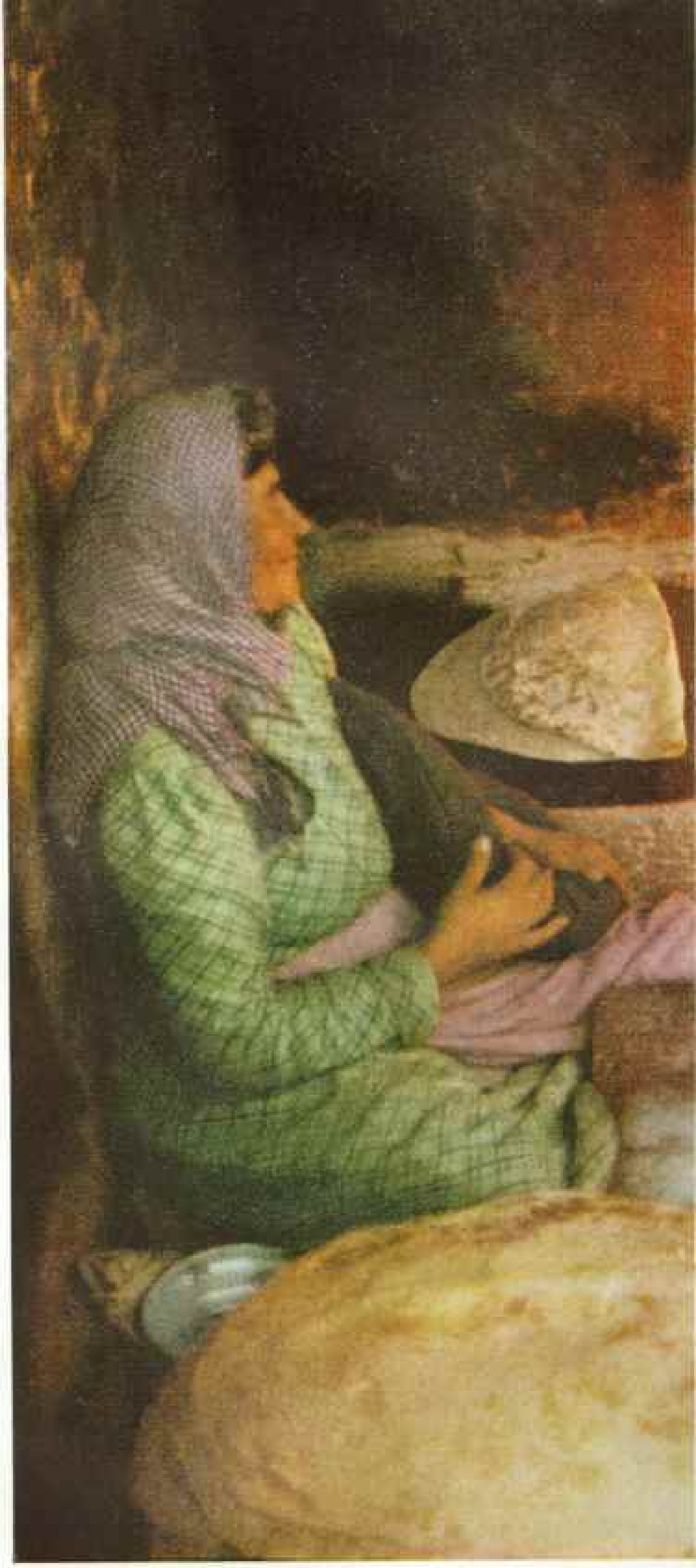
Laden burros trudge to market.

Ṣaydā Fishermen Mend Nets Beside Their Beached Fleet

Offshore waters, once rich in sardines and sea perch, produce meager catches. Ṣaydā now exports oil pumped from Saudi Arabia through a 1,068-mile pipeline.

Kodachromes by David S. Boyer (above) and Thomas J. Abercrombie, National Geographic Staff © N.G.S.

Al Biqā' Valley: an Enormous Oriental Rug Unrolled Beneath the Anti-Lebanon Range



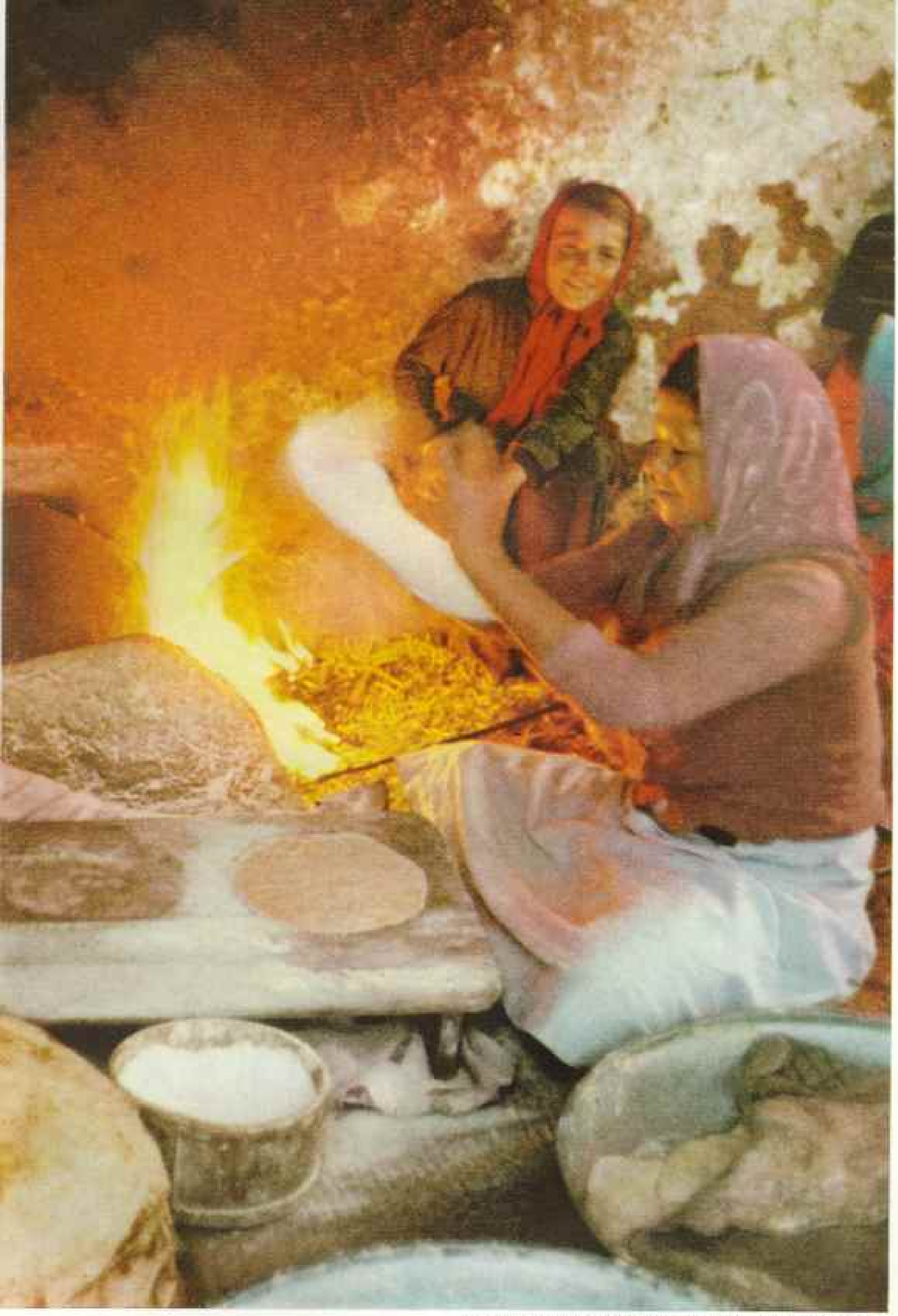
Housewives Bake Bread by the Glow of a Fire Fueled with Straw

These Maronite Christian women in the village of Ta'labāyā bake *khubis al-Jebel*, or mountain bread, wafer-thin sheets of wheat dough often used as scoops to dip up stews and vegetables.

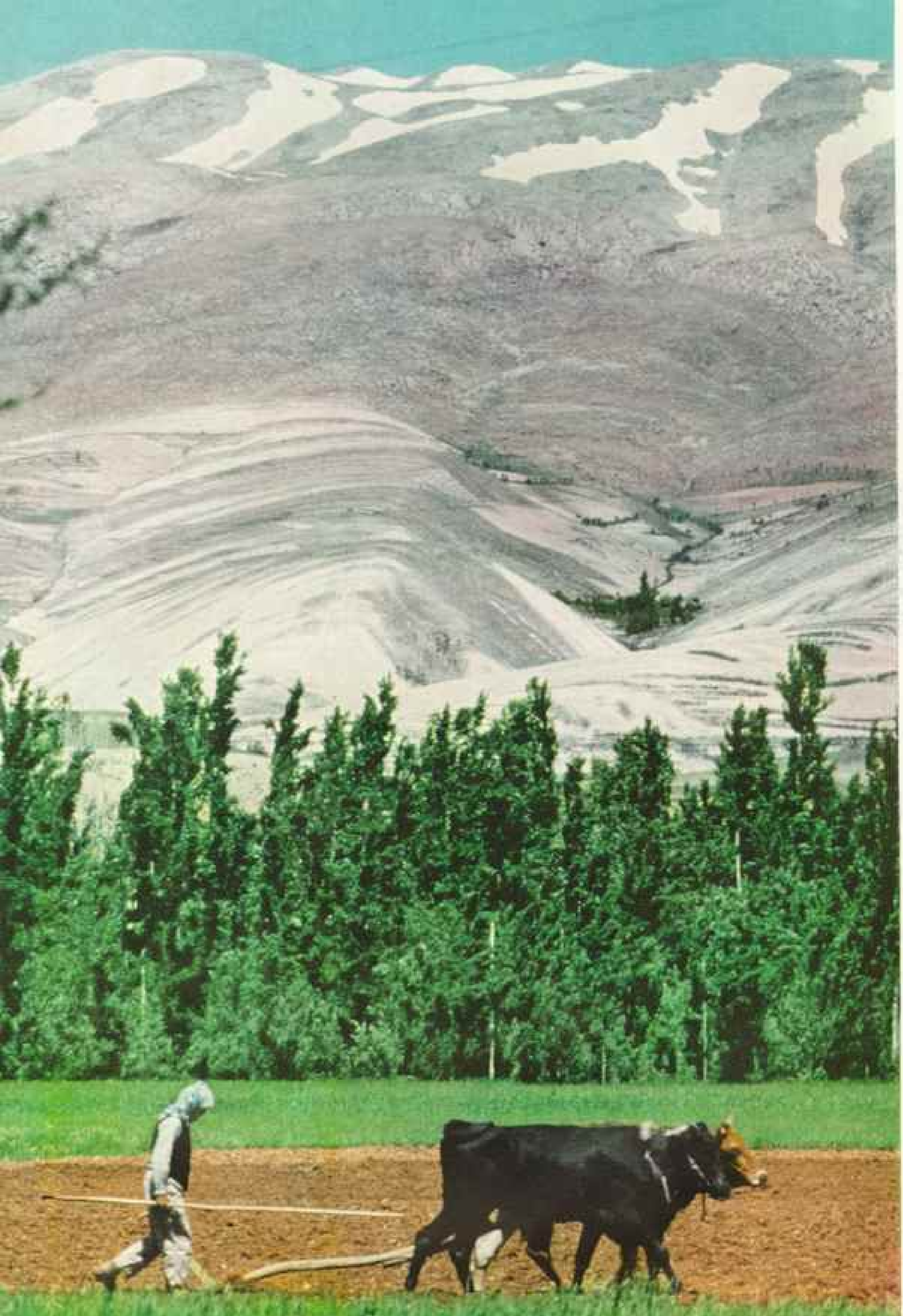
Woman at right shapes the disks. Beginning with a fist-sized ball, she pounds the dough flat, stretching it even thinner by patting it from hand to hand like a tortilla. Then she tosses it onto the cushion held by the woman facing her, who flips the platter-sized sheet onto the domelike oven to bake.

Lebanese eat large amounts of bread. Families bake a week's supply at a time. Westerners find the bread tasteless by itself but good with pungent Lebanese sauces.

Lebanon, like many of its neighbors, lacks wood for fuel.



Aquarelle for Thomas J. Abercrombie, National Geographic Staff © N.G.S.



quarter of the capital, to protest the government's proposed handling of the forthcoming elections.

"You must not go there; you will be killed!" warned my cab driver. The seriousness of his expression stifled some of my enthusiasm. But this was young democracy in action, I thought, and I wouldn't miss it for anything.

Walking through the streets of Al Bastah, I saw gendarmes everywhere, and radio-equipped motorcycles guarding the intersections. Small groups of people milled here and there, but I could hear only low murmurs and the flutter of paper posters strung across the street on a string.

"La suwar." "No photographs!" shouted one gendarme, but I pretended not to understand, and he let me pass. Somewhere ahead people began shouting. I drew out my camera and ran toward the excitement.

Around the corner rushed an angry mob of demonstrators pursued by a squad of gendarmes. I squeezed into a doorway as they neared, but was nearly trampled when I dashed out for a better angle.

Suddenly the mob turned and began throwing rocks at the gendarmes. Spectators standing on the balconies joined in, filling the air with stones. One of the gendarmes stumbled dizzily and dropped his rifle. The rest of the squad fell to one knee, and I heard the smart click of rifle bolts. And I was right in the middle!

Argue Not with Nervous Trigger Fingers

I flattened to the street just as the first shots were fired. Crawling to the safety of the doorway, I saw one demonstrator crumple as the rest fled. A few more shots toward the fast-emptying balconies stopped the flow of stones. I hurried down the street to where another group of gendarmes was congregating.

Inside the corner house, I overheard, the leaders of the demonstration were running the show by telephone. Gendarmes moved in to cut communications and dissolve the meeting. I tried to fight my way up the steps to a better view, but suddenly I felt a strong grip on my arm. I was taken before an iron-jawed officer, who placed me under arrest for "disturbing the peace." Two gendarmes led me to a covered truck. I was furious but not prone to argue with my guards' already nervous trigger fingers. Ambulances were screaming back and forth, and then in the distance I could hear the rumble of tanks. The army was taking over.

At sight of the tanks, most of the crowd began to fade away, but from my canvas prison I could see one determined band throwing rocks at the armored vehicles.

Gendarmes poured back into the truck. We rattled off past smoldering, overturned cars and cement barricades. But it was quiet again. The army's show of force had ended the riot.

We stopped at one battered intersection long enough for me to recognize a familiar face—my friend Capt. Joseph Dahrouge, a gendarme officer. I waved frantically to him, and in a matter of seconds I was freed with a barrage of apologies. I thanked the captain. "Never mind," he said, "you were only doing your job. Besides, I have been reading your magazine since I was a boy," he smiled. "But you must leave this neighborhood now; it is not safe."

I clasped his hand, thanked him again, and took his advice.

Growing Pains of a Young Republic

At the Saint Georges things were going on as usual; guests were apparently oblivious of Al Bastah's unpleasantries. Sailboats were racing in the bay, and a speedboat roared by towing a pair of water skiers. Gay laughter came from near-by tables, while on the beach below me young girls sunned themselves in French bathing suits.

Yet the banner headline of my afternoon paper screamed:

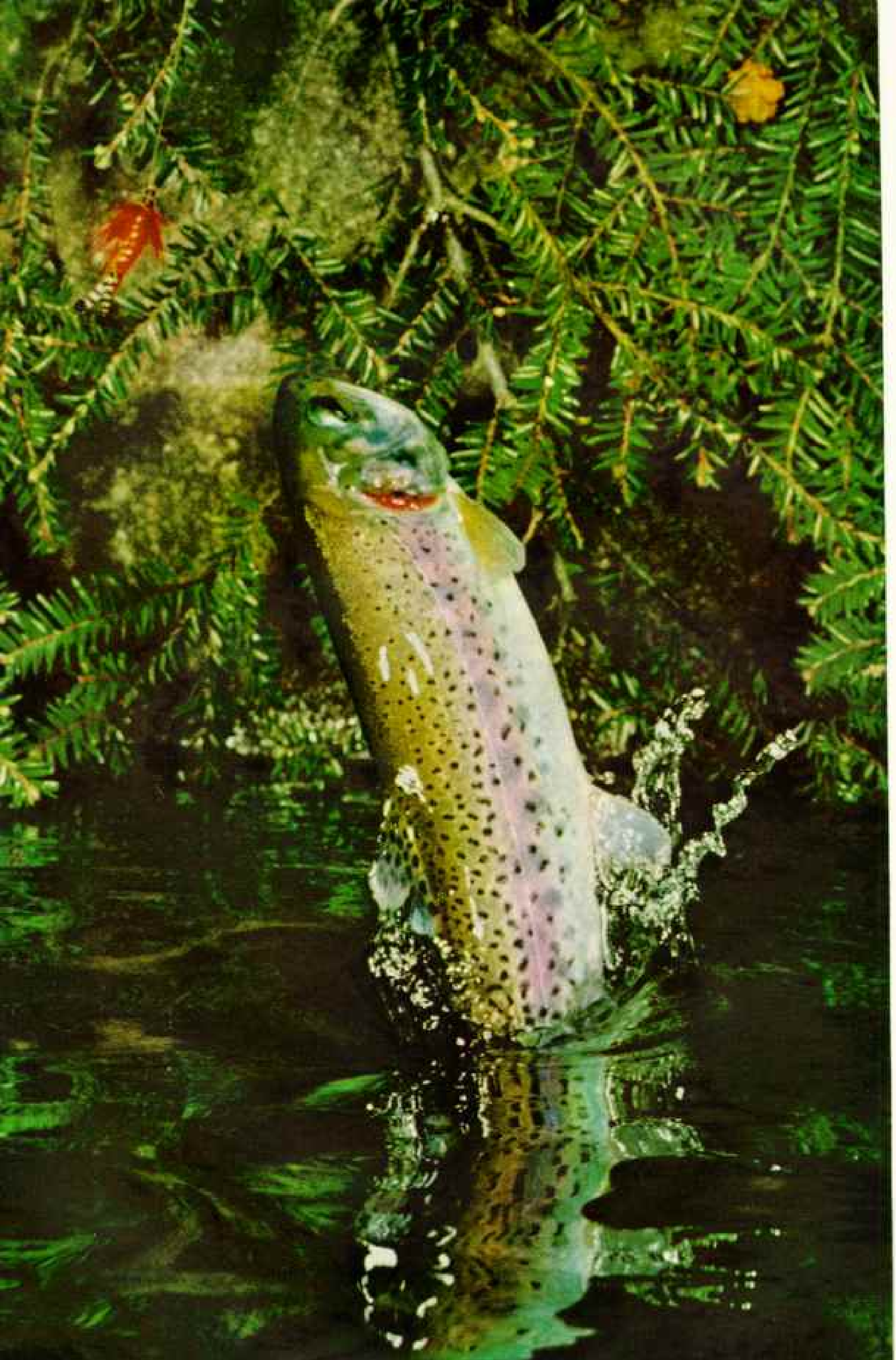
SEVEN KILLED, 73 WOUNDED, 341 ARRESTED

But Lebanon as a republic is young—born only during World War II—and somehow her troubles seemed only minor and temporary.

She is a country of contrasts, all of which contribute to her charm. She is an implausible mixture of the old and the new, West and East, Moslem and Christian, calm and excitement, black veils and bikinis, rich and poor, despair and hope. An independent republic after 5,000 years of conquerors, she looks forward to a prosperous and peaceful future.

Snow and Limestone Whiten Mount Sannīn. Oxen Break Al Biqā' Soil

"Winter upon his head . . . summer . . . slumbering at his feet." The Arab poet's description of Lebanon applies graphically to this picture. Plowman drives his yoke with a goad.



Freezing the Trout's Lightning Leap

A Nature Photographer Tells How He Combines Zoology, Physics, and Patience to Get Action Portraits of Game Fish

By Treat Davidson

THE WATER was cool and turbulent, like many another stream in Pennsylvania's Allegheny foothills. This one was hemlock-bordered Tionesta Creek, and I watched its surface with the special, relaxed attention that a man gives to two things—the fire on his hearth and the waters that harbor trout. Soon the fish would begin to feed.

Suddenly I was startled by the magnificent leap of a rainbow trout at the very spot I was watching. Erupting from the water, he soared above his explosion of droplets, caught a dragonfly well above the surface, and plunged victoriously back. As I reached for my rod, my mind's eye could still see him poised motionless at the very peak of his leap, his magenta stripe curved with his flexing body.

Never Underestimate the Trout

At that instant a new project was born: I would somehow photograph this leap of a feeding trout.

"Good, close-up action shots of trout," an editor friend had once told me, "are among the scarcest pictures on earth."

I had not fully understood the reason. With an angler's interest in trout and some skill as a photographer, I felt my project should not be too formidable. But here I underestimated the trout.

A cousin of the salmon, this cold-water creature is remarkably strong and restless. He can wriggle his way up rapids with his body partly out of water; he leaps almost vertically up solid streams of waterfalls.

The rainbow I saw that day on the Tionesta was a westerner, of course, stocked in Pennsylvania. In a stream on the Pacific slope it might have grown up a steelhead. Scientists have learned that the rainbow and steelhead are really the same fish, *Salmo gairdneri*. When rainbows adopt the habit of yearly migrations to the sea, their clean, brilliant coloring grows drab and dull.

At spawning time, when western rainbows make at least token trips upstream, they seek out clean gravel stream bottoms. Females patiently flick their tails—sometimes for as long as two days—to dig their nests. Then when the eggs have been laid and fertilized, the male swims on guard for a short time as the female covers the nest with gravel.

At this early stage of a trout's life, he is an easy subject to photograph. About a month after eggs are laid, the eyes of the embryos can be seen staring out through semitransparent shells. Later the baby trout can be observed as they develop and move about within the eggs (page 527).

Depending on water temperature, eggs may hatch in about 45 days. The baby fish are then quite helpless and grotesquely shaped, with a protruding yolk, or umbilical sac. This baggage is at first their only source of food. Meantime, the youngsters usually lie on their sides. But even then they give an inkling of their coming agility: when they move, they seem to hop instead of swim.

Fingerlings Develop Flashing Speed

In three weeks or more they have absorbed the yolk sac and are swimming in pursuit of food, a wide variety of microscopic life in the water and insects above it. Eventually they can cruise at more than 20 miles an hour and leap almost as fast—an estimated rate of about 20 feet per second.

Obviously, *I* couldn't move that fast to take a picture of a leaping fish.

"The trout will have to take his own picture," I told myself. "We'll use a photoelectric cell. His leap will break the light beam and trip the shutter."

Needing help, I recalled the name of Dr.

Arching from a Quiet Pool, a Rainbow Trout Strains for the Lure

This 1½-pound rainbow at a U. S. fisheries station at Cherry Grove, Pennsylvania, takes its own picture through an ingenious system devised by the author. Leaping for a hookless fly, the fish interrupts an electric-eye beam, tripping the camera shutter and a stroboscopic light set for 1/5000 of a second. The flash freezes trout, lure, and geysers of water. The rainbow trout, a brilliant member of the salmon family, ranks among the finest game fishes. A native of western North America, it spread east by transplantation.

Jackknifing Brook Trout Clears a Thundering, Yard-high Hurdle

Trout swimming upstream to spawn leap several times their length through the air to conquer obstacles. Unlike Pacific salmon, which spawn once and die, trout make a grueling migration each year.

The eastern brook, or speckled, trout (*Salvelinus fontinalis*) is technically a char. Though native to northeastern North America, it has moved westward by transplantation, just as the sturdier rainbow trout has been spread to eastern waters. But deforestation and stream pollution have limited its numbers.

This brook trout leaps a fall on a branch of Tionesta Creek in Pennsylvania.

Coiled brook trout embryos appear all eyes inside their translucent, capsule-like eggs. The adult female may lay as many as 4,000 eggs in a redd, or nest, scooped from gravelly bottom and covered against floods and predators. Fresh water seeping through the loose covering provides oxygen. These 45-day-old hatchery eggs (enlarged three diameters) are ready to give up their tenants.

Bloated fry, two hours old, feed off yolk sacs developed during incubation. The sacs are gradually absorbed as the fish gain strength and catch food.

Harold E. Edgerton, Professor of Electrical Measurements at the Massachusetts Institute of Technology. In the NATIONAL GEOGRAPHIC MAGAZINE I had seen his pioneering nature photographs taken with speedlights he invented, which can flash as fast as 1/5000 of a second.* I wrote to Dr. Edgerton.

"What luck would I have using a speedlight for trout?" I asked. "And could I use it with photoelectric equipment?"

Dr. Edgerton promptly replied. "I haven't used this arrangement myself, but I've often thought about it. Let me know if it works."

I knew then that I was on my own.

Still, the problem seemed solvable. The speedlight would stop the action. But the photoelectric cell was slower; it would take 1/10 of a second to activate the camera. In that time a leaping trout could move some two feet—out of camera range for a close-up.

I wrote manufacturers of photoelectric apparatus. "Higher speeds are impossible," they told me. But I bought the equipment anyway and experimented by taking pictures of falling golf balls. It was too slow.

Radar Routs a Problem

The project looked hopeless. Then I mentioned my experiments to a good friend and excellent photographer, Comdr. William S. Heston, USNR, an expert in electronics.

"Nothing is impossible," he said. "Let me think it over."

A few days later he telephoned. "I have an idea that ought to work—though it's never been done this way before. Let's put a thyratron tube in the circuit."

Thyratron tubes are used in radar. They control the strong power pulses emitted hundreds of thousands of times each second, acting as the trigger mechanism.

With our new device hooked up, I dropped more golf balls. The difference was astonishing. Just 1/77 of a second after a ball broke the light beam, it had taken its own picture.

Now I could turn to trout—as soon as I could arrange a place for them. My plan was to convert a back-yard building into an aquatic studio. My tank, of stainless steel and plate glass, would weigh more than a ton when full of water. To support such weight, I had to strengthen the floors. My wife and daughter were highly skeptical, but they did not object. By spring everything was ready.

I turned on the faucet to fill my tank and went into the house for lunch. I returned to find water flowing out the door of my outbuilding. I had miscalculated; the large front pane had not been strong enough to carry the pressure. It had burst, covering the place with water and splintered glass.

"Why don't you just quit now?" my wife suggested. But, too furious to be reasonable, I bought a stronger piece of glass.

My repaired aquarium soon had its tenants, two handsome, flashing 8-inch trout. No sooner had I placed them in the aquarium than they demonstrated the rainbow's reputation for pugnacity. Paying no attention to their strange surroundings, they started to fight. Before I could rescue the loser, his fins were so torn he was useless as a model.

The victor, though, was ready for anything. While I adjusted my equipment, I tentatively trailed my finger in the water. He struck at it. He even attacked a pair of pliers accidentally dropped in the tank.

This fellow was too sporty for his or my good. I got only a few exposures before he leaped clear of the tank and landed on the studio floor. Though undaunted, he was now so battered I had to release him.

Perhaps my wife was right—but then I had another idea. The Federal fisheries station in near-by Cherry Grove had a fine lot of rainbow trout in their rearing ponds.

"Sure," said manager Earl Bigford. "You can work over here."

Spurred by appetite, the nursery fish performed beautifully. Of course, I could not control the position of my subjects. About 90 percent of the time the fish were turned at the wrong angle as they jumped for my lures.

Pictures on a Trout's Own Terms

I was using a hookless fly especially styled for color pictures. The smallest puff of wind blew it out of camera range. Even so, out of the 150 pictures I made that day, three were fair and two were really good. I was encouraged to keep at my work.

One sunny day in October I determined to try another sort of trout picture—action pictures of the eastern brook trout migrating upstream. For such shots, my photoelectric beam would be useless. But speed was less important here than at precise portrait ranges.

So I packed my equipment along the Farnsworth Branch of Tionesta Creek. I had just

* See "Freezing the Flight of Hummingbirds," by Harold E. Edgerton, NATIONAL GEOGRAPHIC MAGAZINE, August, 1951.

Jaws Agape, a Hungry Fish Stands on Its Tail for a Damsel Fly Lure

"Almost any insect that flies or swims is food to a brook trout," says the author, "but when you try to take pictures of him at mealtime, everything goes wrong."

Hatchery trout, shy of flash reflectors, had to be fed for weeks near dummy mirrors before they would leap. Rain and visitors kept fish sulking on the bottom. Many subjects contrived to steal the bait without breaking the light beam. On other occasions muggy weather short-circuited the electronic gear, undoing the work of days.

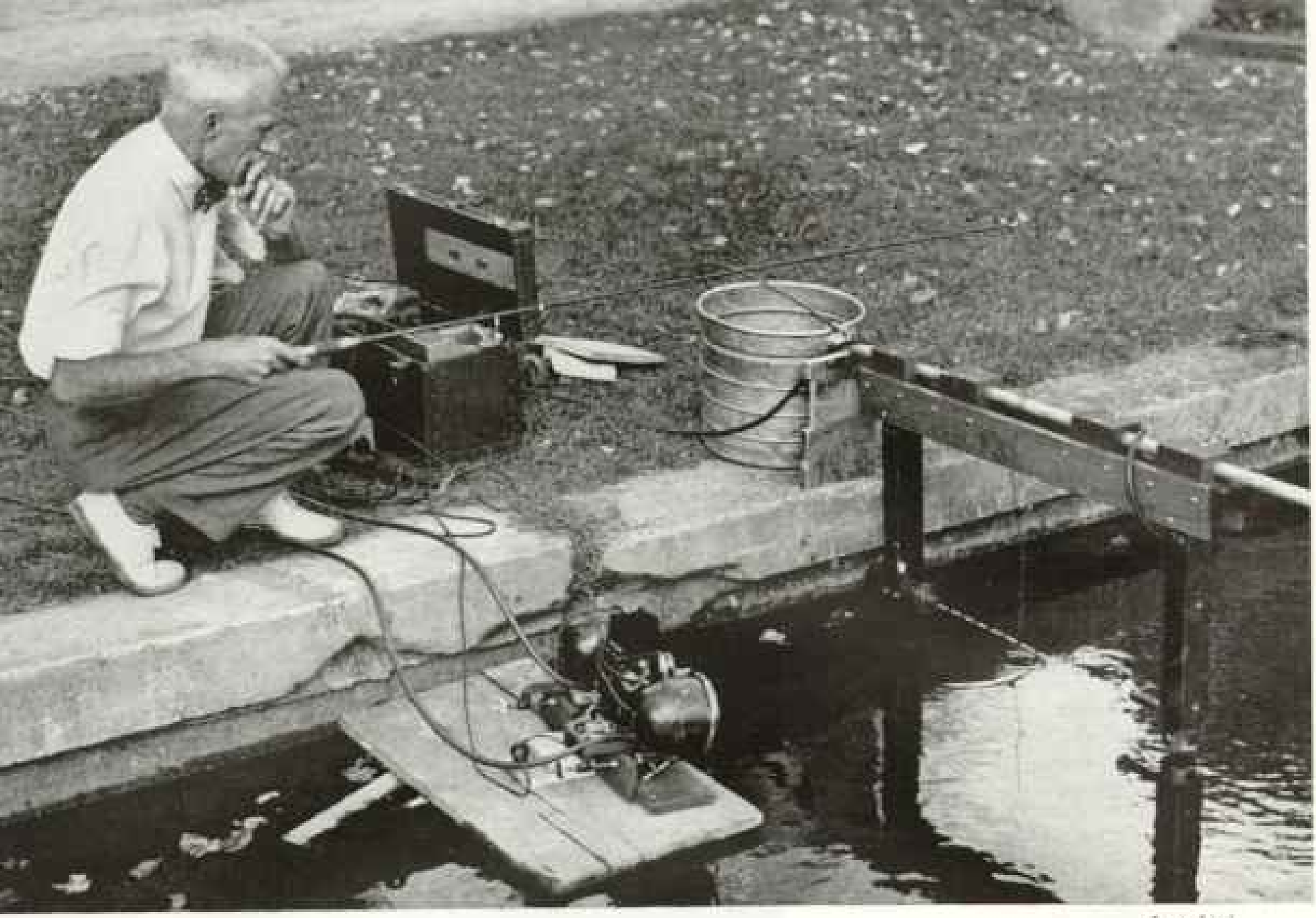
This remarkable photograph, taken at 1/5000 of a second, catches an eastern brook trout seemingly supported by its own reflection as it lunges for a dry lure. So wary were the fish that bait had to be suspended on a black rayon thread to avoid an artificial look.

Photographs by Treat Davidson and Merrill Ellis © National Geographic Society

Quiet Water Explodes with a Leaping Trout

For all their spectacular acrobatics in search of food, trout are cautious hunters. Some, on spying an insect above the water, jump the first time merely to inspect the prize and weigh the value of a second pass. Frustrated anglers may see a leaping fish appraise and reject a choice offering in mid-air.

This young eastern brook trout noses back into the water after inspecting a dried butterfly. Still uncertain of a meal, it takes a last backward look at the lure.



Louis Liotl

The Author Sets a Photographic Ambush for a Wary Subject

Tempting his quarry into camera range, Mr. Davidson maneuvers the fly to attract the trout and induce it to leap through the light beam (dotted line). The electric eye automatically fires camera and speedlights mounted on the board at water level.

found a likely stream fall when I dropped my camera into the water. Fortunately, it dried in the autumn wind, and soon I was working away, shooting whenever my senses told me that a trout was about to leap. I could hardly miss, for fish were coming frequently. And whenever luck permitted me to catch a trout at the peak of his jump, I got a clear picture.

These photographs, of course, lack the close detail of those taken electronically, but they show more of the trout's native world—the current-churned waters and banks rich with hemlock (page 526).

It was appropriate to photograph the brook trout in this setting, for he is a true American among fresh-water game fish. He is also generally conceded the favorite of fly fishermen. But the sportsman is not to blame for the brook's rarity today. As America's population swelled, natural conditions changed. Forests were felled, and small tributary streams dried up. Parent fish had to spawn in the hazardous main streams, where eggs were smothered by muddy water and destroyed by variable water temperatures.

My home State, rich in mountain streams, realized early that something should be done to protect the native trout. Pennsylvania passed conservation laws and experimented in raising trout. Rainbows were brought from the western streams. Fishing improved.

The breeding, stocking, and managing of game fish is now a million-dollar industry in my State alone; nationally, the figure is close to $40,000,000. This expense is largely borne by the sale of fishing licenses. To lure the angler, hatcheries are producing trout with brighter colors (the fish are fed paprika) and with greater fighting vigor.

But no matter how vigorous trout become, they will still be easier to catch on a hook than on film. Out of some 1,000 photographs I have taken of leaping trout, I can find just 36 "keepers" and only 11 of really top quality.

Yet such selectivity has its own rewards. Since exhibiting my earliest pictures, I have received inquiries from a surprising number of people. Other nature photographers have adopted these techniques. Our "impossible" problem is resulting in a more intimate glimpse of nature—from fish to birds, and who knows what else?

Land of Louisiana Sugar Kings

Along the Fertile Banks of the Mississippi River, Columned Mansions Recall the Heyday of the Old South's Sugar Plantations

By Harnett T. Kane

With Illustrations by National Geographic Photographer Willard R. Culver

THE kettles bubble and give off a steamy sweet fragrance. The yellowish-brown mixture inside grows thicker and darker as it cooks. In a circle around the fire, men and women watch as intently as if their lives depend upon it. In a sense, they do.

M. Etienne de Boré, who owns the kettles and the Louisiana plantation on which they cook, stands by with a long spoon in his hand. At length he thrusts the spoon into one of the kettles, stirs briefly, and cries:

"It granulates!"

This scene, enacted in 1795, changed Louisiana's history. Planter De Boré and his friends were desperate. Their experiments with tobacco, wax myrtle, and indigo had failed. They were farmers without a crop. Sugar cane grew well in the moist, rich soil along the Mississippi, but the planters had had heartbreaking trouble refining the sweet juice stored in the thick stalks.

M. De Boré had gambled his plantation on building a mill and hiring an expert to run it. Now his enterprise had given Louisiana a product she could export profitably to Europe and other markets.

From this beginning arose Louisiana's empire of sugar, long-time heart of American cane production, along and near the Mississippi River. With the wealth sugar produced went a grand manner, a largesse of existence that centered about the white-columned mansions that rose along the great stream of the South (map, page 540).

Cane Production at All-time High

Sugar is still king in his Louisiana realm; recent seasons have brought all-time highs in cane production. But the size and look of his empire have changed, and so has the method of his rule. He must now recognize new neighbors, for oil and diversified farming, industry, and other occupations have transformed much of the scene.

From a long, double spread of black land stretching 150 or so miles along the river, and also an extension into the related bayou country, sugar pours in a thicker flow than ever before. For long months of the year the jungle-thick, bamboolike stalks thrust toward the skies, and annually the rich aroma of cane juice lies over the earth.

Many old-time sugar residences remain proudly in place. As in an earlier day, owners still receive throngs of people—friends and also strangers.

Seldom, however, does the "big house" carry on as a center of a cane-growing unit. Sugar production has been mechanized as an agricultural-industrial enterprise. The plantation residences, cut away from their former fields, are now largely the country homes of people who have moved here or remained here because they like the locale.

Spring Fiesta Brings Visitors

Transformed as it is, the sugar empire prepares each year to receive visiting throngs. Of the crowds that fill New Orleans every year for its Spring Fiesta, which complements Mardi Gras, many go by car up and down the river to see the old plantations.

A hundred years ago, from below New Orleans to above the capital at Baton Rouge, the pillared houses rose along the Mississippi in a double line of splendor. Out of the semi-tropical greenery, with towering trees and tangled growths, came an apparently endless parade of columns, some white, others tinted pink or other pastel shades.

Flanking each house stood smaller structures, often temple-shaped buildings for offices or visitors, a separate one for the young bachelors. *Garçonnière* was the word for the last. Grouped about them were the kitchen building, a unit in itself for safety in case of fire; an occasional summerhouse beside the levee, and also *pigeonniers*—pigeon cotes, usually in pairs and frequently two stories high, like residences in their own right. At the back extended "the street," a pathway with cottages in rows—the slave quarters.

Though many of these surrounding buildings have crumbled away, enough remain at

Mighty Oaks Cross Limbs Like Swords Before a Mansion Built by Sugar

An early, unknown French settler planted here a double file of live-oak saplings, 28 in all, as an entranceway to his home on the Mississippi. In the

Kodachrome by Judith Locke © National Geographic Society

1830's sugar planter Jacques Roman acquired the property and reared this pink plastered-brick home. Girdling Doric columns match the trees in number. Roman named his estate *Bon Séjour* (Good Rest), but steamboat passengers, glimpsing the long arch of green, saw it as "Oak Alley." That name prevails.

various points to give an impression of the almost self-sufficient villages that were the sugar estates.

In the early 18th century, French colonists began a series of settlements near the Gulf of Mexico, with *La Nouvelle Orléans* as their capital. The newcomers quickly learned the natural laws of the region. Highest land, and richest, lay at the margins of the Mississippi and bayous; in most cases it was incomparably fertile soil, stirring with life.

When Spain took over Louisiana in 1769, the region kept its south European flavor. Descendants of the early comers were the Creoles, the first families of Louisiana, whose manners and philosophy stemmed from Paris. Their culture was one of geniality, good living, and a shrug. A high style came early, with powdered wigs, duels among the hotheaded, and marriage contracts signed by the families.

In time De Boré made sugar crystallize; Whitney's cotton gin evolved; and men scrambled to reach the precious Louisiana acres. Cotton did best along drier reaches above Baton Rouge, while the lower stretches were sugar's.

"The cane, she particular," a native of the river country once explained to me. "She like it bes' when her feet a lil' wet-like."

Another transforming factor entered Louisiana—the Anglo-Saxon Americans. For years colonists from the Atlantic seaboard, from Kentucky and Tennessee had pushed westward and southward down the Mississippi. Then, in 1803, came the Louisiana Purchase; the sugar kingdom acquired a new master, the United States, and a new rush of settlers moved in.

By 1830 there were almost 700 planters cultivating the "big grass." Enthusiasts cried in delight: Nowhere else on earth, monsieur, could money be made so fast! It poured out like the yellowish juice from the fragrant kettles. As Gov. William C. C. Claiborne put it: "The facility with which sugar planters amass wealth is almost incredible."

America with a French Accent

Americans elbowed Creoles, who frowned, sniffed, and stood aside. To the Anglo-Saxon, the native Louisianian was a man who drank coffee at the cafe when he should be attending to his accounts, who laughed at things that offended sober people, who played the piano on Sunday. To the Creole, the American was either an awkward oaf or a coldly calculating fellow, a man without civilized tastes.

Gradually, however, the two cultures accommodated to each other. The Americans won the financial race; the Creoles extended their ways over the later arrivals. The Anglo-Saxons learned French, ate well-peppered shrimp dishes, and practiced swallowing the potent Louisiana coffee. Something new emerged, something *à la Louisiane*, sharing a bit of each element. Yet for long stretches on the river, France ruled. Repeatedly travelers wrote that at the steamboat landings above New Orleans they felt that they were almost on foreign shores. Now and then in the present century, certain strangers have had the same impression!

Houses on Piers "Catch the Breeze"

The sugar homes were designed to provide a maximum of comfort with a minimum of perspiration. In earliest days the buildings stood well above ground, supported on brick piers, or pillars, 10 or 12 feet high. The elevation had two purposes: to escape any flood and to "catch the breeze," in Louisiana parlance. At the front, or on two or three or four sides, extended a wide gallery.

Inside was luxury in restraint, and also a low temperature. Ceilings lifted 14 or 16 feet or higher; when the tall doors or windows were opened and folding doors thrown wide, air reached everywhere. Only two or three rooms across, one or two deep, the Creole houses had a basic simplicity.

The Americans brought their own impress, with the emerging Greek Revival in architecture. The Creole plan modified; buildings and columns grew thicker, sometimes monumental, with neoclassic pediments against the skies. Hallways appeared, with additional room; but as ever the Americans borrowed from the Creoles, and the result was the classic revival with Louisiana touches. Here was a functional house of dignity and good proportion, suited to the scene and to the owner's needs.

Now followed the glory days of the river, 1825 to 1860. The downriver route seemed the richest highway of America. "The Gold Coast," some termed the sugar area, with a certain accuracy. In most cases a man had to start big or not at all. A fair-sized cane plantation had a $100,000 valuation, and its owner created no stir among his fellows. The saying went that "a man has to be a rich cotton planter before he can start as a poor sugar planter."

All Kodachromes by National Geographic Photographer Willard R. Culver © N.G.S.

Oak Alley: **Beauty Reigns in Rooms Once Haunted by Owls and Bats**

After the Civil War the house suffered decay. Mrs. Andrew Stewart (center) and her husband restored it. This second-floor hall leads to bedrooms and a gallery overlooking the oaks.

Still, all was not glory. The sugar story is one of risk, alternations of high and low years, and periodic tragedy. Sometimes the plantation remained intact year after year, but the master changed every few seasons. A levee break in spring high water could send the destructive river swirling across the fields, wrecking the crop and ruining the crop master. A price fluctuation could mean bankruptcy.

By the same token, if a grower knew three successful years in a row, life would be full. A little duchy was his; for a time he would be the most admired of men, a combination of Croesus and Lord Byron.

Clock Stopped for Guests

Many an English lord had fewer retainers. Specialization in labor went on to a high degree, with field hands, house servants, head cook and helpers, yard workers, gardeners, garden helpers, men to look after family carriages and horses, coachmen, dairy assistants, sometimes a servant for each child.

Houses had doorknobs and keyhole guards of silver, or porcelain knobs hand painted with designs of roses and lilies. (Some may still be found in antique shops.) In the LeBeau home below New Orleans a guest was always brought ceremoniously to the great hallway clock; as he looked, it was stopped on the moment of his arrival. Time, sir, would have a halt during the glad days of his stay! Fortunately, the family had other clocks.

Rooms in many houses were so big as to dwarf ordinary furnishings, and several Louisiana artisans advertised themselves as "specialists in plantation furniture." Four-poster beds stood 12 or 13 feet high; ceilings reached 16 feet. There were private parks for deer and birds and even private race tracks.

The sunlit days went slowly into eclipse with the coming of the Civil War. The great houses remained for the most part unharmed; no Sherman marched here. But with the war's disruptions, with the loss of labor and the destruction of sugar markets, stalks rotted uncut along the river and a sickly sweet stench rose over everything. In 1861 Loui-

Sightseeing Passengers Board the *Delta Queen*, Last of a Proud Line of Mississippi Paddle Boats

Fabricated in 1924 in Glasgow, Scotland, the stern-wheeler was shipped to California and assembled for duty on the Sacramento River. During World War II she shuttled personnel to and from ships in San Francisco Bay.

In 1947 the river boat put to sea behind a tug, sailing 5,400 miles from San Francisco to New Orleans by way of the Panama Canal.

Refurbished and air-conditioned, *Delta Queen* cruised the Ohio, Mississippi, and Tennessee Rivers until early this year, when she was put up for sale.

These sightseers stream down the levee after visiting Oak Alley (pages 532, 533).

siana produced 230,000 tons of sugar; by 1864 production was only 5,000 tons.

The return road has been a rocky one. During the war and the uncertain years that followed, the levee system fell into disrepair, and floods took further toll. In a period of straitened finances, planters sometimes could not pay their workers—when they had them. Tariff troubles developed, and cane disease; at one point in the 20th century, sugar was all but wiped out again.

The River Takes a Toll

A residence that once dominated 3,000 to 5,000 acres now had only two or three left to it. Fire, storm, slow decay—each took its share. A building left untenanted, out of repair, gradually cracked away; it lost windows and doors; poorer neighbors ripped away fireplaces, bricks at the bases of columns, or even whole sections.

Then there was the Mississippi itself. The stream gave and the stream took. "Ain' no use," a bearded veteran once told me, "in trying to figure the behavior of Old Man. He go where he want, he do what he want."

The river would shift; against a stretch of levee long stable, it would send a ruinous new rush of current. Near by it would build up its opposite bank. Houses that once stood hundreds of yards from the river are now near it; others once close to it are well inland.

Many houses continue with new uses, as an office or residence for an industrial plant; as a school, a government headquarters, now and then a place of entertainment. Magnolia, just above New Orleans, has been successively a supper club, a Jesuit retreat, and a training school for retarded children.

At the same time individuals have devoted themselves to the saving and restoration of these buildings. A number are wealthy and use their properties only for weekends or short stays. Others have saved funds for years for this purpose, setting up permanent residence, with vegetable farms, flower gardens, and a few head of cattle.

Meanwhile, the sugar region remembers and

Pillared *Houmas House* Once Surveyed an Empire in Cane and Corn

Named for Indians who originally held the land, Houmas House was built about 1840 by a daughter and son-in-law of Wade Hampton, Revolutionary War hero. So imposing was the home and so vast were its fields that the estate brought $1,500,000 when sold 17 years later. The new owner, John Burnside, added plantation after plantation, until he became the acknowledged "Sugar Prince of Louisiana."

Fourteen columns flank three sides of the plastered-brick structure. Windowed belvedere provided a protected tower from which owners surveyed their fields. Separate kitchen, connected to the house at the second-floor level, utilizes a settler's home that predates the manor. Bachelors in ante bellum days used the hexagonal *garçonnière* (right) for late-hour parties.

Old kitchen serves for salad making. A modern kitchen adjoins this room; another has been installed in the main house.

Houmas Stairway Rises in a Graceful Swirl

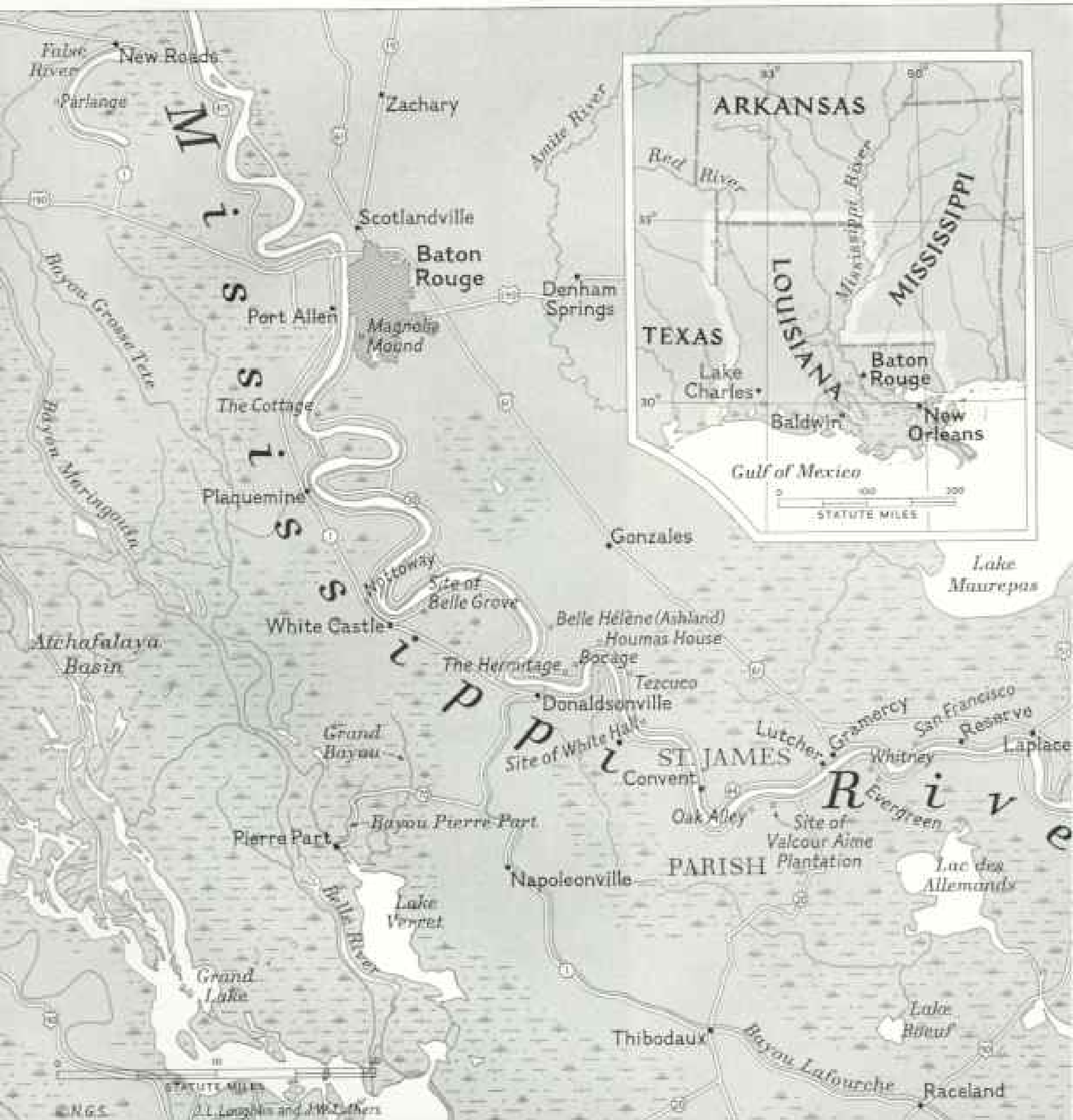
When John Burnside bought the house, the press announced that he had acquired "the finest property possessed by any single individual in America." He filled his home with guests and offered them every luxury from iced baths to European wines. Today Dr. George B. Crozat of New Orleans preserves the house as a country residence.

tells its stories of the houses and the rare, sometimes flamboyant, people who inhabited them. Over all the area there remains the shadow of Valcour Aime, "Louis XIV of Louisiana." Born wealthy, the industrious M. Aime made himself yet wealthier as the golden man of the sugar land.

In 1833, when railroad building was just getting started, Valcour Aime was planning a rail system on his plantation to serve his refinery and family. He kept a famous sugar-growing diary. But people talked mainly because of his grand gestures.

Along the river in the 1840's he set out an elaborate English park, with a lake in front of the house and a small artificial river that wound through the garden. From the Orient and Central America, he imported rarities—early camphor trees, palm trees, spotted fish; he built hothouses for the cultivation of exotic plants, and a *petit bois* inhabited by imported peacocks and swans.

For the children Valcour Aime put up a "fort," "Le Rocher Sainte Hélène," in memory of his beloved Napoleon. Louisianians recalled the Louis XIV comparison, however, and called his place the "Little Versailles." In 1849, Alexander Gordon, a botanical collector,



found the gardens "not surpassed, if equalled, by any in the Union." Others quoted M. Aime's favorite explanation for his generosity to those around him. "I don't want to be like the hog, good only when I'm dead."

A $10,000 Dinner

Once a distinguished French guest visited the Aimes, and sighed: It was sad that a man of discrimination, like monsieur, should be marooned here. Valcour Aime retorted that he had everything a civilized individual could want. The Frenchman looked amused; the talk went to food, and Valcour insisted that he could raise on his own place anything needed for a transcendent meal. He would let the other man be the judge, and he would put down ten thousand dollars. The wager was on.

Soon afterward the servants brought in a gumbo of crab and shrimp, dark-green okra and combined spices, over a bed of steamy rice. Next came

Texuco's Massive Furnishings Fit Big Rooms and High Ceilings

Five years under construction, Texuco opened its doors in 1855. It is furnished with heavy pieces scaled especially for plantation houses—a style sometimes called Deep South Empire.

The handmade mahogany bed dates from about 1850. A mosquito bar hangs from the half-tester. Dr. and Mrs. Robert H. Potts are the present owners of the plantation.

Abodes of Louisiana's sugar kings flank the Mississippi from north of Baton Rouge to New Orleans and below. The river's restless course has destroyed some homes and given additional front land to others. Levees help protect most of the survivors.

© National Geographic Society

***The Hermitage* wears an air of pride** even in decay. Here, flushed with victory from the Battle of New Orleans, Michel Doradou Bringier brought his child bride Aglaé. Nine children and countless friends filled the house with life. Sometimes as many as 50 guests spent the night.

Monumental columns rise in faded glory at *Belle Hélène*, the Greek temple that Duncan Kenner built in 1841 and called *Ashland*. The estate once boasted a stable of blooded horses and private race track. Now cattle graze the grounds and drink from the abandoned sirup kettles.

a fricassee of terrapin, brown, aromatic; then thick breast of wild duck, snipe, and delicate quail; mushrooms, platters of greens with bits of meat in the Louisiana style that can make a vegetable an adventure in succulence.

With each course the gourmet expanded within the guest. Now followed a heady dessert, difficult to place except that the cook must have used wild cherries and a liqueur, and also some tropical fruit. Platters of other fruits from the tropics were placed before him, with cheeses ripely odorous, cheeses soft and hard. Black coffee came, cigars of a lulling mellowness, four or five wines piquant in shading, and finally a brandy to which the guest returned several times.

"Perfection, perfection!" The European let out a deep breath. "Seldom have I tasted a meal so completely satisfying. Still, you have erred; you could not have supplied these things from Louisiana. I shall take your ten thousand—and hand it back to you."

The World in a Louisiana Garden

Making no answer, Valcour Aime took his guest about the Little Versailles. The terrapin? It came from pens in the marshy backlands. The tropical fruits? He opened a hothouse door. Cigars? A patch of tobacco. And here, monsieur, the vineyards that produced the makings of the wine. They went from spot to spot until they reached a last hothouse, under which grew coffee plants. Now Aime nudged his caller: "When *you* hand *me* the ten thousand, *I* shall hand it back to *you!*"

For years the Aimes yearned for a male heir. Madame provided three girls in a row before she finally gave birth to a boy. Gabriel was the family's hope; he would carry on the name. But, in 1854, he fell ill and died at the age of 28.

Aime went to his diary and wrote: "Let him who wishes continue. My time is finished. He died on September 18." The despairing father became a recluse; he turned from the big house to a small side one, and until his death he faced away from the world.

The family went away, the Aime house burned, and the gardens decayed. Several times in recent years I have gone there to wander about the broken remnants. With some effort and help from family descendants whom I know in New Orleans, I have traced the dry bed of the artificial river, the outlines of a mound which once held a pagoda, a fragment of a bridge, the last of the Oriental trees. Enough is there to give a sad hint of the lost glories.

Yet the Aime clan is still represented on the river by a handsome sugar castle. Madame Aime's brother, Jacques Télesphore Roman, moved to the river a short distance from the great Valcour. Between the brothers-in-law a certain rivalry developed. In 1836, after several years of work, Roman finished a brick house smaller than some, but a study in elegance—two-and-a-half stories high with a file of 28 simple Doric columns on all sides.

Bon Séjour Yields to "Oak Alley"

Its color shone warmly, a soft ivory tinged with pink. Before the house extended a remarkable double line of live oaks. The Romans and the Aimes liked the property's French name, Bon Séjour. But when steamboat passengers saw the place from the river, they called to one another to "look at the oak alley." After several generations the estate assumed its present name—Oak Alley.

One family, then another, took it, until about 1910, when Oak Alley lay in weeds, forgotten by the world. Pillars developed deep cracks, and their plaster fell away; a tenant with an iron stove cut a hole for his pipe through a leaded transom. After that Oak Alley stood empty, part of its roof sagging, its interior half wrecked. In time Andrew Stewart, a cotton broker, arrived with Mrs. Stewart. Taken by the scene, he determined to bring Oak Alley back.

Today the widowed Mrs. Stewart presides over a show place. The oaks are in full glory; though any one of them would rank as a giant, the master among them has a 29½-foot circumference. The house sits proudly in the sunlight at the end of the alley (page 532).

One man whom I took there stood awed. "I can't believe it," he said, "but there it is." Mrs. Stewart's brother operates the establishment as a cattle ranch. Open to the public, Oak Alley draws far more visitors now than at any time in its past. In a way, Valcour Aime's quieter brother-in-law has won.

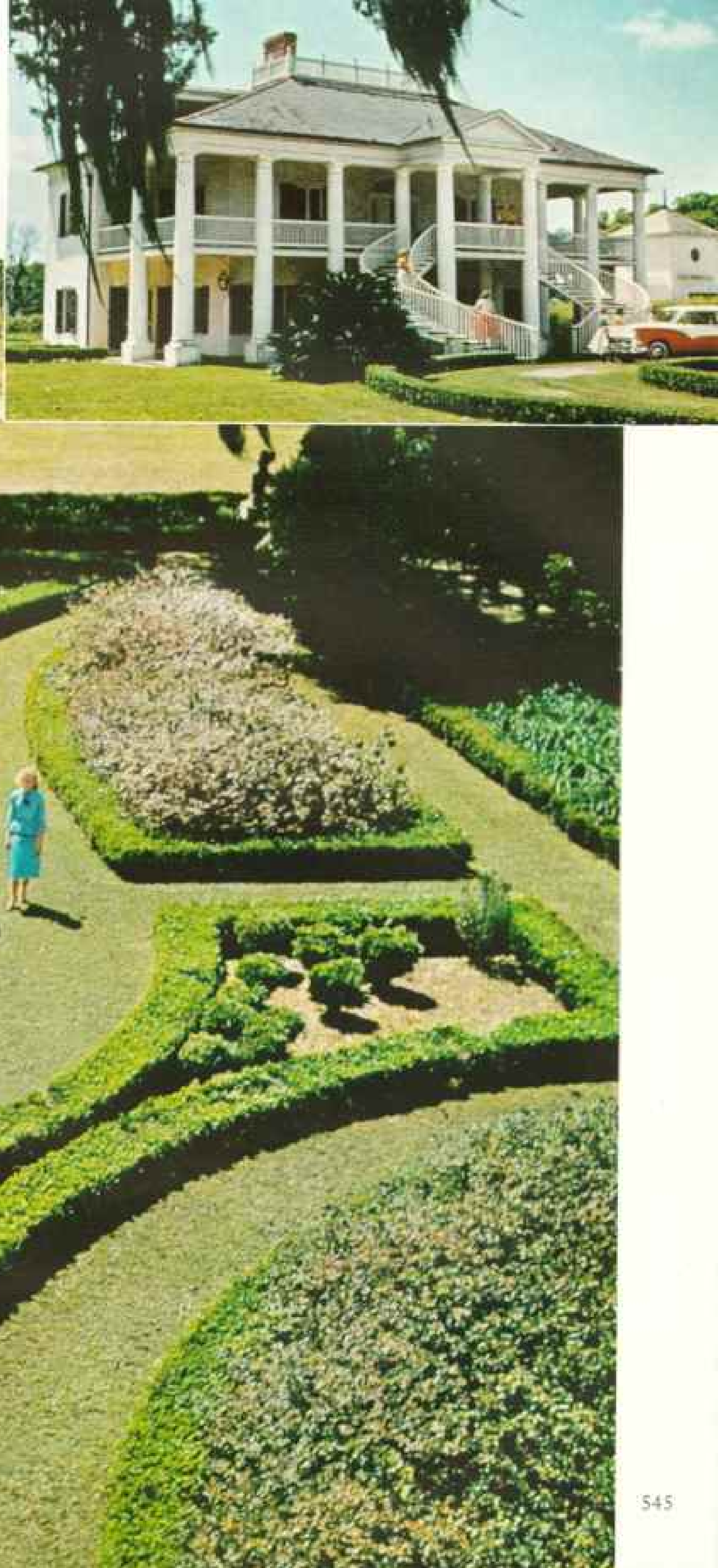
Will You Be My Son-in-law?

On the other side of the river, another Creole family, the Bringiers, left their imprint. Marius Pons Bringier of White Hall was noted for his habit of arranging matches for his daughters. He looked over the field, picked the most impressive prospect, invited him up-river for a visit, then put the question: Will

Beds of Boxwood Pattern the Serene Garden at *Evergreen*

When the Greek Revival swept the United States in the 1800's, the sugar planters' enthusiasm knew no bounds. Homes, stables, and storehouses rose in the image of Greek temples, complete with pillars and pilasters. Small building at the edge of this garden is probably Louisiana's last remaining privy styled in the classic tradition.

Twin staircases curve to a shadowed gallery at Evergreen, a fine example of the old plantation home. Built about 1840, the house has been restored by Mrs. Matilda Gray.



you be my son-in-law? Since M. Bringier had the equivalent of millions, there is no record that any blushing young man ever refused.

Augustin Dominique Tureaud, a man with an impressive profile and a reputation for high living, was once asked to the plantation. Tureaud nodded casually to the 13-year-old daughter Betzy, blinked at Papa's proposal, then accepted at once. The girl, he explained in a memoir, also appeared pleased.

But the family has told how poor Betzy threw herself on the bed, weeping to Maman. M. Tureaud was 37—an old man! Nevertheless, Papa knew best. On the wedding day a year later, Betzy "cried her eyes out" but went through with the ceremony. The marriage worked out well; the high-living gallant settled down, ended as a judge, and the family decided that Papa *had* known best after all.

A Doll for a Teen-age Bride

Betzy's brother, Michel, had his bride picked for him by Papa and the girl's uncle, the Abbé Du Bourg of Baltimore. Michel was 23, Aglaé Du Bourg only 14. She nodded obediently; she showed no surprise when, shortly before the wedding day, she received a superb present—a beautiful doll.

"Do you think it's for me or for my first baby?" Aglaé asked. She played with it for hours, then changed to her wedding dress.

This couple also lived happily together. Theirs was a white house with six columns on each side, a combination of simplicity and massiveness. Young Michel Bringier fought in the Battle of New Orleans under Gen. Andrew Jackson. With French fervor he named his big new house The Hermitage, after Jackson's own place in Tennessee (page 542).

Meanwhile a third Bringier had her mate chosen by Papa. She was Françoise, or Fanny, a bit older than the other girls—almost 14 and a half. The man was a sprightly character, the colorful Christophe Colomb from Santo Domingo, a 31-year-old with no known livelihood, yet the brightest of social gifts. He was a skillful dancer, a singer, a superb conversationalist and *bon vivant*.

The patriarch Bringier listened to the bright Colomb and decided he wanted him around. When Christophe recovered from his surprise, he accepted like all the others. Bringier cut off a plantation and built a house—Bocage, Shady Retreat. It was a kind of dollhouse version of the paternal residence, impeccable in detail.

At Bocage Christophe Colomb proved that he liked plantations and plantation life, as long as he had nothing practical to do with either. Business bored him, he said. In that emergency, teen-age Fanny took over. She announced that she would run things, and she did, riding the sugar acres like any man, inspecting refinery and crops. Meanwhile, Christophe played his guitar, painted pictures, and wrote poetry; he acquired a cushioned, gilded barge with colored sails and had servants row him about the river and bayous. And everybody was happy!

Today, though Papa Bringier's White Hall has gone, two monuments to the Bringier dynasty still exist. Bocage, the Shady Retreat, is the resourcefully restored country home of Dr. Anita Crozat Kohlsdorf of New Orleans. With her late husband, Dr. E. G. Kohlsdorf, this descendant of the Creoles has given Bocage its old luster. Near by, The Hermitage, home of Fanny's brother, has had a succession of owners; today it is owned by Dr. C. Walter Mattingly of New Orleans.

Diplomatic Mission That Came Too Late

Another Bringier, daughter of Michel and Aglaé of The Hermitage, made history when, to the alarm and consternation of conservative Creoles, she married an American. Her husband, Duncan Kenner, created Ashland as a home for his French-American wife, Nanine. The distinguished architect James Gallier designed the residence with square pillars, eight to each exposure, and a heavy majesty.

Duncan Kenner became a high Confederate; on a wartime visit to the sugar region, he had to jump on a fast horse and escape the arriving Unionists. Eventually he had a vital diplomatic mission, an attempt to gain British and French recognition for the South in return for the freeing of the slaves. The Confederacy sent him too late.

In recent years Ashland, renamed Belle Hélène in the 1880's, has known many changes.

(*Continued on page 555*)

San Francisco's Panels Echo the Lavish Decor of a River Packet

Built in 1849, San Francisco was intended to resemble the floating palaces that plied the near-by Mississippi. This style of architecture, known as Steamboat Gothic, stressed deck-like galleries, fluted pillars, rococo grillwork, and profuse interior ornamentation. Dominic Canova, an Italian artist, painted the designs on the drawing room doors.

All Kodachromes by National Geographic Photographer Willard R. Culver © N.G.S.

A Bride's Father Built *The Cottage* as a Wedding Gift

Completed about 1824, the house welcomed such guests as Lafayette, Henry Clay, and Zachary Taylor. During the Civil War it served as a hospital. Recently The Cottage provided a background for *Band of Angels*, a motion picture starring Clark Gable.

Descendants of the Frederick Daniel Conrads, newlyweds for whom the house was built, still own the estate.

Parlange Reflects the Luxury and Taste of Paris a Century Ago

Gilt-frame mirrors, crystal chandelier, inlaid tables, and brocaded sofa and chairs were collected in France by Virginie Ternant Parlange, mistress of the home during the mid-1800's. The portrait shows her son Marius. Her grandson and his wife (seated) now inhabit the 200-year-old house.

Harvester Cuts Jungle-thick Cane in Louisiana's Sugar Bowl

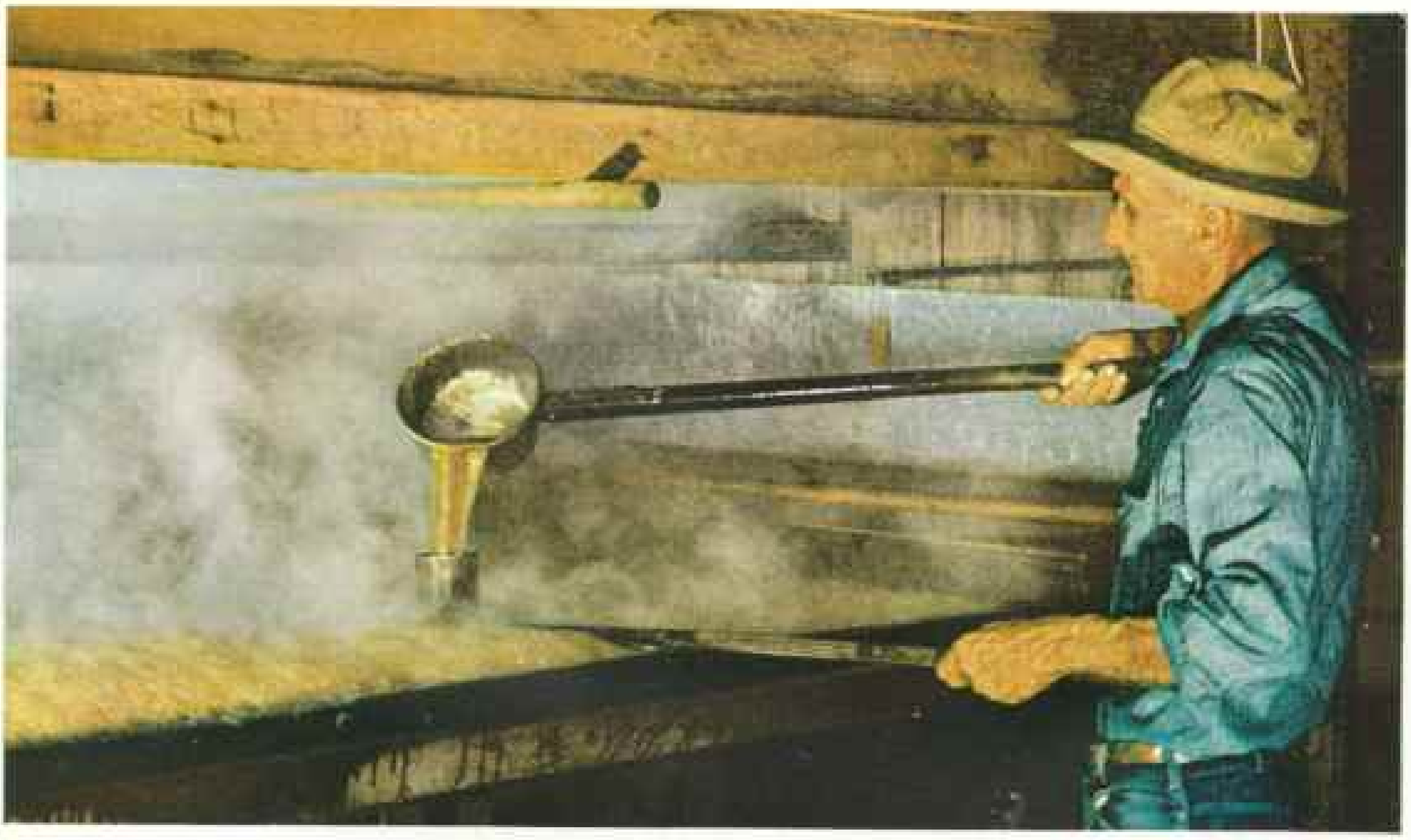
Once men with machetes laboriously slashed their way through cane-choked fields. Now the industry is largely mechanized.

Replacing 75 laborers, this harvester mows down a stand near Raceland. In preparation for burning (opposite below), conveyor chains lay cut stalks across the rows. Elsewhere in the world cane is burned standing.

The State produces more than 75 percent of the sugar cane raised on the U. S. mainland.

Flash fire sears dry leaves off stalks. Juices remain unharmed. Tractor-drawn burner shoots a stream of flaming gasoline. Later, the cane is loaded on trucks and delivered to the grinding mill (page 552).

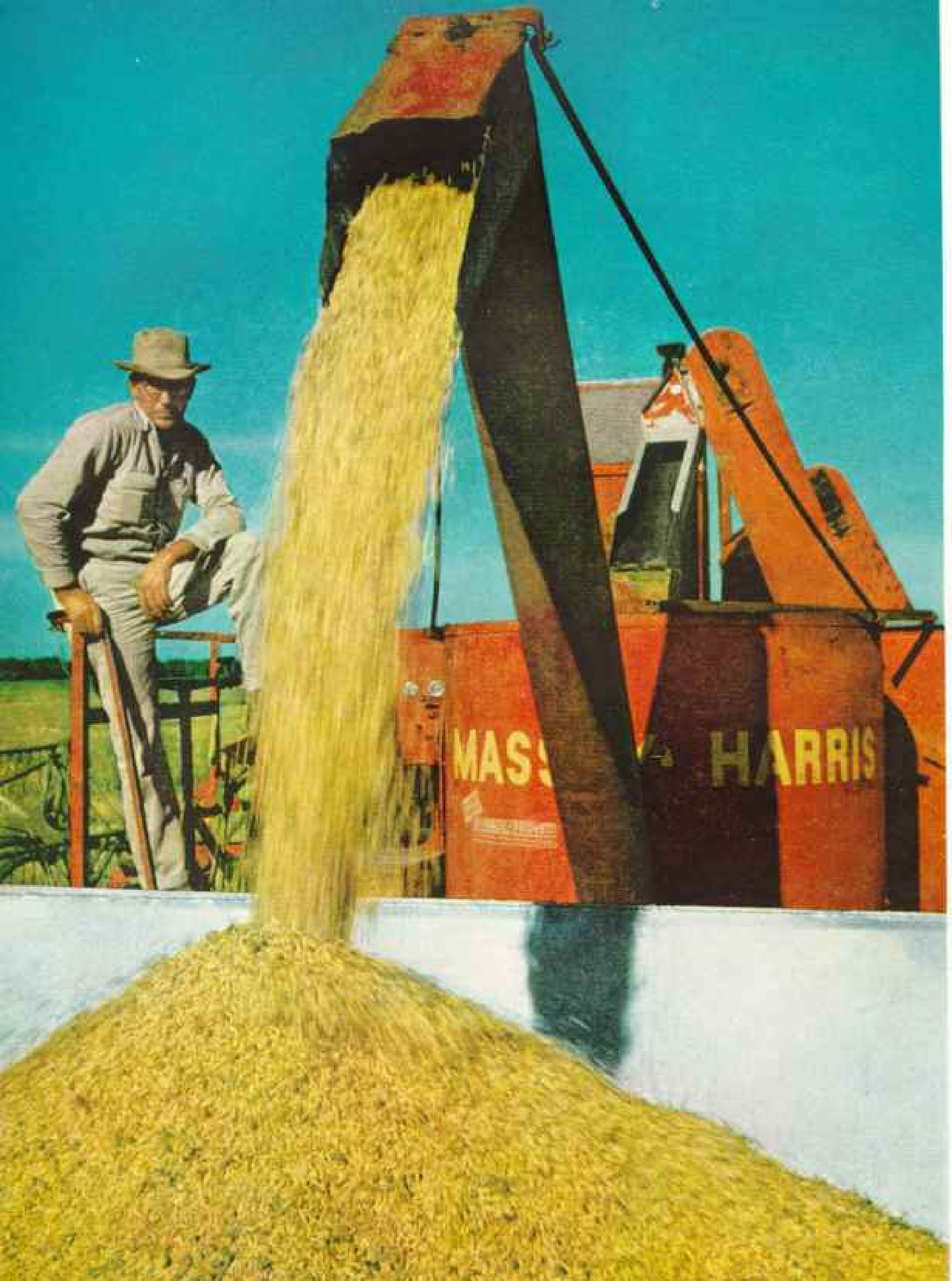
Workman draws off a cup of boiling sirup for testing. In this small mill near Pierre Part, juices crushed from the cane are boiled in open vats. Impurities, rising to the surface, are skimmed off.



Groaning with Cane, Trucks Roll to Mill in Continuous Convoy

Mid-October signals the start of furious activity in the sugar country. The theme of every waking moment is "Get the cane to the mill before the freeze." Derricks here lift the crop from trailer beds. This grinding mill at Baldwin works around the clock—chopping and crushing stalks to extract juice; clarifying and evaporating juice to produce sirup; and whirling the sirup in centrifugals to separate it into molasses and raw sugar.

Rollers crush shredded cane in a sugar mill at Raceland. Juice extracted, the fibrous residue, called bagasse, makes fiberboard, paper, and other products.


MASS
HARRIS

Weather-stained, still imposing, it has been repaired by Mrs. Hélène R. Hayward (page 542).

A short way up from Baton Rouge lies False River, once a main course of the Mississippi, now a lake sealed off from the river. Its great house of tradition is still there, its present owners direct descendants of the original builders.

Some time before 1750, the Marquis Vincent de Ternant of Damvillier sur Meuse arrived with a land grant on the placid waters. Within a decade or so the Marquis de Ternant had put up the beginnings of a brilliant Creole home—a first floor with brick piers, wooden galleries on all four sides, walls of brick between wood, and a downsweeping roof.

Ghost Haunts False River Mansion

The marquis died; his son married, became a widower, married again. The new wife, Virginie de Ternant, achieved celebrity as the "Great Lady of False River," a woman of rare tastes, of extravagances, and, not least, a stubborn will.

That will brought tragedy and gave her house its ghost. When her pensive daughter Julie fell in love with a Louisiana boy, Madame silenced her; the lady had other plans—a French count. Julie submitted, and on the wedding evening hundreds of guests filled the estate to watch the white-faced girl take her nuptial vows.

An hour later, standing in the drawing room, Julie gave a scream, ran down the front stairs, and threw herself at the roots of a great oak. When she died, some say of melancholia, she was buried in her wedding gown.

The girl's mother, for years a widow, remained her dominant self. In time she was married again, to Col. Charles Parlange of the French Army; the house took its name, Parlange, from him. His wife made an impressive figure at the Paris opera and on tours of the Continent. After some years she became a widow once more and spent most of her time in Louisiana.

Her house was now the heart of her life; all her interests centered there. When war began with the North, a Union Army marched toward False River, and Virginie determined to save Parlange. Her neighbors left the area or stared out in cold hostility. Not so Virginie. She ordered a brilliant meal set on snowy tables under the trees and then, freshly garbed, combed, and powdered, she advanced with a smile—and the keys of her estate.

They could have what they wished, she told the invaders. At the same moment servants ran up with bottles of the best wine. As a result, the soldiers took little.

After the war Parlange declined badly; the widow cried when she saw Charles, her son by the second marriage, plowing his own land. Yet the durable lady eventually did best of all with this last boy. He became Lieutenant Governor, United States District Attorney, Supreme Court Justice of Louisiana, and finally a Federal District Judge. Later Parlange lay empty until after World War I, when the judge's son, Walter Charles Parlange, and his Creole wife returned to False River.

They are still there. In 1958 their home, serene among its trees, is a museum of plantation life, with rare furnishings of earlier days (page 549). Two thousands acres of the original 5,000 remain; Mr. Parlange raises cattle, cotton, cane, and corn, while he leases part of the land to oil companies.

Parlange has its ghost, one of Louisiana's most famous. Even now, it is said, those with the eyes to see may make out a pale figure moving in the dark among the trees—poor Julie, the girl who collapsed on her wedding night.

Have the Parlanges of today seen Julie? When I stayed with them, they smiled at the question. "We do not say. But there are stories. . . ." Through two evenings I watched and listened, but alas, the sad wraith never materialized. Others may have better luck.

Prince Became a Postmaster

Swallowed up in present-day Baton Rouge is Magnolia Mound, of early design but boasting the sophistication of an arched music chamber. Built before 1800, it once housed a prince who became an American country postmaster.

The effervescent Charles Louis Napoleon Achille Murat was Bonaparte's nephew; for a time he enjoyed himself as crown prince of his father's kingdom of Naples. Then events forced out the Murats, and Prince Achille went to Florida, where he married a great-

Rice Flows from Combine to Cart in a Golden Cascade

The grain may sour if not dried within 24 hours of threshing. To save the crop, rice buggies drawn by tractors trail the combines through the fields. Filled, the carts dash for trucks, which complete delivery to driers. This farm near Convent helps make Louisiana a top-ranking rice producer. In the State, the grain runs second only to cotton in value.

Ghostly Shrouds of Spanish Moss Drape Gaunt Cypresses

Pickers on Bayou Pierre Part use long poles to hook the hairlike plant found on lower branches; they climb the trees to strip higher limbs. The harvest goes to furniture manufacturers for stuffing chairs and sofas. Not a parasite, Spanish moss feeds on air, but can smother trees.

A Fur Trapper Pilots His Home to Work in the Watery Wild

The foot of Louisiana's boot is a vast lowland cracked by thousands of rivers and channels, bayous and sloughs. Countless muskrats, nutria, minks, raccoons, otters, and opossums make the State the Nation's ranking fur producer.

Winter's coming signals the exodus of thousands of trappers and their families from bayou villages to wilderness. Headquarters such as this house on a tuft chug out through the waterways, carrying everything from children to chickens.

The slash of a knife skins a raccoon. The pelt will dry on a square rack (right). Center frames hold mink.

Kodachromes by National Geographic Photographer Willard R. Culver and Justin Locke (right) © N.G.S.

grandniece of George Washington and also served as a part-time postmaster.

In time the prince moved to Magnolia Mound and enjoyed experiments with sugar vats, the hunting of swamp animals, and, to his neighbors' astonishment, the cooking of meals using owls, rattlesnakes, and alligator tails. Prince or no prince, he eventually had few dinner guests. Hating the heat and humidity of his adopted land, Achille spent days reading in a chair fixed in the water on the bottom of a shallow pond. But he also neglected his fields; when he departed he left only debts and anecdotes behind.

Not far from New Orleans stands a pair of houses famous for, among other things, the family quirks of their former owners. Ormond is identified with the "Fighting Butlers," five Revolutionary heroes honored by Washington. After 1800, Richard Butler, son of one of the heroes, came to the Creole city and bought the Trépagnier home. He renamed it Ormond, for the residence of his ancestors, the Dukes of Ormond.

It was Richard's peppery uncle Thomas, however, who attracted the most attention. He collided with his Army superior, Gen. James Wilkinson, in a roaring dispute that almost split the service. Wilkinson issued a famous order calling on officers to clip the braids at the back of their necks. Thomas Butler said he would use scissors for no man; gentlemen had always had such "tails."

Wilkinson had Butler arrested for tending "to excite . . . sedition and mutiny." So hot was the argument that it came to the attention of President Jefferson himself. It ended only in 1805, when Butler died at Ormond plantation—and went to the grave still wearing his braid.

Greek Statues Wore Mother Hubbards

The Butlers married McCutchons, who took over Ormond; then the McCutchons allied themselves with the d'Estréhans of the adjoining plantation of that name. The d'Estréhans had a paterfamilias who made sugar people chuckle when he erected a museum for his children and filled it with Greek statuary. He exposed them frequently to this cultural influence, but before each visit he had a slave hurriedly cover the undraped male and female figures with Mother Hubbards.

The d'Estréhans bought and remodeled a home in the West Indian style, with raised basement. After 1820 the Greek Revival spread over the State, and Destrehan shows its influence, with heavy columns added to the earlier style. Both houses, Ormond and Destrehan, have had many vicissitudes. Today the American Oil Company has taken over the latter property, with storage tanks spotting the fields once devoted to cane, and the building operated as an office (page 566).

Ormond has been snatched from ruin at a late hour by Mr. and Mrs. Alfred W. Brown of New Orleans. Operating his business in the city, Mr. Brown maintains his residence at the plantation. The Browns also raise superior cattle on their acres. Thousands who pass admire Ormond's central Creole building with two side structures tied by galleries to the earlier section.

Houmas House, an Anglo-Saxon Island

Upriver is Houmas House, a monument to American determination to rule the Creole area. In 1811 the famous Revolutionary War hero Wade Hampton of South Carolina, a pioneer in the growing of cotton, bought a great tract on the Mississippi. Eventually, this island of early Anglo-Saxonism spread itself over the riverbank.

Hampton's son-in-law put up a massive structure, two and a half stories with columns on three sides and a glass-windowed belvedere —a building imposing to the point of haughtiness (pages 538-9). Then in 1857 a red-headed Irishman, bachelor John Burnside, rode upriver and bought the 20,000 acres or so that included Houmas House. Burnside said little, but it soon became apparent that he intended to be the great man of the river.

He succeeded, adding plantations in the way some growers bought necklaces for their wives; in time he had five or more. The newspaper *True Delta* called Houmas House "the finest property possessed by any single individual in America." Few women were to be found there; it was a bachelor's paradise, with its own peculiar luxuries.

A British traveler, William Russell, visited Houmas House about a century ago and described in his diary some of the pitfalls of plantation hospitality. One was the morning bath—a tub full of Mississippi River water with lumps of ice floating in it. Another was the pre-breakfast mint julep, borne into the bedroom by a servant.

Sometimes, Russell recalled, julep number one was followed by julep number two—shudderingly rejected. And on one occasion,

Father and Son Trap Crayfish on the Belle River

The edible crayfish (or crawfish) is a harbinger of spring in the fresh-water swamps and flood plains of Louisiana. Many are taken by amateurs. One old-time recipe for crayfish bisque recognizes this fact by calling for "as many crayfish as a little boy or girl can catch."

Here Godfrey Cavallier, a trapper in winter, pours a catch of some 120 crayfish that crawled into his wire trap during a day. He sells to restaurants specializing in crayfish dishes.

Housewives catch supper. Heads are stuffed and served in bisque.

National Geographic Photographer Willard R. Culver (above) and Justin Locke © N.G.S.

at least, a third julep arrived; this time the servant delivered a firm message: "Master say you better *take* this. It's the las' he gon' make before breakfast!"

Today another bachelor, Dr. George Crozat of New Orleans, maintains Houmas House as a country residence. Cattle and a few crops occupy his staff, but Houmas is primarily a riverside home. "It represents," says Dr. Crozat, "the kind of place I wanted for a long time. I consider myself fortunate to be able to restore it in much the way I hoped to do."

Eight Belles in an Oval Ballroom

On the opposite, western bank, two former Virginians did brilliantly in sugar; each tried to outdo the other in plantation grandeur. In the late 1850's, the region saw a pair of residences that broke all records for size and ornamentation.

The first man, John Hampden Randolph, had 11 children—eight girls and three boys, which meant eight husbands to be found. In 1858 Mr. Randolph finished building Nottoway, a sprawling structure with white woodwork, black and white marble mantels, and tiered crystal chandeliers. It has a spacious oval ballroom all in white, even to the tiled floors. With all those daughters, the Randolphs needed their own ballroom!

Nottoway has 50 rooms of assorted sizes, porticoes, an oval gallery with its own columns that follows the curve of the ballroom; and, inside and out, more pillars, ornamental arches, and carved wood atop carved wood. There are 200 windows, 6 stairways, and 15 slave bells, each with a different tone to summon domestics to the proper rooms.

A neighbor, John Andrews, also specialized in girls; he produced five. Mr. Andrews entered the building contest and in 1857 gave Louisiana its most massive private home, Belle Grove. It was grandeur in pink stucco over brick, an irregular pile of 75 rooms, with galleries, a series of wings, dozens of inside columns and pilasters, silver doorknobs, and, outside, an overpowering façade with four florid Corinthian columns.

When I took a Texas girl to see Belle Grove some years ago, she sighed: "It's wonderful, but it's really three or four houses in one. And I'd pity any woman who had to look after it!"

An alcove was the "flirtation room" with a "courting sofa," on which, the natives said, 11 young men became engaged to 11 belles; after that the sugar people lost count. Many also tell the story of a grande dame who dropped a diamond earring at a supper in the great dining room. "Don't bother," she waved away the man beside her. "The servants will sweep it up in the morning."

Each house soon lost its original owner. But the man with the eight daughters has triumphed in the end over the one with five. Nottoway was acquired in 1915 by Dr. Whyte G. Owen. His son Stanford, a school administrator and attorney, maintains the estate with his wife, though he admits that such an establishment offers many difficulties—not least the matter of heating. Everything is scaled in proportion to the size of the house.

At times I have walked with the Owens through the silent White Ballroom with its columns and friezes and through the dining room, with its delicately tinted plaster moldings representing pink camellias with green leaves. At such hours it is impossible not to feel a certain nostalgia for the days long past when the house was filled with bright entertainment.

But on the massive Belle Grove calamity has fallen. For years it was a ponderous ruin, and friends with whom I have visited it shook their heads whenever we stopped before gaping window holes and saw grass growing from cracks in the walls. Stately staircases dropped off; once, walking across a damp floor over which gay dancers had moved, I fell nearly a foot through the rotting wood. And cows grazed about the wreckage. Then, a few years ago, fire destroyed the interior, and the remaining brick walls were torn down.

Where Lafayette Was Entertained

By contrast there are others up and down the river. Evergreen, shining in a memorable restoration, is owned by Mrs. Matilda Gray of Lake Charles and operated as a farm, cattle property, and country place. Mrs. Gray, an expert business woman, sees Evergreen as "an experiment that proved itself." It has an imposing double curving wooden stairway before the house, and an unusually complete set of side buildings, all in Greek Revival, including the privy—probably the only classic-style privy left in Louisiana (pages 544-5).

Near Baton Rouge stands The Cottage, wide, tall, with a dozen majestic pillars (page 548). The Bailey and Reynaud families, descendants of the original owners, have formed a corporation to preserve the old house with

Women Tie Twists of Perique, a Tobacco Grown Only in Louisiana

Throughout the world only about a thousand acres in St. James Parish appear to have the right soil and climate for the cultivation of this strong, spicy leaf. Blenders call it U. S. type 72 and use it to flavor lighter tobaccos in mixtures prepared for pipe smokers. These twists will cure in their own juice under pressure, according to a unique process.

its remaining 30 acres. "The building is surprisingly sound," says James Bailey, an attorney, "and yet it needs much work. We hope to create a kind of memorial to its long history."

At The Cottage, Lafayette was entertained, as were Henry Clay and Judah P. Benjamin, the Confederacy's Secretary of War. It has seen glory and tragedy. When the steamboat *Princess* exploded in the river in 1859 the victims, burned and scalded, were brought to the lawn. Sheets were thrown hastily on the ground, flour was poured on them, and men, women, and children were rolled in the white coating. Some died in only slightly lessened agony; others survived.

The many-columned Three Oaks near New Orleans; Bellechasse, down the river, onetime home of Judah Benjamin; Tezcuco, Whitney, Keller . . . there are many others.

In recent years special attention has been drawn to the mansion called San Francisco, 35 miles above New Orleans, a remarkable example of the so-called Steamboat Gothic type of architecture, with much wooden carving, many small dormer windows, ironwork, and a belvedere.

It is now the home of Mr. and Mrs. Clark

Like Venetian Gondoliers, Bayou Men Stand Up to Paddle Their Skiffs

In country that road builders once despairingly described as liquid mud, bayous serve as the main highways and boats as the leading vehicles. The

© National Geographic Society

shallow-draft vessels can "ride a heavy dew," as the local phrase has it. One bayou man's wry comment on his life's condition: "If I'd be born any further to the south, I'd be a soft-shell crab right now." Here on Grand Bayou, near Pierre Part, teen-agers gather under a moss-fringed cypress and live oaks.

Molten Aluminum Gushes from Crucible to Half-ton Molds

Kaiser Aluminum & Chemical Corporation's Chalmette Works produces 495,000,000 pounds of primary aluminum annually, more than the whole Nation turned out before 1941.

Thompson and is open to the public, with old cisterns, galleries, fountains, and interior intact—and doors and ceilings painted by Dominic Canova of Italy (page 547).

The old-time kings and captains have departed, but sugar making continues. Today the world consumes more of the sweet stuff than it ever did. The average American uses about a hundred pounds a year; the United States absorbs a fifth of the world supply.

Sugar is dependent on warm sunshine, plentiful rainfall, and proper drainage—enough water but not too much. The longer the stalks stay above ground, the higher the sugar content; and yet if they remain too long, cold may destroy the crop.

Machines Speed Harvesting

Cane is grown not from true seed but from stalks, each bearing "eyes," or buds, at the joints. Planting takes place in late summer or fall, and before long, light-green shoots push up. They become thicker, stronger; by the next July the waving emerald growth spreads everywhere, like a becalmed lake.

Then, usually by mid-October, a signal goes out. Regularly for much of my life I have gone to friends' sugar establishments to hear the banging of bells, the excited cries in the morning. The cane cutting is on! For weeks the plantation will operate at full speed, with unending intensity. "Get the crop in before a hard freeze"—that is the theme of every waking hour.

As a boy I watched big-eyed as bandannaed Negroes went down the lines, knives flashing in the sun, men grinning as they slashed off the stalk. "Gotta move fas' terday . . ." "Ain' *no* time ter was'e!" Crews competed for prizes, and work-worn carts lumbered off with the produce.

Gradually I have seen cane harvesting modernized. The American Sugar Cane League calls the industry one of the most highly mechanized in the world. Yet it still uses 16,000 field workers during peak months.

Last fall, with guests from the East, I went above New Orleans to the town of Reserve to look on as mechanical harvesters, each doing the work of 75 persons, cut the cane evenly with the ground, severed the tops, and deposited the stalks on the ground. A day later, after the leaves had dried a bit, flames, applied by other workers, burned off foliage. After that, mechanical loaders lifted the cane into carts that hauled it away (pages 550-3).

At the National Sugar Refining Company's plant at Reserve we blinked while mechanical knives cut stalks to bits, and thick rollers crushed them for their juice. Lime was added to help precipitate impurities, and the liquid flowed into great clarifiers; there the foaming juice rolled about at some 190° F.

Everywhere was the hiss and pound of machinery and a smell never forgotten from childhood, the cloying richness of the cane.

In towering evaporators the juice became a thick sirup; in vacuum pans it crystallized. "And there are still more steps," I explained to the newcomers. Revolving screens, called centrifugals, separated the molasses, and now the raw sugar crystals were washed, melted in water, treated with chemicals, filtered with animal bone char, and eventually recrystallized. At last came sugar driers—revolving drums—and the packaging department.

"What's that?" One of my companions pointed to bales of a pale stuff piled high. It was bagasse, the juiceless pulp left after the crushing. Once bagasse was burned as refuse; now it is used for fuel and to make paper, wallboard, and other products.

A few hours later, in a remote spot, our party halted before one of the last remaining little sirup-making mills. There several families fed crushers by hand; in open kettles the liquid bubbled, and we took samples of dripping sirup. As a boy I had thought it a taste more wonderful than anything on earth; it still had a pleasant flavor.

Today more than 200,000 acres of Louisiana cane are harvested annually—producing over three-fourths of the Nation's mainland crop.

New Plants Among the Cane

But meanwhile a lower Mississippi revolution has modified sugar's reign. Early in the 1900's the first large industrial plants appeared; with World War II and in the years since then an astonishing complex has sprung up, involving some two billion dollars in new or expanded operations.

Chemical, manufacturing, and processing establishments occupy mile after mile of Mississippi frontage. Steel towers rise and derricks dot the levee edge, until the region from New Orleans to Baton Rouge seems one great chemical-industrial plant.

The area within a 100-mile radius of New Orleans contains about 6,300 active oil wells and 665 producing gas wells. Each week the State brings up oil greater in value than the

Oil Tanks Engulf *Destrehan*, Once a Manor, Now an Office

Planter Jean Noël d'Estréhan lived in the tree-flanked Mississippi River home in the early 1800's with his wife and 14 children. Today storage tanks and refinery of the American Oil Company dot the fields. An ocean-going tanker ties up where steamboats once loaded sugar.

Black gold flows from 6,300 oil wells within a 100-mile radius of New Orleans. This derrick towers above sugar cane.

$15,000,000 the United States paid for all the Louisiana territory.

Aluminum, gasoline, plastics . . . these and many other products have their role in a vast new industrial empire (page 564). The area meets five basic needs: Fresh water, natural gas, petroleum, salt, and sulphur are all available.*

In the old days sugar workers occasionally earned a few dollars by setting traps in the marsh. Today Louisiana produces more pelts than any other State. Shrimp, crabs, oysters, fishing—each source provides income for thousands. Within a few miles of the old sugar castles reapers of the water go for days through echoing stretches that might be a continent—and a century—away.

For other miles along the river, acres are thick with vegetable growth. The easy climate makes it possible to send truck goods to eastern and northern markets ahead of most other sections in spring and winter. Creole and Acadian vegetable growers work side by side with descendants of Italians, Irishmen, and Germans. Together they produce, for instance, about 95 percent of the Nation's shallots, a kind of green onion.

And in the heart of the cane locale there thrives a curious agricultural subindustry. Only on some 1,000 acres near Lutcher can perique tobacco be grown (page 561). A combination of climate and soil content may be the explanation; attempts to cultivate it elsewhere have failed. Cured perique is glossy and black; though natives smoke it straight, most Americans gasp at the experience. After many tries, even though Louisiana-born, I gave it up. The world uses perique for blending with milder kinds. Indians first grew it here; the people of the river edge took it over.

Oil, chemicals, truck gardening, trapping, perique. . . . Sugar shares some of his sway with them. But he has still to give up his throne completely.

*See, in the National Geographic Magazine: "Louisiana Trades with the World," December, 1947; and "How We Use the Gulf of Mexico," January, 1944, both by Frederick Simpich.

THE MANY-SIDED Diamond

By George S. Switzer, Curator of Mineralogy, Smithsonian Institution

A DIAMOND as big as an ice cube lay in the cutter's hand. Light glinted from a flat "window" ground smooth on one side of the jagged stone.

"Take a look," the craftsman said, tilting it into my open palm. "Not a flaw!"

Squinting through a jeweler's lens, I peered into the clear depths of the stone. "How much will it be worth when finished?" I asked, still bent to my examination.

"We hope about two million dollars," a voice answered casually.

I started, the lens slipped from my fingers, and in that instant I almost dropped the largest new diamond seen in the United States in 15 years—one that the late Sir Ernest Oppenheimer, head of the vast De Beers diamond empire, described as "the most magnificent stone ever discovered in South Africa."

I had driven to New York City to see this newest of the world's great gems, bought and being cut by Harry Winston, Inc., one of the world's leading dealers in diamonds.

As a mineralogist at the Smithsonian Institution in Washington, D. C., I am often concerned in my daily work with rare and precious gems. In the Smithsonian's new Hall of Gems and Minerals, opening this spring, both cut and uncut diamonds will be displayed.

Yet seldom do I have a chance to examine a new diamond of the size and perfection

Ice-pure and flawless, the 128-carat pear is now called the Niarchos Diamond for Stavros S. Niarchos, Greek ship operator who bought it from Harry Winston, Inc. The square-cut canary-yellow diamond, also of 128 carats, recently went on sale at Tiffany's.

Tragedy Haunts the Hope Diamond, Fabulous Treasure of Royalty

The rare, deep-blue stone is traditionally associated with some dozen violent deaths and with disasters to two royal houses. As part of the larger French Blue, the diamond adorned Louis XIV. Stolen during the French Revolution, it reappeared in England cut to this 44½-carat oval. It took its name from banker Henry Thomas Hope, who acquired it in the mid-1800's.

Later, Sultan Abdul-Hamid of Turkey bought the gem and hung it on the neck of a favorite wife. When his throne toppled, the jewel was purchased by Evalyn Walsh McLean. After her death the Hope passed to Harry Winston, New York jeweler.

Mounted in a clip, the 79-carat diamond at left was mined in India and treasured for years by a noble family of Nepal. Now a Winston property, it carries a $500,000 price tag.

Diamonds sparkle in rainbow colors. Arranged like a necklace, these gems form part of a treasury of 150 "fancies," world's largest and best collection of naturally tinted diamonds. Owned and exhibited in London by The Diamond Corporation, Ltd., the stones are not for sale, and thus have never been priced. However, the pinks and blues have the greatest value, as they are rarest. Shown for scale, the 167-carat uncut stone was found at the Dutoitspan Mine, Kimberley. Its name: The Cape; its estimated worth: $42,000.

of the stone Winston then was cutting, and which he later sold to the Greek shipowner Stavros S. Niarchos (opposite, below).

It is strange, in a way, that the diamond holds such fascination. For untold centuries men have fought and died for possession of far smaller bits of this same glittering mineral. Yet today nearly five *tons* of diamonds are mined in a year, the greater proportion destined not for gems at all but for use in workaday industrial plants.

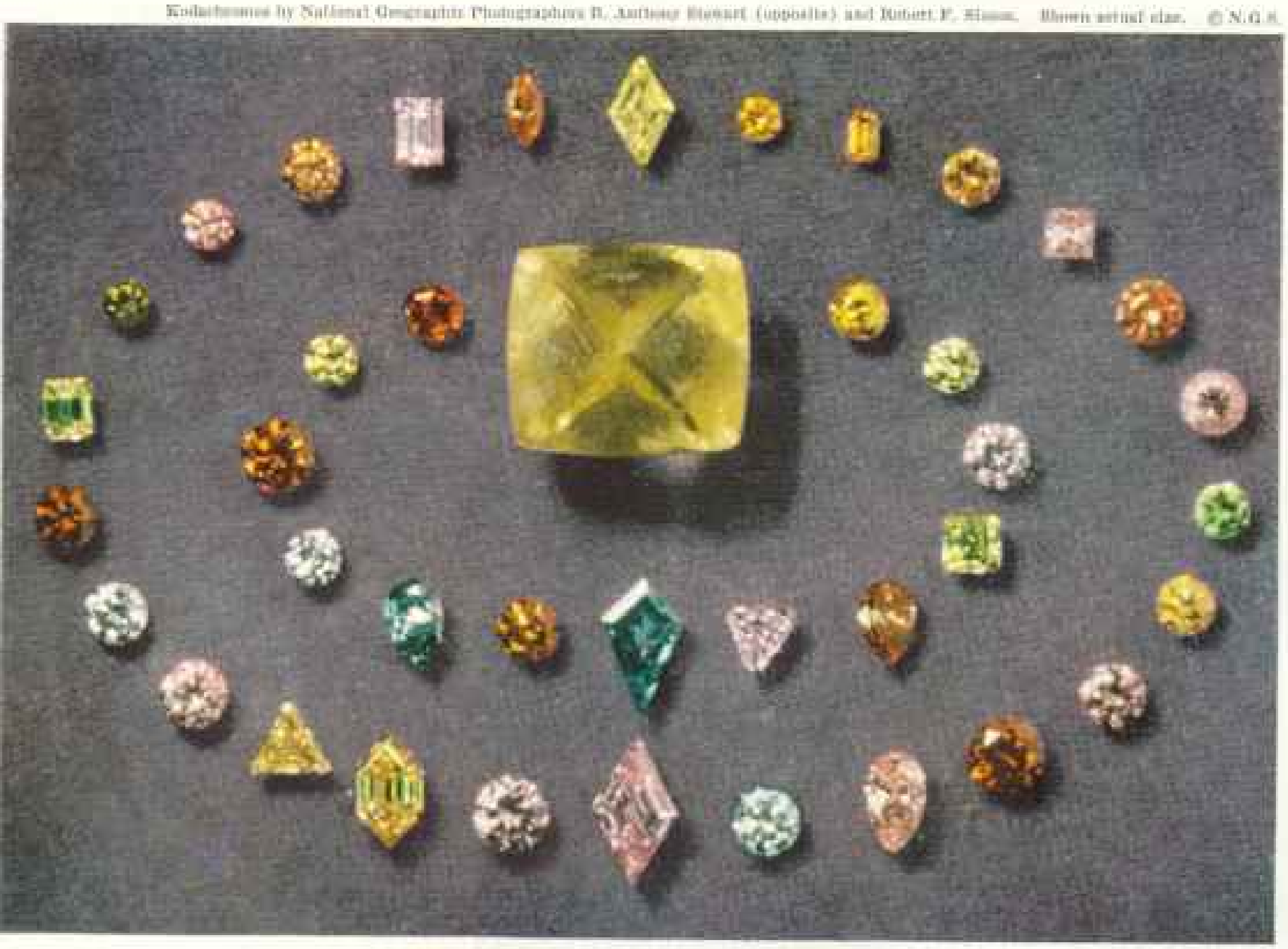
This substance, diamond, is familiar to most of us as the glint on the third finger of a woman's left hand, in a flashing necklace in a jeweler's window, or perhaps as the nearly invisible tip of a high-fidelity phonograph stylus.

But the day before, in a clattering New Jersey factory, I had watched a sackful of rough dark-brown pebbles—all diamonds—disappear into a crushing mill and emerge as dust for making grindstones.

The car I drove ran smoothly, in part because diamonds had polished its piston rings. It ran on gasoline taken from wells drilled by diamonds. The wire in its ignition system had, in all probability, been drawn through a hole in a diamond.

Diamonds cut steel, saw stone, shape bowl-

Kodachromes by National Geographic Photographers B. Anthony Stewart (opposite) and Robert F. Sisson. Rhoen aerial elec. © N.G.S.



ing balls, polish dental fillings, and play much of the world's music today. Without diamonds, many machine-age mass-production processes would come to a stop as surely as if their power were shut off.

Earth's Masterpiece Is Ordinary Carbon

What is this spectacular substance, which can be worth $2,000,000 for a polished chunk scarcely larger than the bowl of a teaspoon?

Pure carbon—the same basic element that forms coal, graphite, lampblack, and common soot. But in this case the carbon was forged by giant pressure and heat deep in the earth.

Diamond is the hardest natural material known to man; it is many times harder than corundum, of which ruby and sapphire are formed. It is harder, too, than the best man-made abrasives now in use, such as silicon or tungsten carbide. Only recently have scientists been able to make synthetic diamond, as well as a previously unknown substance named borazon, which can make a scratch even on a natural diamond.

The ancients considered this king of stones indestructible. The very word "diamond" comes from the Greek *adamas*, meaning invincible or unconquerable. Pliny, in the first century A. D., wrote "these stones are tested upon the anvil, and will resist the blow to such an extent, as to make the iron rebound and the very anvil split asunder."

A diamond will cut any other substance; it remains unaffected by the strongest acids. Yet heat a diamond hot enough in the presence of air, and it will disappear as a colorless gas, carbon dioxide. Tap it in just the right spot, and it will shatter.

Diamond can be split, or cleaved, along what diamond cutters call its "grain." In the alignment of carbon atoms in the crystal, electrical bonds are stronger in certain directions than in others. Where they are weakest, a diamond can be cleaved.

Workshop Turns Pebbles into Jewels

Sawing, shaping, and polishing a large rough diamond into a great jewel often requires more than a year from start to finish.*

Just off Fifth Avenue on 51st Street, the Winston showrooms and workshops present a dignified granite face framing a heavy wrought-iron gate, and, inside that, a barred front door of stainless steel.

I pushed a buzzer, was admitted by a watchful receptionist and a burly guard in plain clothes, and a few minutes later met the firm's general manager, Daniel Frey. We hummed upward in an elevator no larger than a coat closet, and on the fifth floor were admitted through another locked door to the cutting room.

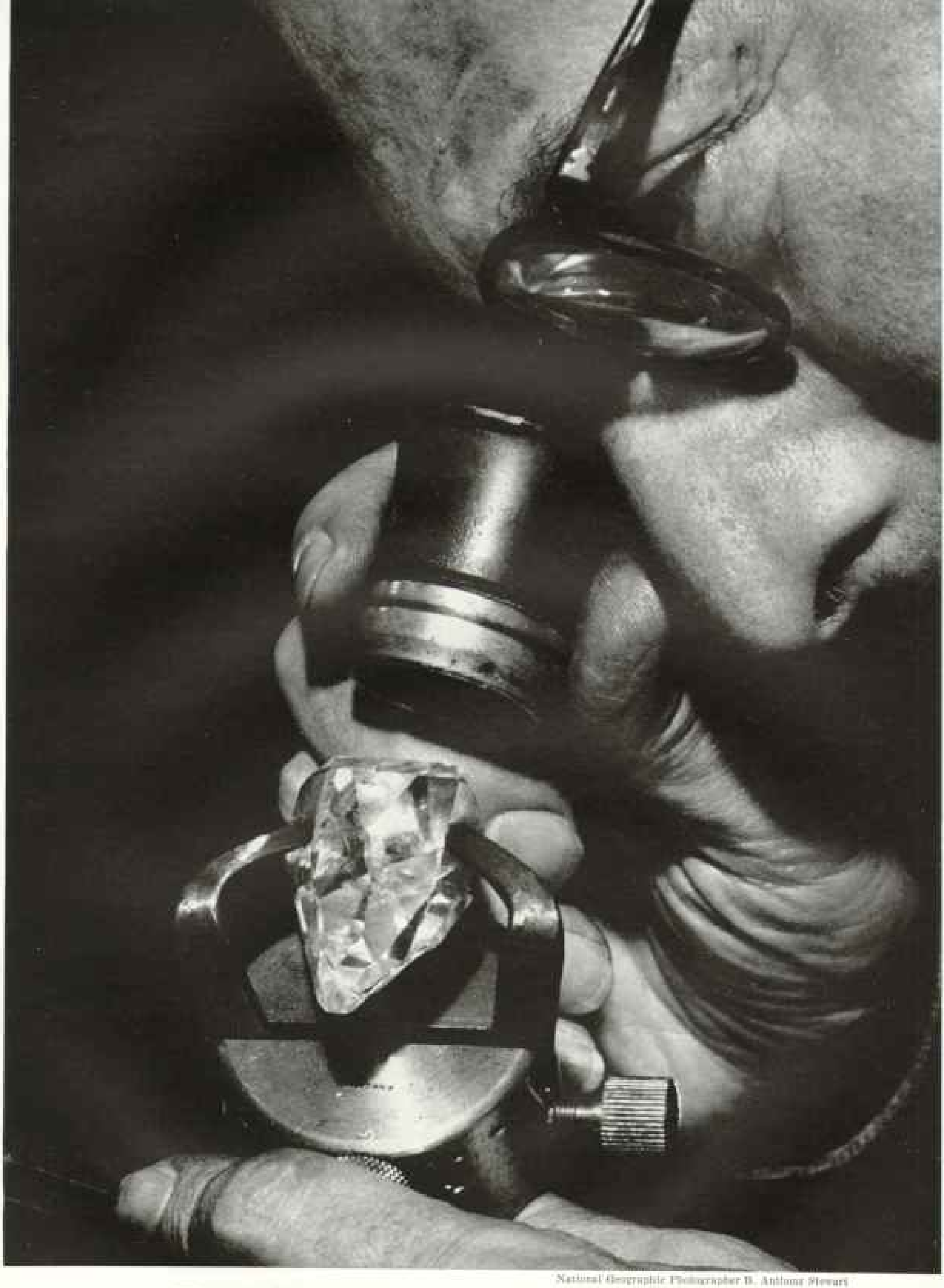
The new diamond I had come to see was dubbed the Ice Queen among the cutters (opposite). For six months it had been studied, sketched, and modeled in lead in various possible final shapes. Then Mr. Winston had to make a momentous decision.

Should he cut this huge rough stone, weighing 426½ carats, or nearly three ounces, into a number of smaller jewels, or should

* See "Exploring the World of Gems," by W. F. Foshag, National Geographic Magazine, December, 1950.

Diamond dust on spinning wheel opens a window to the shimmering heart of the big stone that became the Niarchos (page 568 and opposite). In the rough, it weighed 426½ carats. Two pieces cut off in early shaping yielded gems of 40 and 28 carats. Now taking the shape of a pear, the jewel undergoes faceting on a grinding skeif. Since diamond must be used to cut diamond, the wheel wears an oily film of diamond powder.

National Geographic Photographer B. Anthony Stewart



National Geographic Photographer B. Anthony Stewart

Winston's Chief Cutter, Bernard de Haan, Studies His Ice Queen

Son, grandson, and great-grandson of Amsterdam diamond cutters, Mr. de Haan met his greatest challenge in New York while fashioning the Niarchos. "I called it the Ice Queen," he says, "because the rough stone would have been hard to spot in a bucket of ice cubes."

he create the largest possible gem from it? He chose the latter. Now his cutters were busy shaping a dazzling teardrop that would measure nearly two inches long (page 568).

He was taking a daring gamble. In the finishing, the stone would shrink to less than a third of its original size; much of the remainder would be lost into thin air as dust.

The final giant pendant, potentially more valuable than the same weight in smaller diamonds, might not even be salable. The jeweler could think of no more than a dozen possible buyers for such a stone: one or two Near Eastern oil potentates, a few kingdoms that might want a new crown jewel, even fewer private individuals of kingly wealth. But the finished stone would surely join the world's great gems. (Its eventual name: The Niarchos.)

Diamonds Scream on Cutting Wheel

Winston's chief diamond cutter, Bernard de Haan, greeted me with a smile. His workroom whirred with the sound of electric motors, broken by the occasional piercing screech of a rough diamond bearing against a metal cutting wheel.

One end already had been cut from the huge rough stone. Instead of cleaving the original crystal, splitting it dramatically by a single tap of a hammer on a steel wedge, Mr. de Haan had to wait while the stone was sawed twice, for the two necessary cuts did not fall along the diamond's natural grain.

A paper-thin phosphor-bronze disk spinning at high speed, its edge "charged" with diamond dust mixed in olive oil, wore its way slowly through the big stone. The sawing took weeks.

Then Mr. de Haan was ready to grind the facets that would bring out the gem's inner brilliance and fire, the unique power of a diamond to break up light into rainbow colors.

Again and again he would carefully adjust his oversize dop, a mechanical pincers that held the rough stone against a whirling metal turntable, or skeif (page 570). Again, diamond dust on the face of the wheel did the actual cutting. Otherwise the stone would have cut into the metal as through a wheel of cheese.

As it rode upon the revolving disk, the new diamond lay 8,000 miles and unknown ages of geologic time from its birthplace deep in the bedrock of South Africa.

On May 24, 1954, at the Premier Mine in the Transvaal, the stone had emerged from a jiggling river of crushed ore and water flowing down across a series of rocking, grease-covered separation tables (page 582).

A day or two before, an African miner hundreds of feet underground had blasted the ore free from a dimly lighted mine face, shoveled it into a miniature railway truck, and trundled it along a whitewashed tunnel. The ore, including the hidden diamond, had fallen into a steel-jawed crusher built on solid bedrock in the depths of the mine.

Broken to the size of eggs, the bluish ore rode a big bucket to the separation plant on the surface. A chain of dancing screens, other crushers, whirling vats, and conveyors passed it along. Finally, with the peculiar affinity for grease that mine diamonds possess, gleaming grains, gravel-sized crystals, and that one huge stone had burrowed into the sticky coating of the recovery table.

A diamond's discovery represents a major feat of engineering even at the Premier, most modern diamond mine on earth. For a single carat of diamond, 1/142 ounce, the Premier processes an average 6,000 pounds of worthless rock. It is like digging up your back yard with a steam shovel to find a button.

Penknife Dug World's Biggest Diamond

Oddly enough, the largest gem diamond ever found at the Premier—and in the entire world—was unearthed with no more equipment than a penknife.

One memorable day in 1905, when the three-year-old diggings were simply an open pit some 30 feet deep, the superintendent, Frederick Wells, glimpsed a flash of sunlight just under the crater's lip. He scrambled up to the spot, pried at the earth with his pocketknife, and soon had freed an incredible chunk of diamond as big as his fist.

The Cullinan, as the stone was named for the Premier Mine's discoverer, Thomas Cullinan, weighed 3,106 metric carats—one pound six ounces. It was presented by the Transvaal to King Edward VII, who chose a famed Amsterdam diamond cutter, J. Asscher, to cleave the stone. Asscher studied the Cullinan for months. Finally he made a groove on one edge, placed his wedge, and, perspiring freely, brought down his hammer. The steel blade broke instead of the diamond. Asscher went to a hospital to recuperate.

When his nerves calmed, he tried again. This time the stone split perfectly, but others had to tell the cutter. At the moment his

Volkmar Wentzel, National Geographic Staff

Diamonds in Matched Pairs Glorify the Exquisite Rovensky Necklace

New York financier Morton F. Plant, paying a reputed $750,000, bought the necklace about 1916 as a gift for his wife. Later she married John E. Rovensky, and upon her death the jewelry passed to her estate. In January, 1957, the diamonds went on the auction block at Parke-Bernet Galleries, Inc., New York. Several thousand spectators sat breathless as Julius Fürst acquired the string for $185,000, a record price at public auction.

Mounted on a platinum chain, the 94 diamonds weigh 213 carats. The pear-shaped pendant of 46 carats came from Tiffany, the others from Cartier, who made the necklace.

mallet hit the wedge squarely, Asscher fainted into the arms of his doctor.

The Cullinan finally was cut into nine royal jewels and nearly 100 smaller gems. The largest, a 530-carat capstone set in the head of the British Royal Scepter, is known as the Star of Africa I (opposite).

Seventy-five Bushels of Diamonds

Africa produces 97 of every 100 carats of diamonds found in the world. Put another way, the current annual world production of some 23,000,000 carats would fill about 75 bushel baskets; African diamonds would account for 73 of these.

Yet diamonds were discovered in South Africa only in the 1860's. The first sparkling pebble was picked up in 1866 or 1867—the record is unclear—by the children of Daniel Jacobs, a Boer farmer on the Orange River near Hopetown. They kept it among their playthings until it caught their mother's eye. She gave it to a neighbor, who sold it to a peddler for a few pounds.

The trader, Jack O'Reilly, sent it to Dr. W. Guybon Atherstone, a noted mineralogist, who pronounced it a diamond weighing 21¼ carats.

Other finds followed. In 1869 a shepherd boy sold an 83½-carat stone for 500 sheep, 10 cattle, and a horse. By year's end several thousand fortune hunters were camped on the Vaal River, scene of most of the finds.

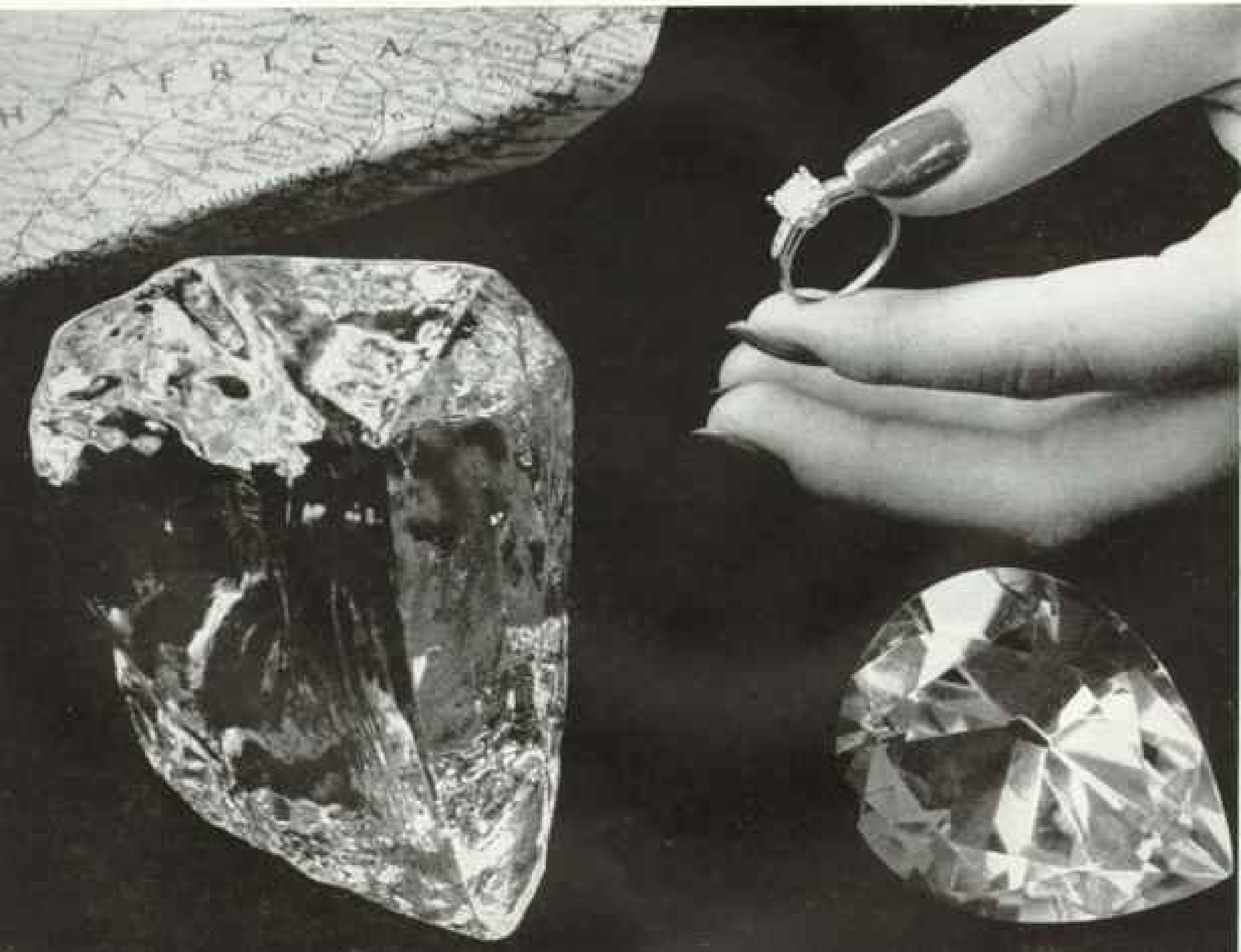
In 1871, southeast on the open veld where Kimberley now stands, prospectors began finding diamonds in a different ground from the water-washed gravel beds of the river deposits. This was yellowish, crumbly earth; beneath it lay a strange, heavy greenish-blue rock. Miners called it the "blue ground." It was kimberlite, native lode rock of diamonds.

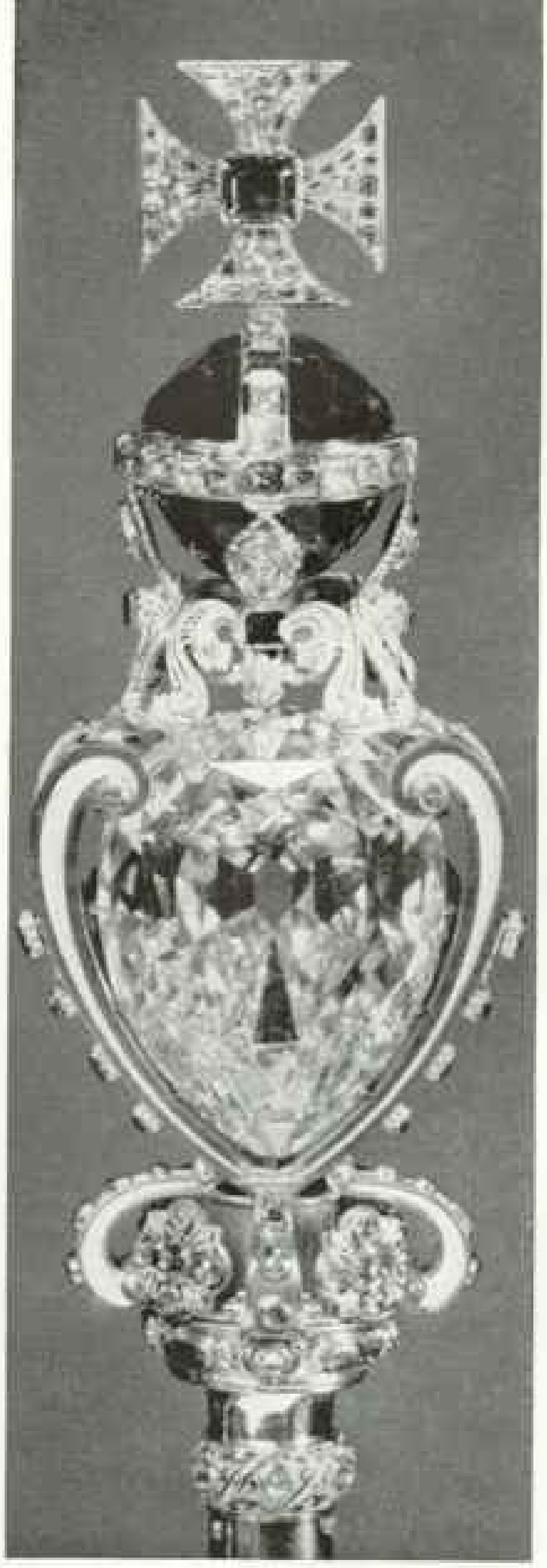
Even today geologists only half understand how and why diamonds occur in this dark ore, which weathers away to yellow soil. Evidently kimberlite was forced upward in some ancient age from extreme depths in the earth, through fissures shaped like thin tubes or pipes.

Four main diggings delved these pipe deposits, presumably bottomless, discovered in the Kimberley area. Mining them soon proved

(*Continued on page 578*)

National Geographic Photographer B. Anthony Stewart





Great Britain's Royal Scepter Bears the Heaviest Stone Cut from the Cullinan

The Transvaal bought the Cullinan (opposite) and presented it to King Edward VII, who had it cut into four main gems—the Stars of Africa. All found settings in the British regalia. Here the First Star, world's largest cut diamond, dazzles in the Ensign of Kingly Power and Justice. Gold clasps permit the gem's removal for wear as a pendant. Its weight: 330 carats.

The Imperial State Crown (below) holds the next largest cut diamond, the Second Star, some 200 carats less. Two other Stars of Africa adorn a crown worn by the late Queen Mary.

Aglitter in priceless gems, Queen Elizabeth II returns to Buckingham Palace following her coronation (see the September, 1953, National Geographic Magazine). She wears the Imperial State Crown, the Second Star of Africa and some 2,800 lesser diamonds make it the most valuable single piece of jewelry. The Sovereign's Orb (in left hand) is set with rubies, pearls, sapphires, and emeralds. First Star shines from the Royal Scepter in her right hand.

British Information Services (left); Acme Special Services (below)

Big as a Man's Fist, the Cullinan Ranks as the Largest Gem Diamond

In 1905 a manager of South Africa's Premier Mine saw a sparkle on the wall of the open pit (page 581) and dug the object out with a penknife. It was too large to be true, he thought; the crystal must be glass planted as a hoax. But tests revealed 3,106 carats of pure diamond.

Glass models of the Cullinan and of one of the gems it yielded are displayed at the Smithsonian. A 1¼-carat engagement stone is compared for size.

Anglo-American Corporation and N. W. Ayer and Son, Inc. (upper left)

Men Dug Out Kimberley's Big Hole by Hand

In July, 1871, a party of prospectors arrived at this spot, then a farm. During dinner one night a servant was sent out to dig as punishment for misbehavior. He discovered diamonds, and the rush was on. Today the town of Kimberley rims the old pit, and miners work underground.

Like the strands of a monstrous spider web, cables link hundreds of claims in Kimberley's Big Hole to the brink of the mine. Using these wires, old-time diggers hauled up buckets of pay dirt. Picture dates from 1875.

This check established an empire in diamonds. In 1889 Cecil Rhodes sought to merge his De Beers Mine with the Kimberley, whose control he had won from Barney Barnato. When dissatisfied Kimberley stockholders won a court decision against the merger, Rhodes and Barnato dissolved the Kimberley company. They paid off dissident interests with a history-making check for £5,338,650 ($26,092,652).

De Beers Consolidated Mines Limited.

No 5050 Kimberley 18th July 1889

The Cape of Good Hope Bank Limited

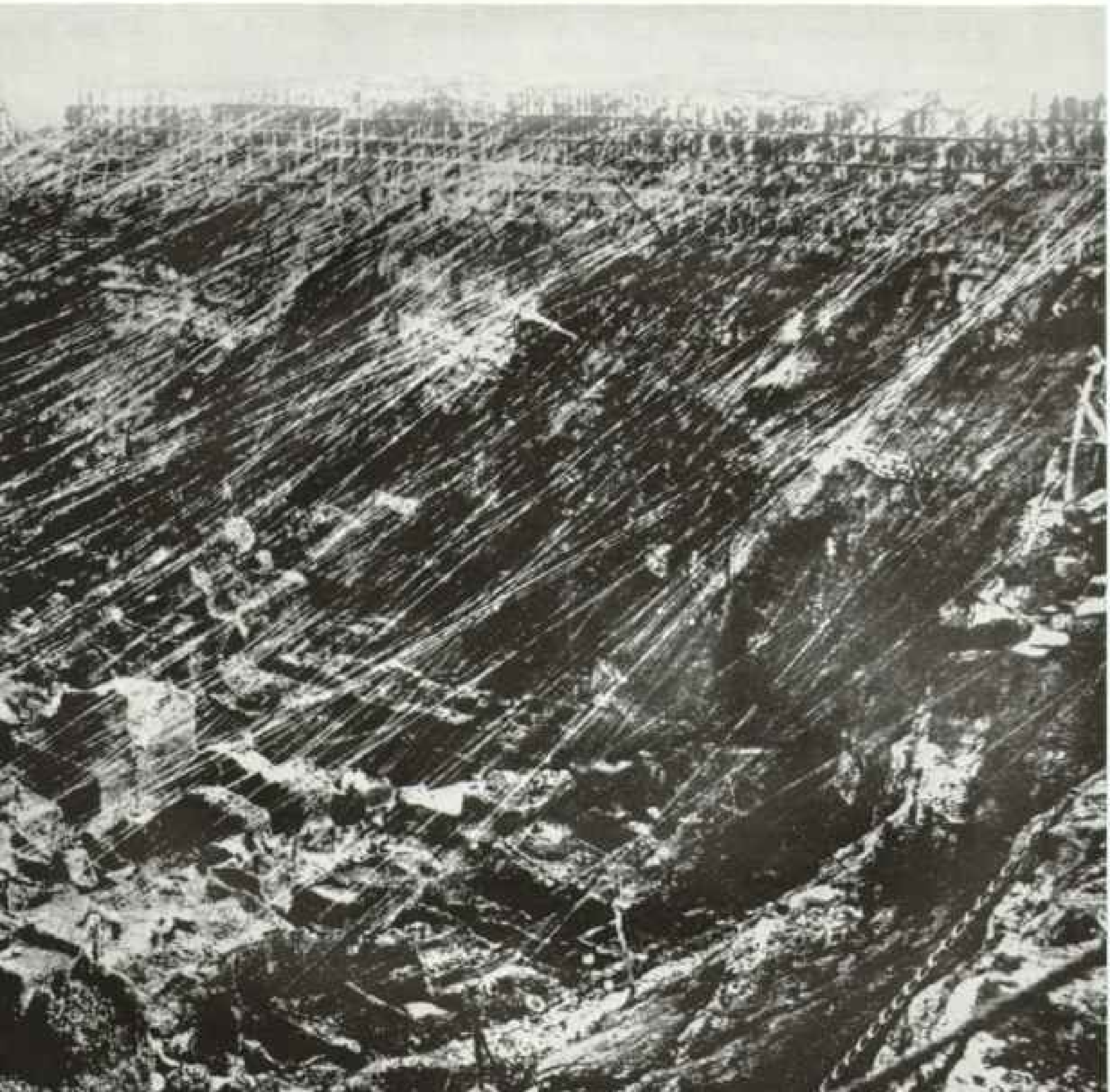
KIMBERLEY BRANCH

Pay Liquidators Kimberley Central A. Mg Co Ltd or Order

Five Millions three hundred and eighty eight Thousand one hundred & fifty Pounds &

£ 5.388.150

This Cheque must be endorsed by the party to whom it is drawn.



a more difficult matter than panning the alluvial river deposits.

The Kimberley Mine, the largest and most lucrative, at one time embraced 1,600 claim holdings in little more than 10 acres. Roads ran across the dig, giving equal access to all claims. But as the pits deepened, the roads began to crumble and slide away.

Then the miners ran cables from the rim of the honeycombed pit to haul out their ore. So numerous were the cables that the "Big Hole" seemed mantled by a monstrous cobweb (page 577).

As the individual claims sank at varying rates, walls caved in. Then water flooded the deeper pits. Month by month, the situation grew worse. Consolidation became inevitable.

Two clever, resourceful men, both dreaming of a diamond monopoly, gradually gained control of the Kimberley mines. Their names were Cecil Rhodes and Barney Barnato.

Barnato began his career as a buyer, or "kopje walloper," riding from claim to claim to bargain with the diggers. Rhodes, son of an English clergyman, emigrated to South Africa and joined his brother in working a diamond claim. He soon saw his opportunity in the scarcity of pumping equipment to keep the pits dry.

In 1874 Rhodes bought the only large steam pump he could find, hiring it out to claim owners. Soon he owned many pumps. He began to buy up claims, and eventually he and a few close friends controlled the De Beers Mine, so named for a Boer family that had owned the original farm.

Rhodes Founds a Diamond Empire

A few years later Rhodes gained control of the Kimberley Mine from Barnato. When dissatisfied shareholders won a court order against their proposed merger, Rhodes liquidated the Kimberley company, paying for its assets with a check for £5,338,650, or more than $26,000,000 (page 577).

Thus De Beers Consolidated Mines, Ltd., was founded. It was to affect the development and wealth of all South Africa. Today it stands undisputed as the controlling organization in mining and marketing diamonds.

The Union of South Africa still leads all other countries in the value of its diamonds, for its mines yield a high percentage of gem stones. In sheer quantity, however, the Belgian Congo holds the largest known diamond deposits on earth. From gravel beds along the Bushimaie River, an upper tributary of the Congo, more than 13,000,000 carats were taken in 1957. But 95 percent consisted of bort, the lowest industrial grade, usable only for crushing into powder.

Along the coast of South-West Africa, near the mouth of the Orange River, diamond beds rich in fine gem stones lie beneath enormous sand dunes, ceaselessly built up by winds from the inland deserts and eaten away along the Atlantic by crashing surf.*

As in the Belgian Congo, giant power shovels and bulldozers here gouge huge open-pit mines. They move millions of tons of sand and gravel for a few hundred pounds of rough diamonds.

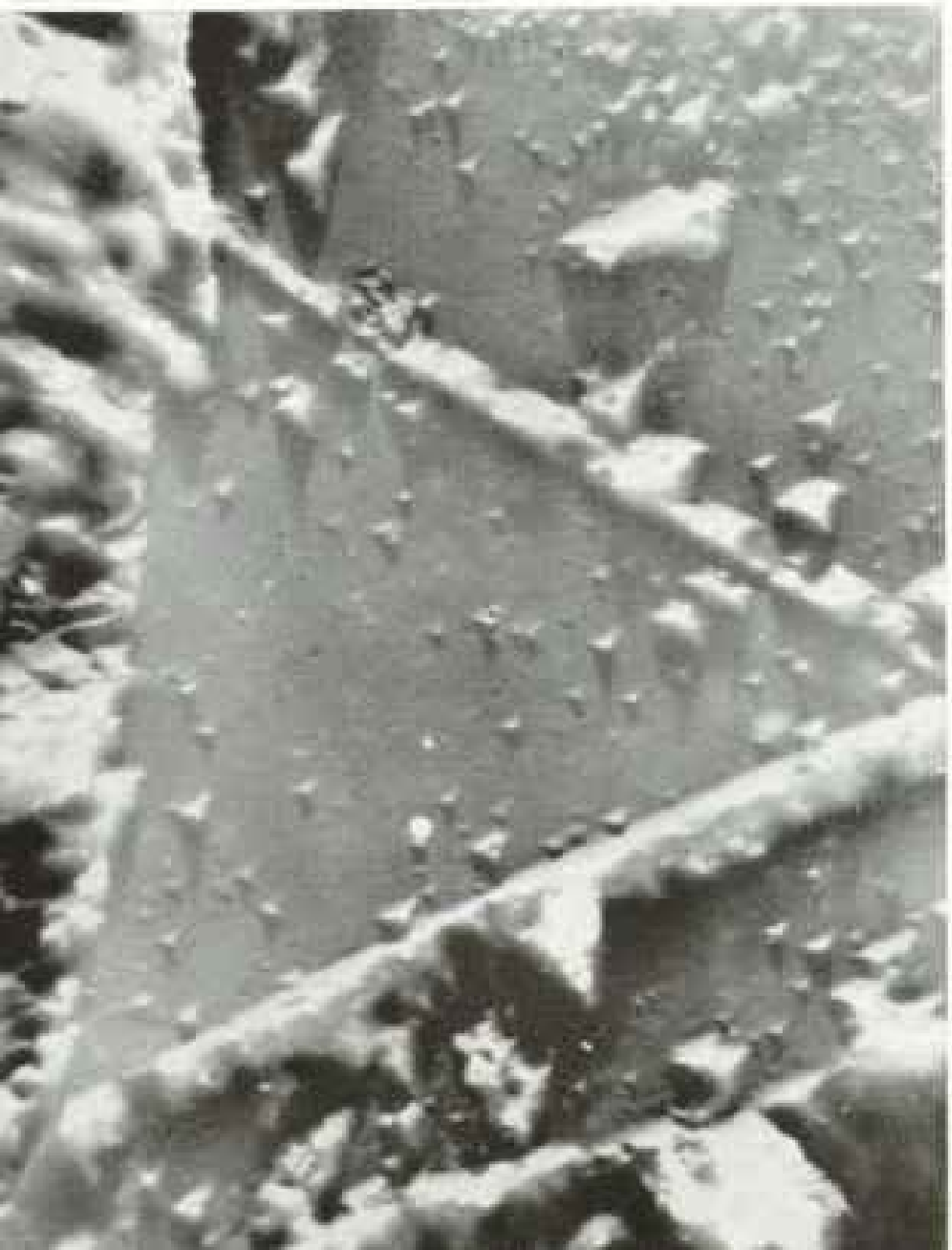
Since World War II, as the demand for both industrial and gem diamonds has steadily mounted, deposits in Tanganyika, Ghana, Angola, Sierra Leone, French Equatorial and French West Africa have been increasingly worked.

Tanganyika, like South Africa, holds true

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

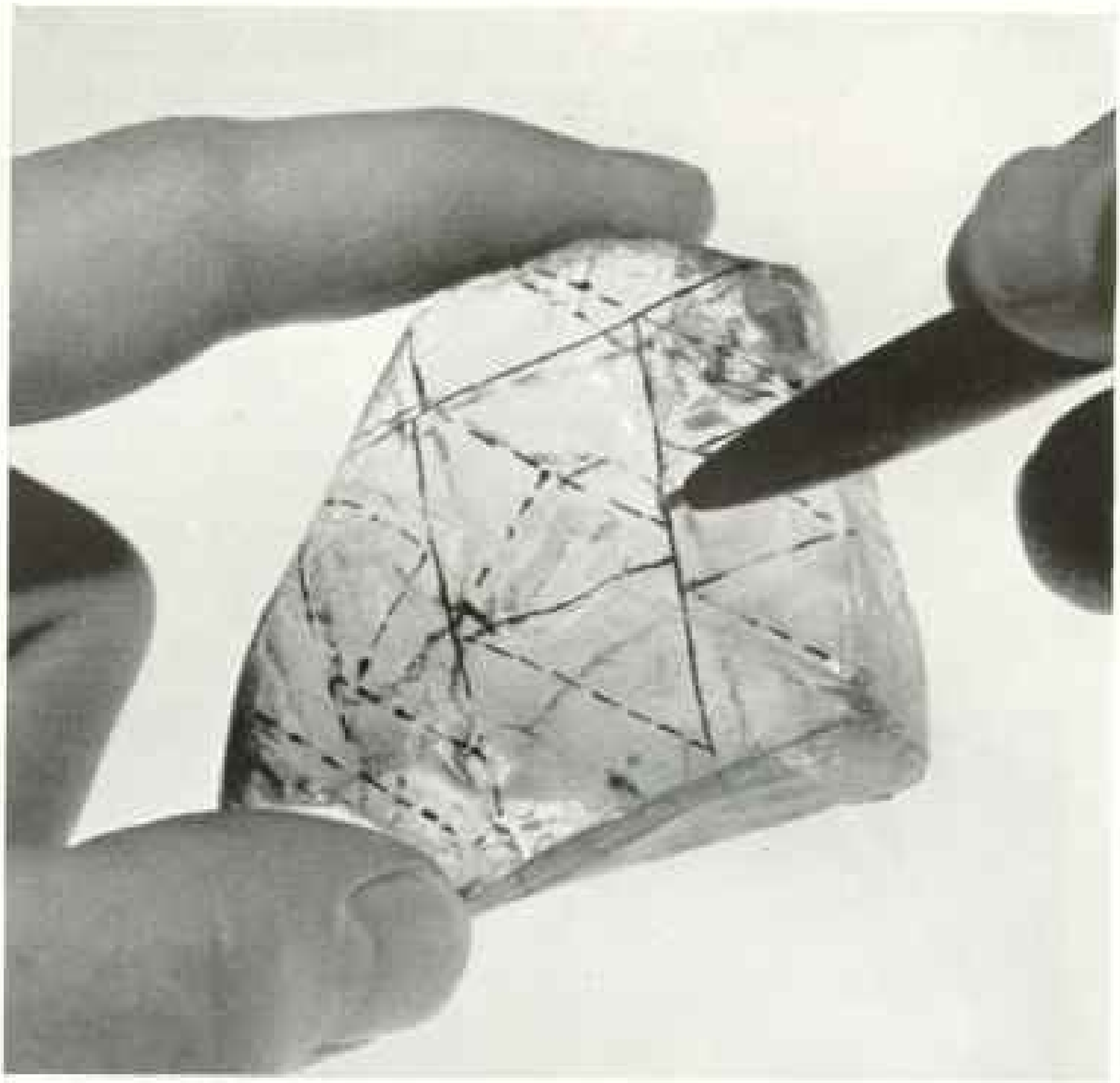
Rough diamond, magnified 30,000 times, shows the triangular pattern of the crystal structure. This diamond, like any other, will split in only four directions. Grain must be determined (opposite) before cleaving, lest the stone shatter.

Bradley C. Williams



pipes of native kimberlite. Far back in bush country near Lake Victoria, Bantu workmen have only to scratch the surface of the ground to find high-quality gem stones. These deposits were owned by the late John Thoburn Williamson of Mwadui, in Tanganyika. Their output, like that of most other African mines, is marketed under an agreement with De Beers.

Just when the first diamond was found by man, and where, is lost to history. It may have been in India; diamonds were known there hundreds of years before the Christian Era. There is even a Hindu tradition that the great Kohinoor diamond, now among the British crown jewels, was worn by a hero of the Hindu epic, the Mahabharata, thousands of years ago.



National Geographic Photographer B. Anthony Stewart

Months of study dictated the cutting pattern of the 726½-carat President Vargas, largest gem diamond ever discovered in Brazil. An impoverished farmer in 1938 picked the stone out of the Santo Antônio River. He sold it for $10,000 to a broker, who promptly resold for $425,000. Later the Vargas passed to Harry Winston; he had it cut into 29 jewels. The Smithsonian Institution displays this model.

The ancient mines and diamond mart of Golconda were so rich the name became synonymous with Oriental splendor. From India came not only the Kohinoor, which means "Mountain of Light," but most of the other great diamonds of history.

Mystery of the Missing Great Mogul

The legendary Great Mogul, said to have weighed 787 carats when found, disappeared sometime after 1665, when the French traveler Jean Baptiste Tavernier saw it in an Indian rajah's court as a cut jewel of 280 carats.

In the Russian diamond treasury today, however, is a 200-carat crown jewel of the Tsarist empire known as the Orloff. This stone can be traced to the early 1700's, when a French soldier stole it from the eye of a statue of a Hindu god in a Mysore temple. The gem then passed from hand to hand amid violence and deceit, and eventually reached Amsterdam. There, in 1774, an exiled gallant of the Russian court, one Prince Orloff, bought it for the equivalent of $450,000 to regain favor with Empress Catherine II.

The Orloff diamond weighs somewhat less than Tavernier's estimate, but its shape and cut lead to speculation that this may be the lost Great Mogul.

By the 18th century India's mines were largely worked out. A diamond rush in the 1720's, half a century before the American Revolution, made Brazil the leading producer until diamonds were found in South Africa.

Small, scattered deposits in Minas Gerais, Bahia, and Mato Grosso States are still worked by foot-loose Brazilian *garimpeiros* (diamond seekers). But today Brazil's output amounts to only about 250,000 carats a year.

In 1938 two Brazilian farmers walking a dry riverbed stumbled on a diamond the size of an egg. Thinking it only a stone, they tossed it away, but later one of them went back for a second look. Weighing 726½ carats, it was named the Vargas for Brazil's president.* The Winston firm bought the gem in 1941 and cut it into 29 jewels, the largest weighing 48¼ carats. Unfortunately World War II left no market for a single huge diamond such as might have been cut from the Vargas.

Not for 15 years would Winston acquire

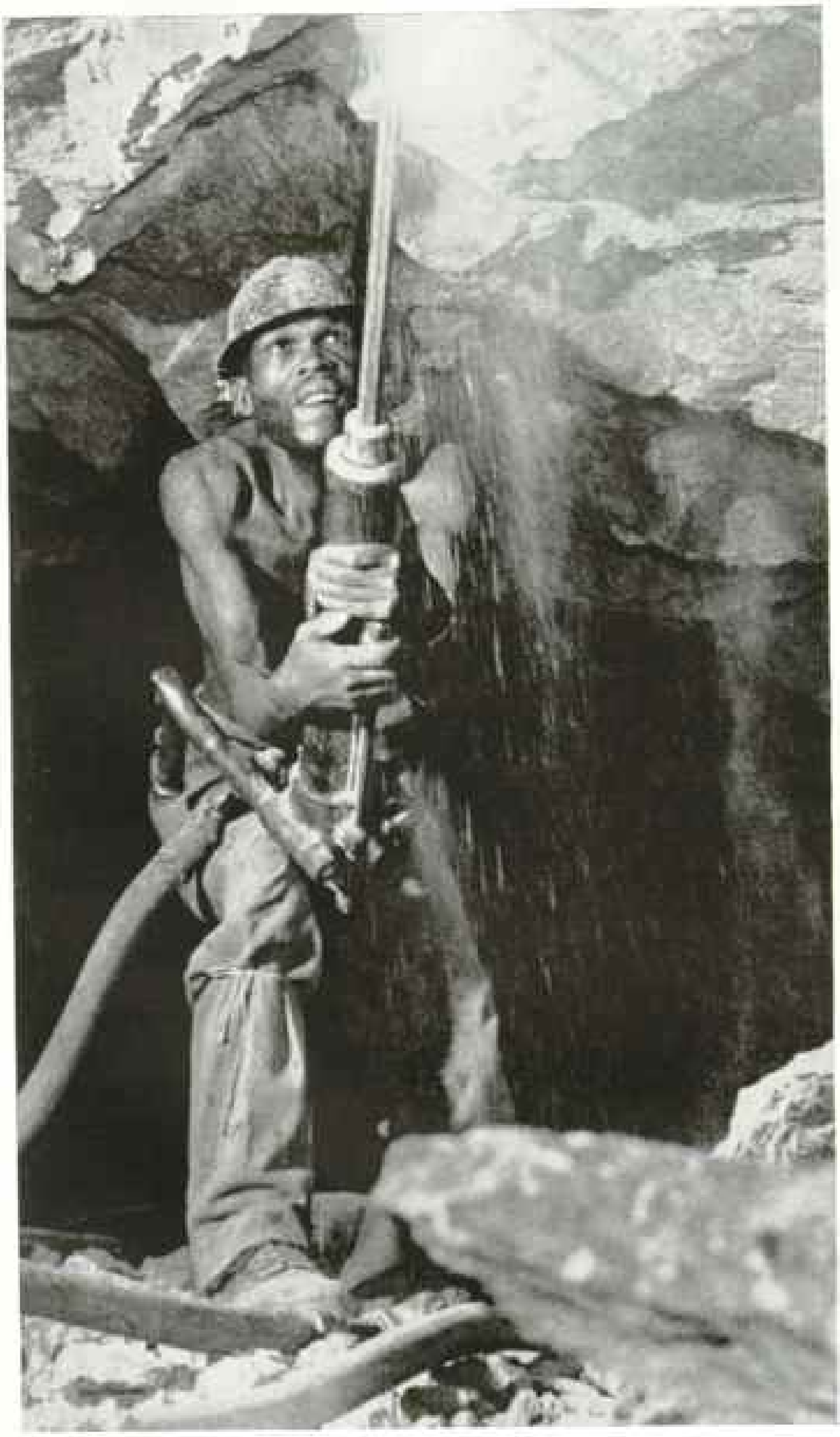
* See "Brazil's Land of Minerals," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, Oct., 1948.

Premier's Once-busy Pit Stands Empty; New Diggings Plunge Under the Veld

Late in the 1890's Thomas Cullinan, onetime bricklayer, played a hunch that this land near Pretoria was diamondiferous, though it lay far from known fields at Kimberley. He began mining in 1903; two years later the pit yielded the world's largest gem diamond (page 572).

In 1904 Alfred Beit, a director of the De Beers syndicate, came to see the new mine. Distressed that his company owned no part of the vast and productive operation, Mr. Beit suffered a stroke on the spot, as the story goes. De Beers began buying stock and won control of the Premier by 1922.

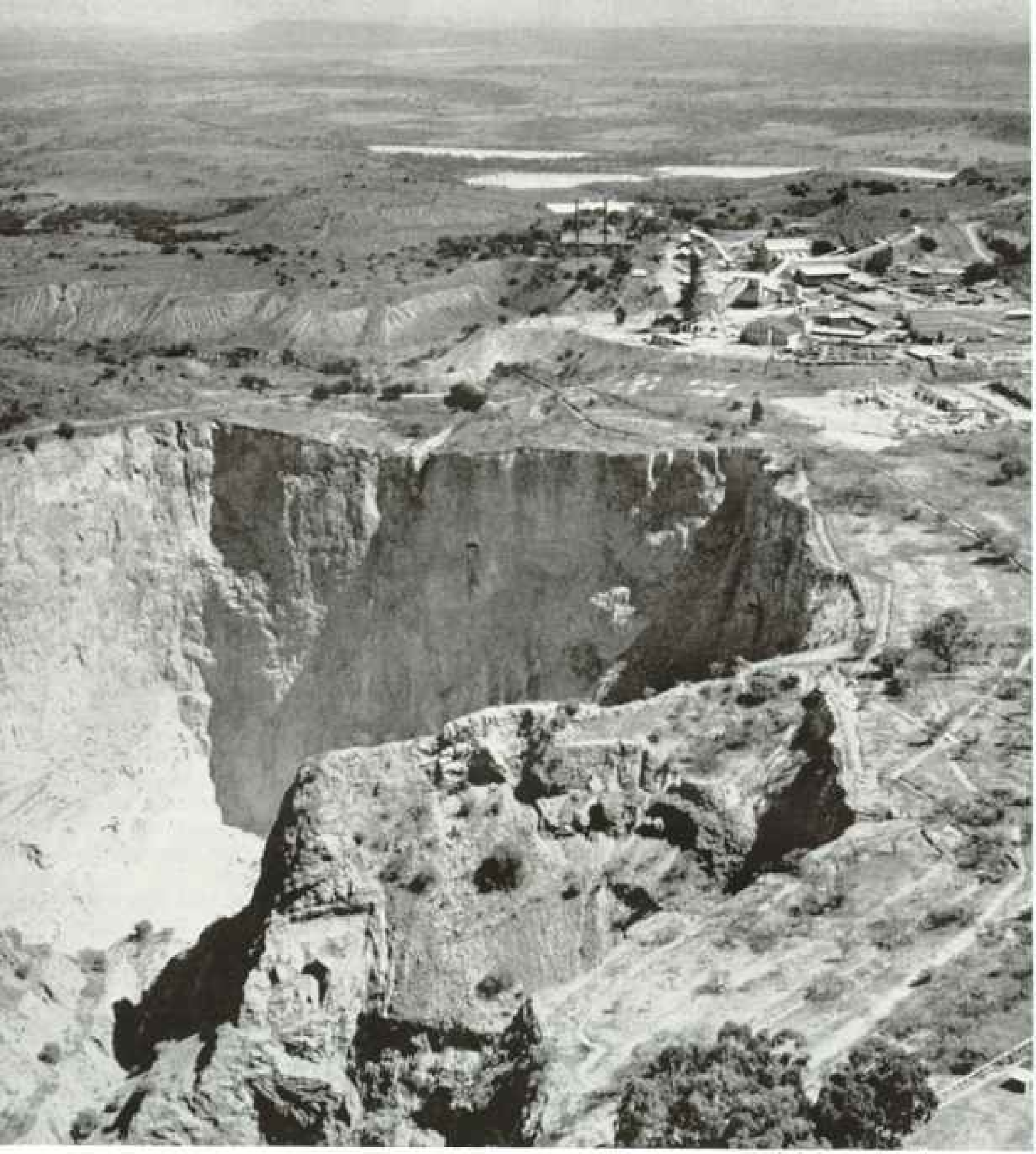
N. W. Ayer & Son, Inc.



South African mine worker drills a hole for a dynamite blast.

In the early days of underground work, diamond miners ran the risk of being caught without warning in a smothering flood of mud. Many died from breathing clouds of poisonous blue dust stirred up by drills.

Mines today are air conditioned. Pumps reduce the flood hazard, and jets of water on the drills dampen dust before it can accumulate.



Anglo-American Corporation

another rough diamond of spectacular size and quality. This time it came from South Africa—the 426½-carat Ice Queen.

What was the chain of events that took that great stone—destined to become the glorious Niarchos teardrop—from the Premier Mine to a cutting room in New York City? It began with the diamond's appraisal by the De Beers central sorting office in Kimberley. There the stone was judged to be of virtually matchless gem quality.

Gem diamonds ideally must be colorless, or slightly bluish, and free of internal flaws; light shimmers from them in a characteristic silvery beauty. If clouded internally or marred by too many foreign particles, cracks, bubbles, or feathery flaws, even a large stone may be usable only as an industrial diamond.

Often a rough diamond, though otherwise perfect, will have a yellowish cast, reducing its value. But a few will boast a clear, deep color —pink, blue, green, or canary yellow—and thus be graded as "fancies." Carat for carat, these are the most costly of all diamonds. The deep-blue Hope and the Tiffany Yellow (page 568) are among the most spectacular of the world's fancies.

The word "carat" once meant the weight of

a carob tree seed, against which diamonds originally were weighed. Since 1913, however, most countries of the world, including the United States, have adopted the metric carat, equal to 200 milligrams or 1/142 ounce. Since this is slightly less than the older English carat, its adoption gave many of the great diamonds a seemingly greater weight; the Cullinan, for example, increased from 3,024 carats to 3,106. (The diamond in an average engagement ring weighs less than half a carat.)

Very small gem stones, used as the "paving" around larger diamonds, are called "melee." Yet even these tiny grains are ground and polished to enhance their sparkle. Usually they are given a "single cut" of 16 facets, as compared to the "brilliant cut" of 58 facets given most larger round stones.

De Beers itself does no cutting. Its diamonds are sold in the rough, in one of the world's most rigidly controlled marketing techniques. At regular intervals major diamond dealers around the world—in Antwerp, Toronto, Tel Aviv, and New York—receive an unsigned, mimeographed notice from the De Beers central selling organization:

THE DIAMOND TRADING COMPANY, LIMITED
London Office: 2 Charterhouse Street
London, E.C. 1

We have to inform you that a Shipment will be shown on 20th January, 1958. Applications for which should be sent direct to this office to reach us not later than 10 a.m. on Thursday, the 9th January, 1958.

To attend a showing, or "sight," a dealer must indicate beforehand just how much money he wants to spend for new stones. He sends a cable to London, applying for a sight and specifying the amount. Most large dealers, once their applications are accepted, then send a buyer to London for the showing.

In January, 1956, Harry Winston was asked to come himself to discuss a special offer. The big new stone from the Premier Mine had arrived from Kimberley by air and was to be included in the transaction, together with a number of other stones.

For Sale: a Parcel of 50,000 Diamonds

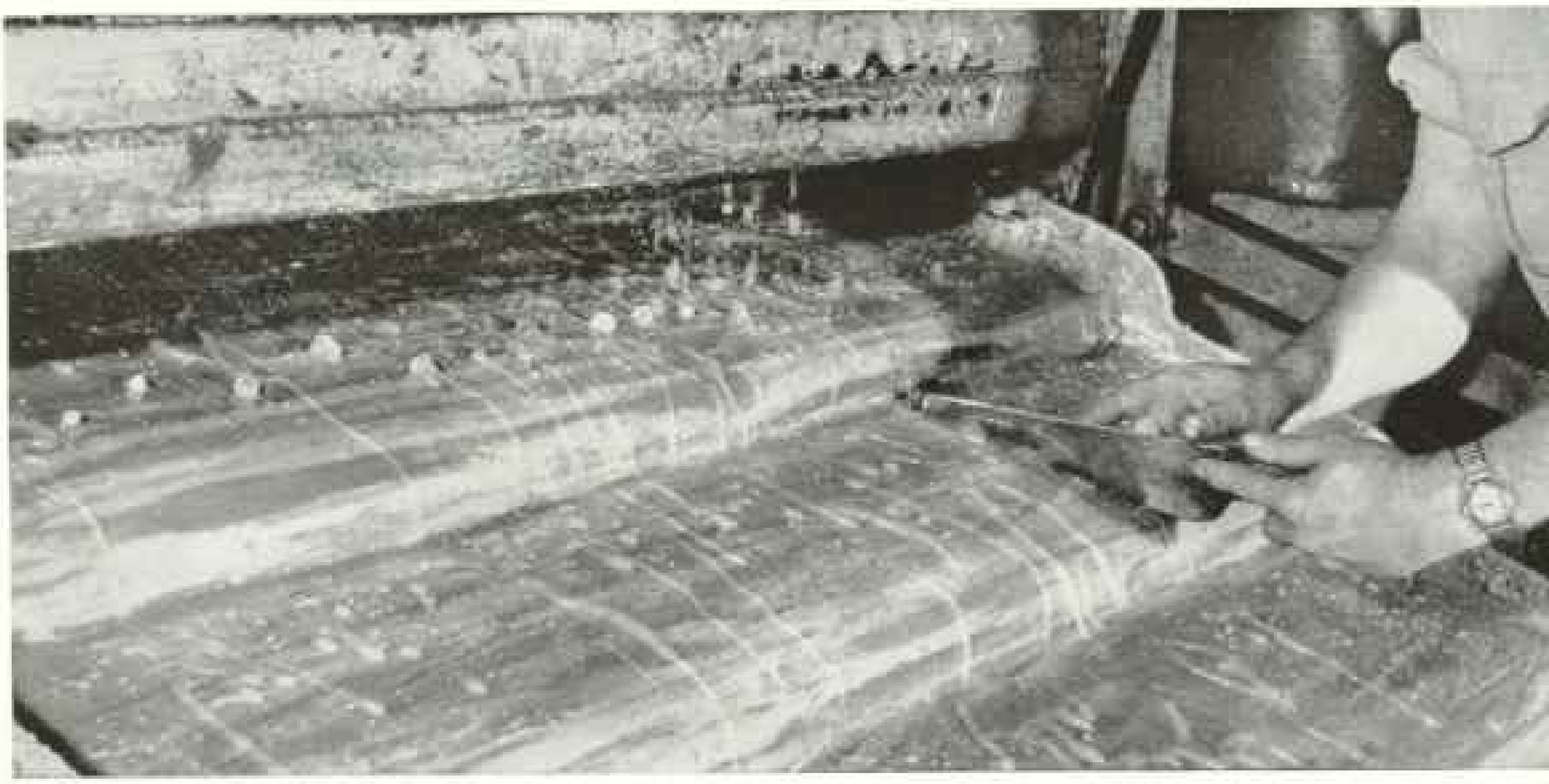
At the Diamond Trading Company's offices Mr. Winston was brought a "parcel"—a box holding a number of folded paper packets of diamonds. The stones had been sorted; some were small, some large. Their quality varied. One was the 426½-carat giant.

The jeweler was left by himself to examine the offered stones under a north light. There was no hurry. He could take as many days as he might wish to study the selection. He had no others to choose from; he could either take the entire parcel or leave it—all or none.

To buy the big stone, Mr. Winston accepted the parcel, which contained more than 50,000 separate diamonds. He paid something over $8,400,000 for the lot.

When his bank draft had been turned over to the Trading Company (De Beers does not operate on credit), the diamonds he had bought began their journey to New York.

Anglo-American Corporation



Anglo-American Corporation

Jiggling Chutes Smeared with Grease Capture Precious Gems from Gravel

Most South African diamonds are found in pipes of blue ground—magma that welled up from the earth's interior and later solidified as a plug. Pipe-mine diamonds demonstrate a natural affinity for greasy surfaces. Stones washed by rivers or surf fail to stick. Diggers first feed chunks of blue ground to crushers, which reduce it to coarse gravel. Water then flushes away the lighter stone. Here, in the Premier Mine, the heavier residue is agitated on tables covered with half an inch of grease (opposite).

Diamonds Caught by Grease Are Scraped Off a Rocker's Aluminum Steps

The operator stops the machinery to reap the harvest. For each carat of diamond, the process discards three tons of blue ground, on the average.

They went in the normal fashion by registered mail, heavily insured, wrapped in brown paper packages sealed with wax, on several different transatlantic airliners.

After passing through customs (there is no duty on uncut diamonds, though there is on finished jewelry), the stones were forwarded to Winston's. A bonded messenger rode the subway uptown with the big stone in a plain brown paper bag in his lap. The Ice Queen's transformation to a giant teardrop began.

More than 15 million carats of diamonds came into the United States in 1957, about 1,800,000 carats in gem stones, the remainder industrial. It is hard to estimate the final value of the diamonds sold as gems. But at $1,000 or more per carat for top-quality gem stones, it is little wonder that prospectors for generations have scoured the United States for diamonds or diamond ground.

Yet, although occasional stones have been found from coast to coast, only one deposit of diamond-bearing ore has ever been found, and not an exciting one at that.

Near Murfreesboro, Arkansas, since 1906, some 10,000 rough stones have been taken from the only United States diamond mine, no longer in active operation. The last full year of digging in 1948-49 yielded only 246 carats of industrial diamonds, worth $985.

Tourists now may pay a small admission charge and prospect for diamonds on their own. In March, 1956, a Texas housewife chanced on a 15½-carat rough diamond. Appraised as high as $15,000, it was christened the Star of Arkansas by the governor.

The largest diamond ever found in this country is the 40.2-carat Uncle Sam, unearthed near Murfreesboro in 1924. The second biggest, discovered in West Virginia in 1928, is the Punch Jones, a 34½-carat rough stone that has been on exhibition at the Smithsonian Institution for 14 years.

How the Punch Jones diamond reached West Virginia, or how other stones have been scattered from Virginia to Georgia, has yet to be explained. Diamonds occasionally found in the Great Lakes area suggest that these might have been carried south by glaciers from somewhere in Canada. Yet the mother lode, if one exists, has never been located.

To sharpen carbide tools, the Norton Company of Worcester, Massachusetts, developed a wheel with crushed diamonds bonded into the grinding face. Industry adapted the tool to cut glass, ceramics, and stone. Here Norton's Irving West tests the alignment on wheels worth some $6,500.

David S. Boyer, National Geographic Staff

Stones Vital to U. S. Industry

The more than 13 million carats, or nearly three tons, of industrial diamonds brought into the United States last year exceeded by 100 times the 130,000 carats imported in 1930.

In a real sense the Nation's productivity and even its security is poised on the industrial diamond, used in cutting tools, grinding and polishing wheels, saws, hard-rock drills, and other indispensable implements.

In ordinary bronze, the hardest steel edge can cut a groove five miles long before needing to be sharpened, and a tungsten-carbide tool remains sharp for 21 miles, but a diamond will make a cut 1,200 miles long.

Diamond-edged tools are virtually the only thing that can efficiently cut some of today's superhard metals.

Consider the life history of "Diamond No. 3160" in one automobile factory. It was purchased in January, 1930, as a 19-carat industrial stone, a whopper. During the 16 years that followed it was checked out of the tool crib 105 times. Worn down finally to less than one-quarter of a carat, the remainder was ground at last into diamond dust—and thus went on working.

At J. K. Smit & Sons' diamond-tool factory in Murray Hill, New Jersey, I saw sure-fingered women set pea-sized uncut diamonds with tweezers into a mold much like an angel-food cake pan. Covered with metallic powder and baked in an electric furnace, this cake would come out a diamond core drill, worth up to $7,000.

In another New Jersey plant, I watched holes being bored through single diamonds to turn them into wire-drawing dies. Through such a carefully shaped hole, a wire maker would pull thicker copper strands out to perhaps 15,000 miles of fine metal thread before the diamond would be worn away enough to require reshaping.

Thomas Edison used a "diamond point reproducer" on his early talking machine. Today the transcribed programs and music broadcast by radio stations across the world come in large part from the tips of tiny diamonds, shaped into phonograph styli, or needles.

General Electric Company

Man-made diamonds pour like sand. General Electric research scientists created the revolutionary industrial material by subjecting carbon in a secret mixture to extremely high temperature and pressure. In 1957 GE announced it was making industrial diamonds at Detroit, Michigan, on a large scale. These engineers helped work out the techniques.

"Look here," said an official of a diamond-needle manufacturer. He adjusted a small glass dish beneath a microscope.

I bent to see a jumble of eight-sided crystals that appeared like giant grains of sand clustered together. "Each one of those weighs about 1/400 carat," my guide said.

"Yet to make a good needle from one of them, we have to give it first a shape like

that of a long, narrow box, then round off one end and polish the point to an accuracy of 1/30 the thickness of a human hair."

I could see why, though the diamond itself might be worth only a few cents, the finished needle would sell for more than $10.

With the demand for industrial diamonds steadily increasing, and even the cheapest crushing grade, or bort, worth about $7,500 a pound (an equal weight of pure gold costs only about $550), science has increasingly attacked the secret of making synthetic diamonds.

On February 15, 1955, the General Electric Research Laboratory announced that the goal had been reached experimentally.

I flew to Schenectady, New York, at GE's invitation to see the giant press in which man-made diamonds had been formed. A special pressure vessel in the huge machine made it possible to create—and maintain—temperatures of 5,000° F. and pressures up to 2,400,000 pounds per square inch, conditions matching those some 250 miles down in the earth's crust.

The largest of the first tiny crystals made in the GE press was less than a sixteenth of an inch long and weighed only 1/100 of a carat. It had cost four years of research and several hundred thousand dollars. Yet General Electric considered the cost modest.

New Substance Can Cut a Diamond

In later research, GE scientists produced borazon, an entirely new substance, not known in nature, that proved virtually equal to diamond in hardness. By squeezing a white compound called boron nitride, similar in many characteristics to graphite, they obtained this new crystal that can scratch a diamond.

Borazon may be even better than diamond for many industrial uses. It is much more resistant to high temperatures, caused in cutting tools by friction.

In the past many men have dreamed of making diamonds, but the ways they tried were not effective. In 1880 a Scot, J. B. Hannay, heated various mixtures in heavy-walled iron tubes, often until they exploded and wrecked his laboratory. Then a French scientist, Henri Moissan, tried dissolving carbon in molten iron and quenching the mixture suddenly in cold water. Diamond, he knew, had been found in meteorites. Perhaps he could duplicate a meteor; as his molten iron solidified from outside in, tremendous pressure within might squeeze the carbon atoms into diamond. But Moissan, too, was unsuccessful.

At Harvard University in the 1940's Prof. P. W. Bridgman achieved pressures on samples of graphite of more than 6,000,000 pounds per square inch at room temperature, yet without producing diamond. General Electric used extremely high temperatures as well as high pressures, and with the right raw materials (still secret) finally reached the long-sought goal. A cluster of GE's first tiny man-made diamonds has been presented to the Smithsonian Institution.

Knowledge of the Diamond Still Grows

Scientists continue to study the atomic structure and odd characteristics of this unique mineral, diamond. Why, for example, do certain diamonds conduct electricity, while most others are highly resistant?

Some diamonds possess the ability to detect atomic radiation, when employed in instruments like the Geiger counter.

Recent experiments have also shown that atomic bombardment can change a diamond's color. Different types of atomic "bullets" can give colorless diamonds shadings of green, blue, pink, and other colors. When irradiated stones are then subjected to intense heat, the hues change to yellow or amber tones.

Such tampering with a stone's natural color has made diamond traders and cutters extremely nervous. The value of a gem diamond often hinges on minute shadings of color.

The deep blue of the famed Hope Diamond, for example, is a natural and extremely rare color. The Hope, a 44½-carat stone, is thought to be a piece of another stone, the French Blue, stolen with the French crown jewels in 1792. It literally is unique among the world's natural diamonds (page 568).

Should man, however, learn how to upgrade a run-of-the-mill yellowish stone to a high-valued "blue-white" or colorless gem, or beyond that to a fancy color such as the Hope's, the very foundation of the diamond world would rock.

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ON a National Geographic assignment in strife-torn Cyprus, Franc and Jean Shor visited Roxandra, a village matron in shawl and flowing skirt. As they left, Franc offered to pay for the lunch she provided, but she refused.

"You should be careful," he joked. "The National Geographic Society has more than 2,000,000 members, and if I write that you give lunches free, they may all come and visit you."

She smiled and threw her arms wide.

"But they would be welcome!" she said.

Not many members may have a chance to enjoy Roxandra's hospitality, but all who visit the Nation's capital are invited to drop in at their Society's headquarters.

Thousands each year enjoy the displays in Explorers Hall, from grotesque masks of New Guinea tribesmen to a replica of the great stone head in La Venta, Mexico (*right*). Other fascinating exhibits include ancient Greek wine jars from Mediterranean depths, Sky Atlas views of the universe, and the historic flag Admiral Peary carried to the North Pole.

Here members also view a changing display of projected color slides made by the Geographic's world-ranging staff.

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BY LAND...Canada's only stainless steel scenic dome streamliner, "The Canadian," moves under smooth diesel power for 2,881 miles across Canada along the spectacular Banff-Lake Louise Route in the Canadian Rockies.

BY SEA...New sleek "White Empresses" sail one third of the way to Europe along the sheltered St. Lawrence River "Landscape Route," offering travelers modern accommodations with superb shipboard service.

BY AIR...New jet-age "Britannias," the world's largest, fastest and quietest jet-prop airliners, in service this year between Canada and Europe, the Orient, Hawaii, Australia, New Zealand, Mexico and South America.

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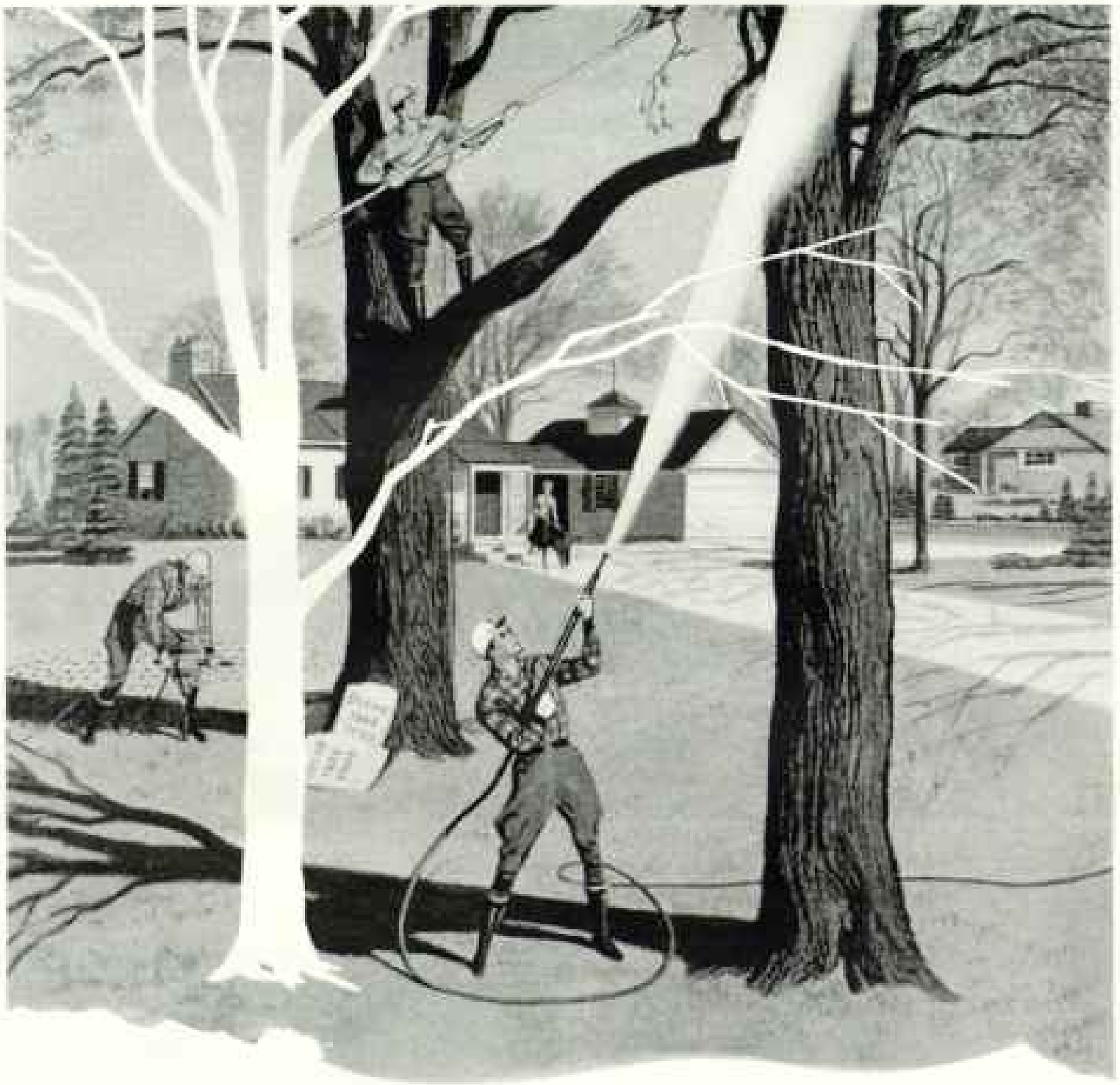

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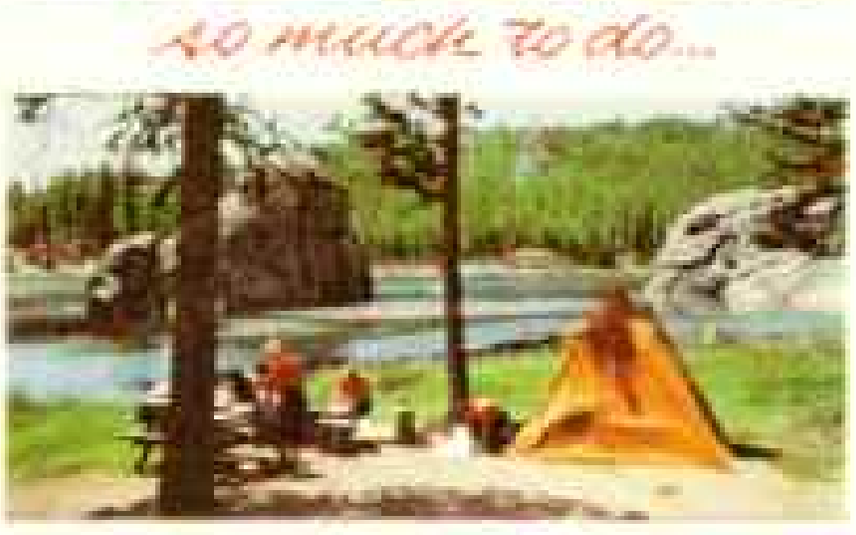

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OR $ 5000 in cash, if the winner of this prize purchased a 1958 NEW MOON HOME during the period of the contest.

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3. Mail your entries to: "$20,000 NEW MOON MOBILE HOME CONTEST" Post Office Box 6708, Chicago 77, Ill.
4. Enter as many times as you wish. Each entry must be your own original work and submitted in your own name.
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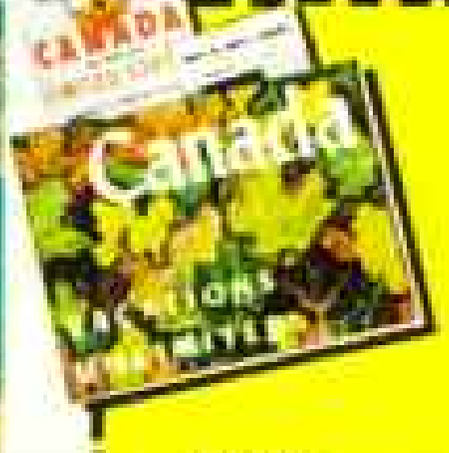

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* Source: Compton's Encyclopedia, 1954.

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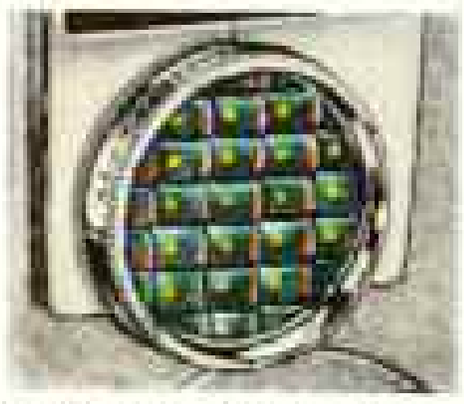

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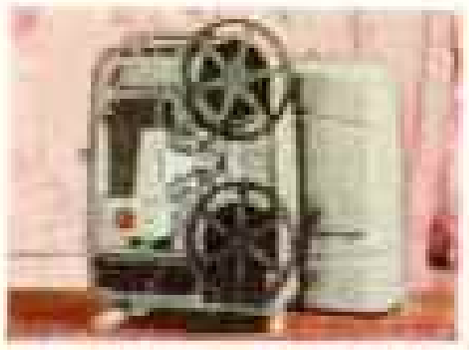

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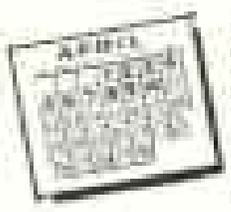

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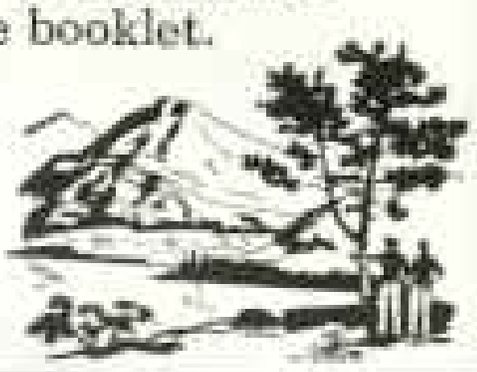

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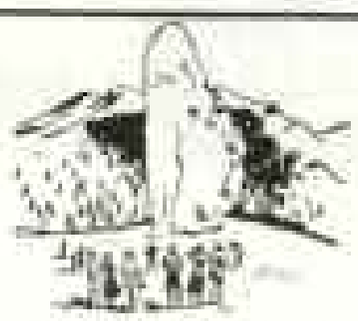

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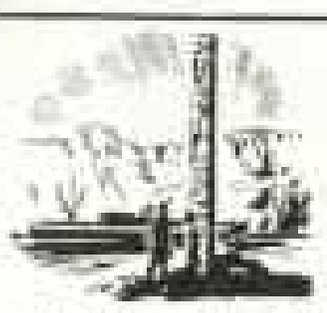

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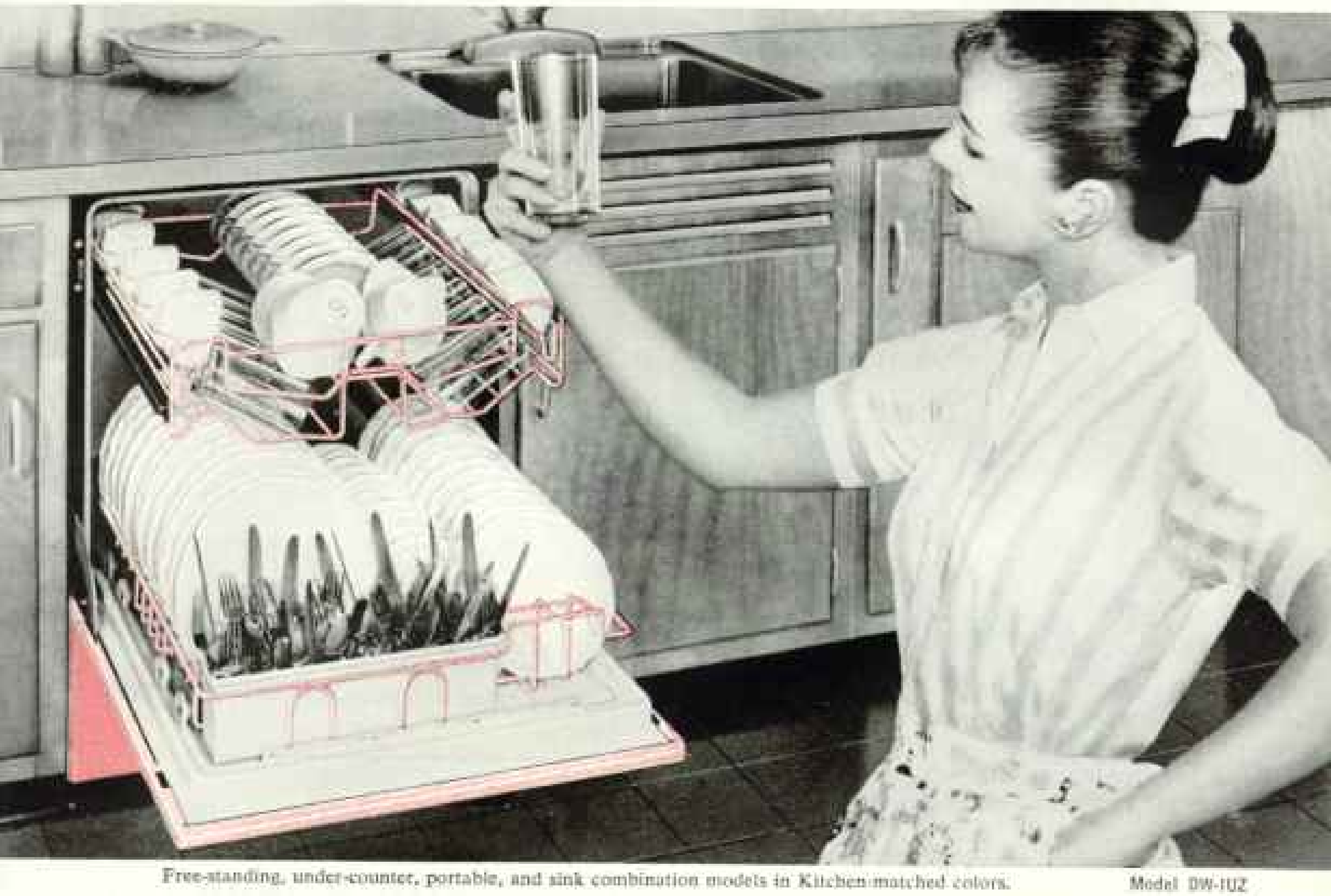
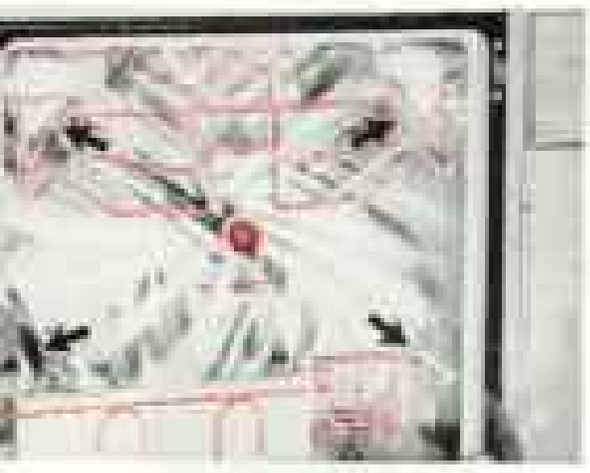


Free-standing, under-counter, portable, and sink combination models in Kitchen-matched colors. Model DW-102

Easy front-loading Frigidaire Dishwashers hold up to 48% more than other leading 24" models... *every single dish is double-scrubbed and triple-rinsed!*

That's not all. Those big racks glide to you for easiest front-loading. Exclusively designed automatic dispenser releases detergent twice for two full washing cycles. Every inch of every dish is jet-flooded with three rinses, including a special "Spots-Away" rinsing cycle, *then dried and sanitized at pasteurization temperatures.* There's more—but call your Frigidaire dealer or kitchen specialist—or write Frigidaire Division, General Motors Corporation, Dayton 1, Ohio, for illustrated brochure.

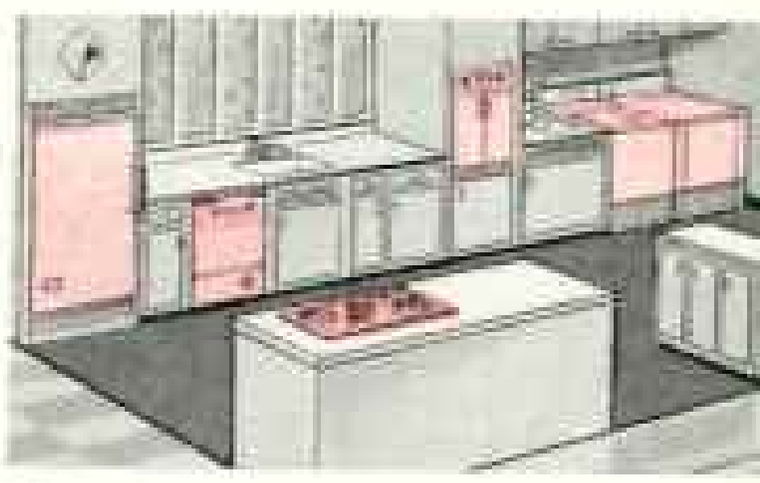


No wander Dishes Sparkle, Spots Disappear!

Dishes come cleaner with the Frigidaire Turbo-Spray Tube that spins safely between the loading racks, soaking every surface with thousands of hot wash-and-rinse sprays. Even dried-on egg vanishes. Scientifically designed racks expose every piece of more than 12* place-settings to full contact with water. A special "Spots-Away" wetting agent is automatically injected into the final rinse to make everything rinse brighter and dry faster.

Speed Clean-Up Time!

The perfect team-mate for your new dishwasher—quieter, faster Frigidaire Food Waste Disposer—now safer than ever. Quickly shreds and flushes away leftovers of all kinds. Ends garbage problems.



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FRIGIDAIRE Division, General Motors Corporation, Dayton 1, Ohio

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What is the outlook?

While cancer is still one of our nation's greatest health problems, several recent developments are encouraging.

• Mortality from cancer among women has been declining. The total decrease is substantial in degree—no less than 15% in the last ten years alone among several million women ages 25 to 74.

• The proportion of cancer patients surviving 5 years or more after diagnosis has measurably increased. This improvement is recorded for most major sites of cancer, and is especially large for certain cancers among women and for cancers of the digestive system.

Such facts indicate that still greater gains are possible. In this connection, the American Cancer Society states:

"One half of all cases of cancer could be saved with present knowledge if individuals would seek medical attention early enough, and if the latest and best means of diagnosis and treatment can be made more generally available."

So, pending a major break-through against this disease, *you are the first line of defense against cancer*. And here are things you should do:

1. Know cancer's seven warning signals. Should one of these signals appear, no time should be lost in seeing your doctor. In the vast majority of cases, a danger signal turns out, upon examination, to be a symptom of some other condition.

Cancer's Seven Warning Signals

1. Any sore that does not heal.
2. A lump or thickening in the breast or elsewhere.
3. Unusual bleeding or discharge.
4. Any change in a wart or mole.
5. Persistent indigestion or difficulty in swallowing.
6. Persistent hoarseness or cough.
7. Any change in normal bowel habits.

2. Have regular health examinations. Many cancers occur in parts of the body which a general practitioner can readily examine in his office. Should you notice changes in normal body functions between examinations, have another check-up.

3. Avoid any treatment except your doctor's. Cancer is cured only by physicians using surgery, X-ray, and other forms of radiation. In many forms of cancer, the majority of cases can be saved when diagnosed early and properly treated.

Current research on the causes of cancer, its prevention and treatment gives even greater hope for the future. But it is still important for you to be alert to cancer's danger signals and get prompt treatment should one of them occur.

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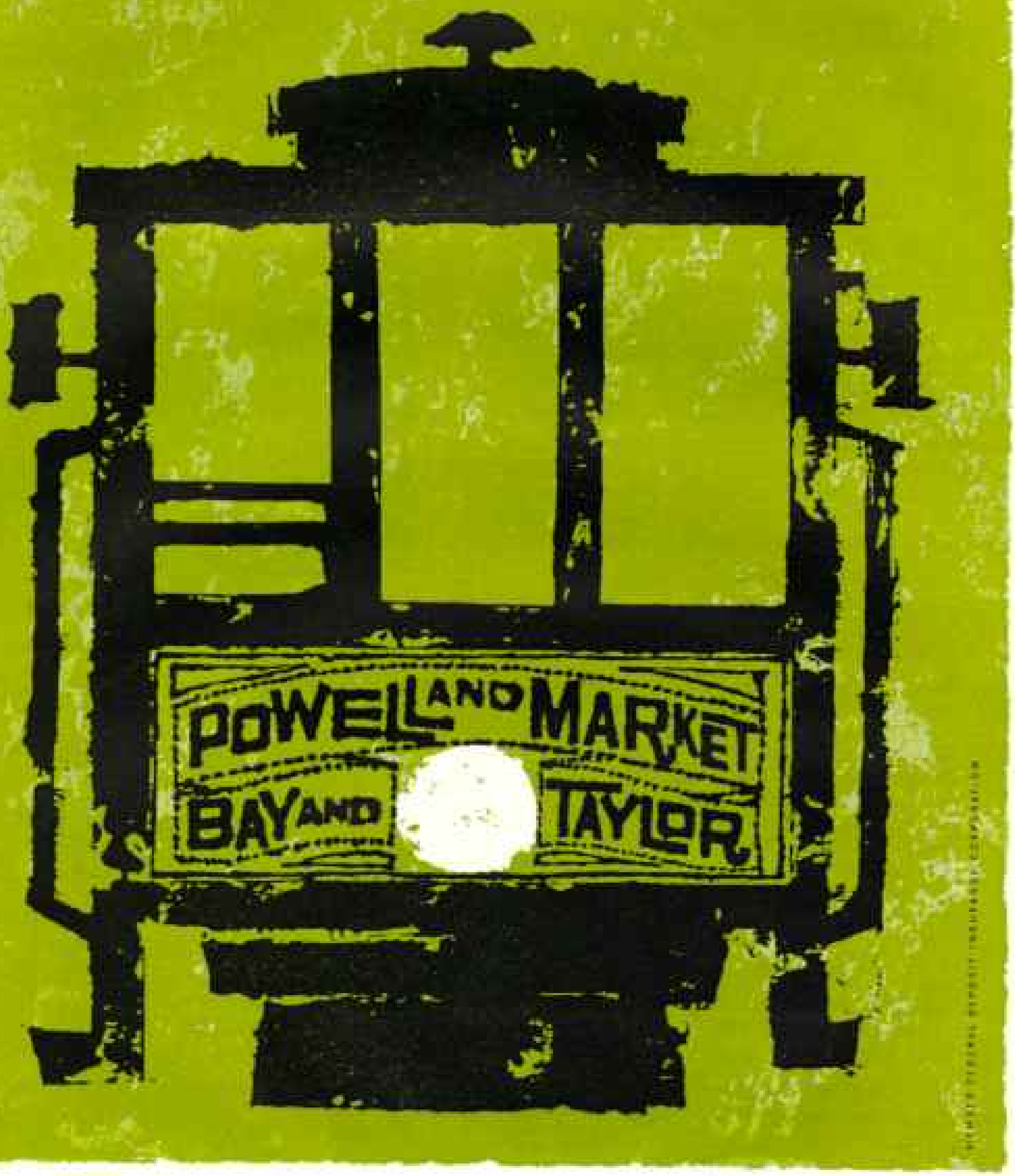

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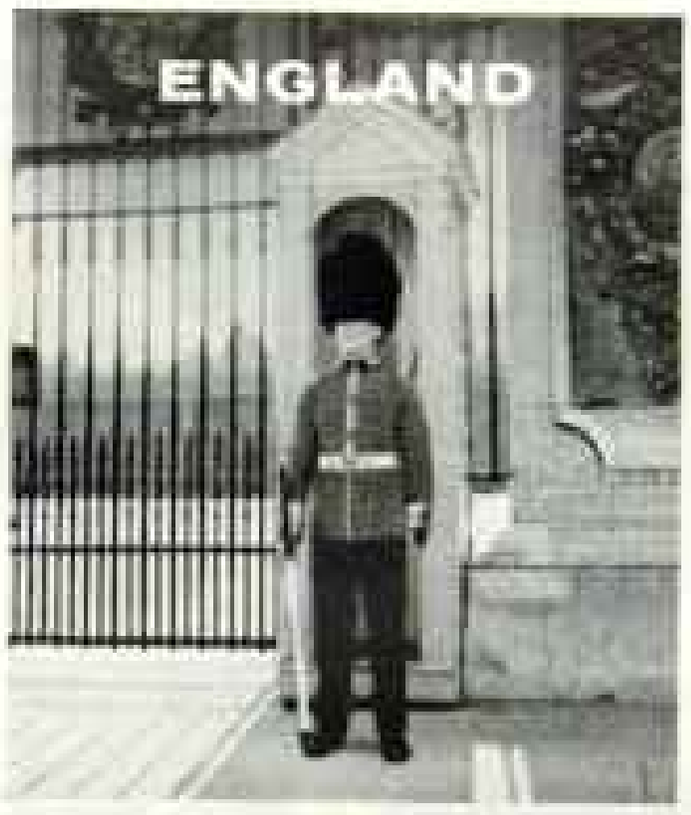

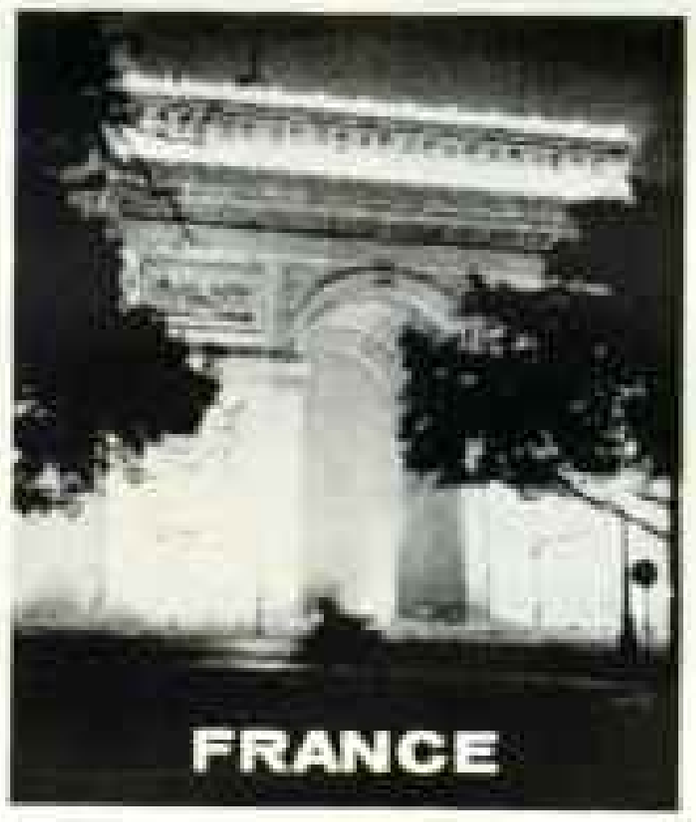

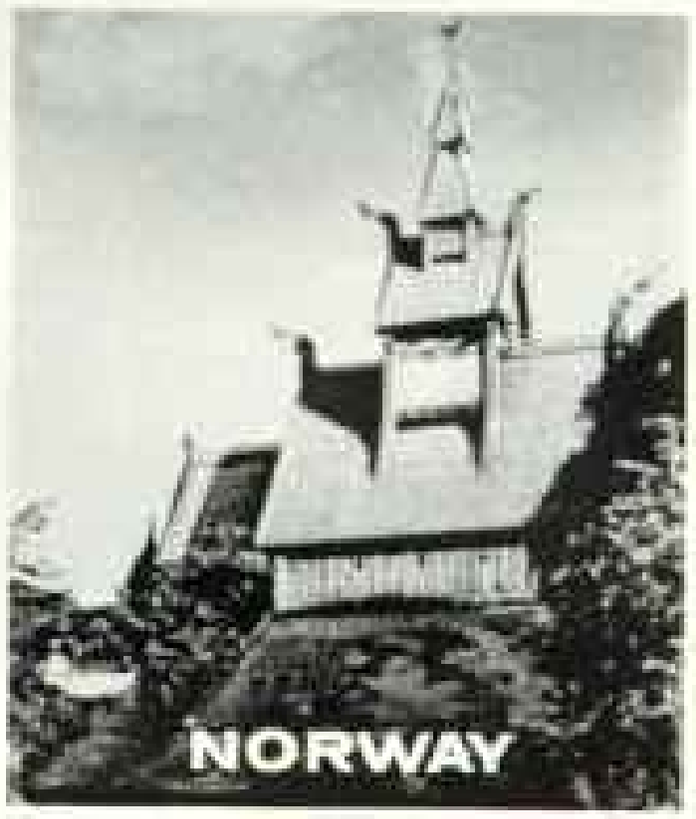

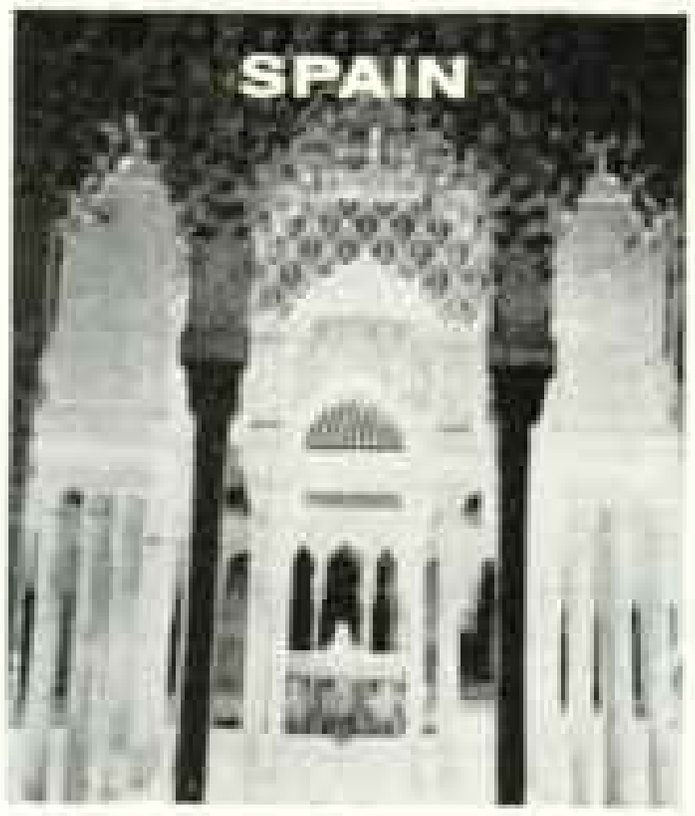

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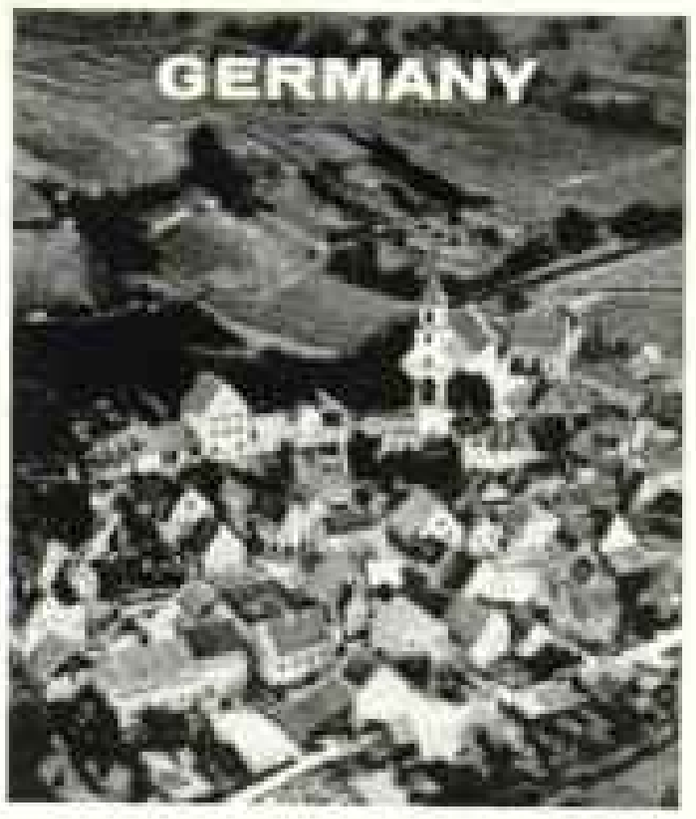

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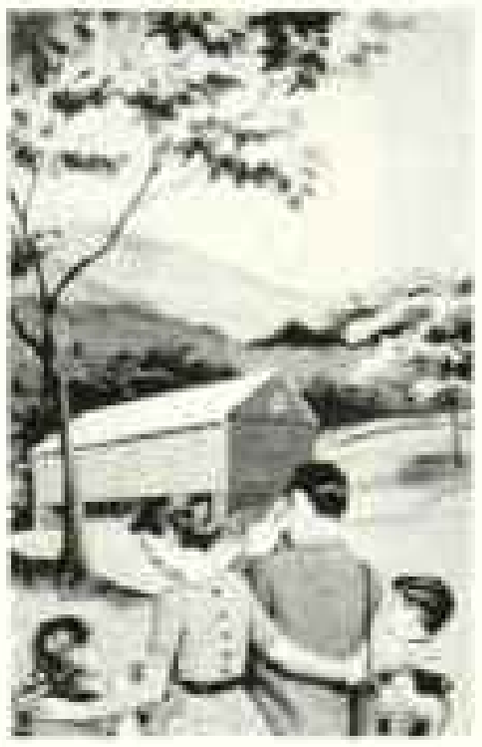

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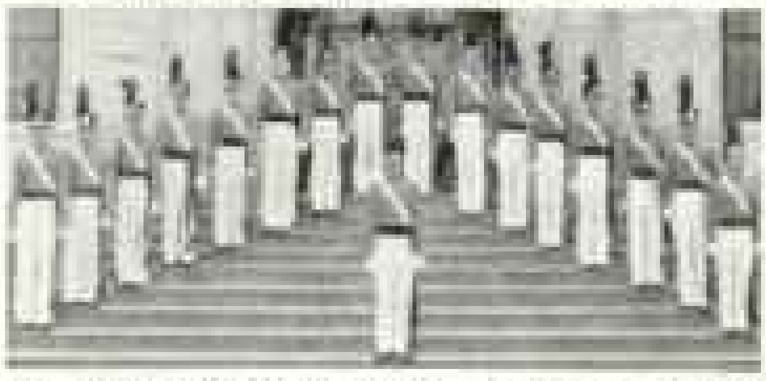

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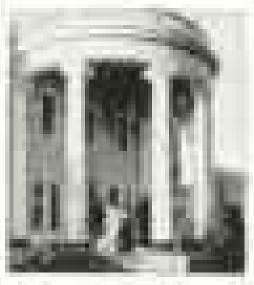

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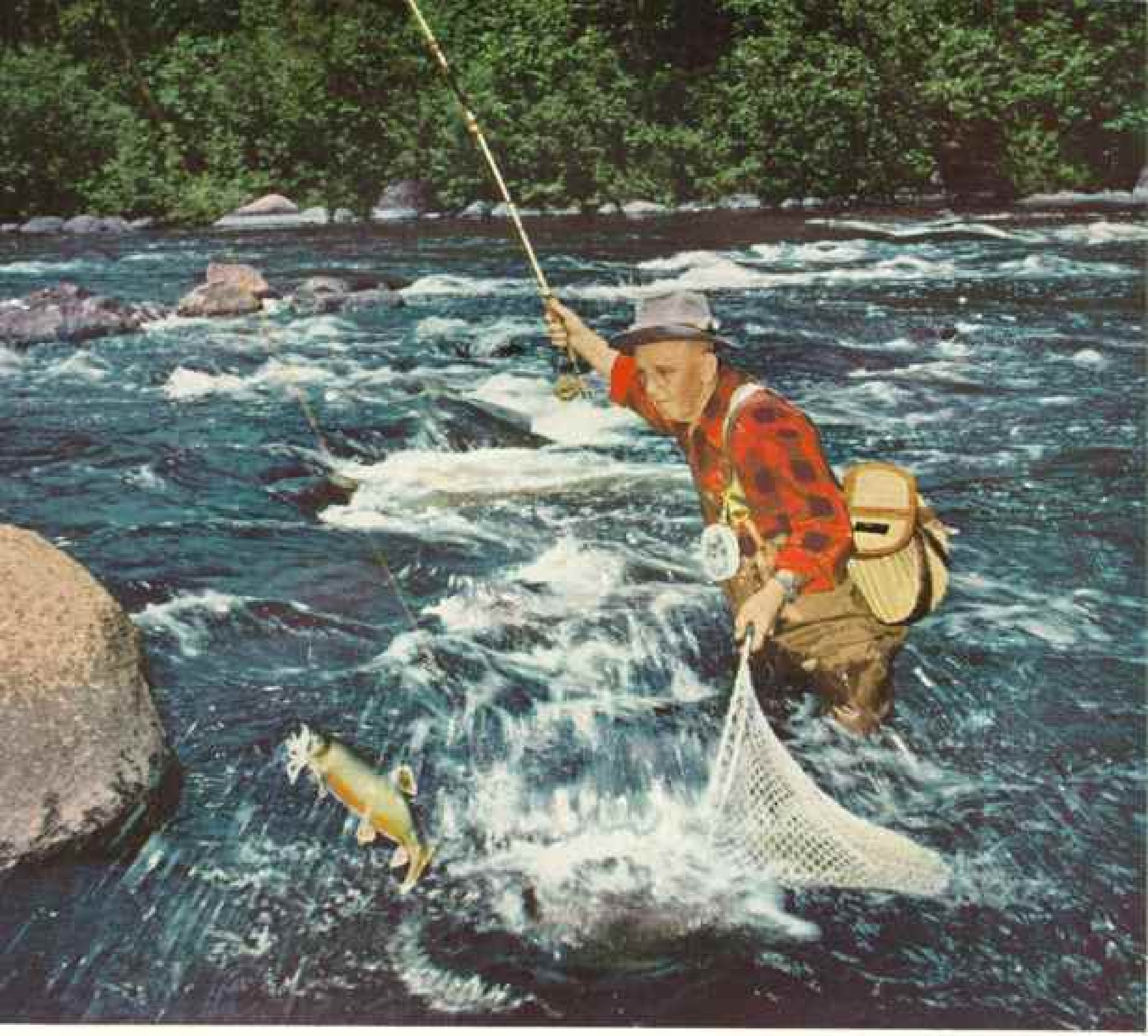

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