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THE NATIONAL GEOGRAPHIC MAGAZINE

Paricutín, the Cornfield That Grew a Volcano

By JAMES A. GREEN

HOW DOES it feel to be the owner of a live volcano? What do you do when, having plowed for corn, you reap ashes and lava? Where do you go when your level field becomes a cone of fire?

Owner of such a property is Dionisio Pulido, a simple Indian who lived in the village of Paricutin, State of Michoacan, Mexico. His story is almost as incredible as that of Jason who sowed the mythical dragon's teeth and harvested armed men.

I heard Dionisio's story from his own lips. On February 20, 1943, he and his ox were turning furrows for corn. Dionisio's small son was with them.

His Cornfield Growls and Fumes

"My boy," Dionisio told me, "came running and said he had heard a noise under the ground. As I had been shouting to the ox, I heard nothing. Then I stopped and listened. I heard a low rumble, as if something underground had growled. I looked; there was nothing. Then, just behind my furrow, I saw a spiral of white smoke."

As if lost in contemplation, Dionisio stopped talking.

"What then?" I asked.

With a sweep of his arm and a soft whistle he conveyed the impression of speed.

"My boy and I ran," he said. "The ox ran, too."

Dionisio hastened to save his animals. Then he broke the news to the *padre* at Paricutin, two miles away. Thereafter he informed the *presidente* of Parangaricutiro, a village two miles from his own.

That night Dionisio's terrified neighbors saw a luminous spiral smoking above his field. They heard the thunder of explosions.

On the following morning those who ventured near saw a cinder cone, possibly 25 feet high. At noon it began belching stones. Again they felt the earth quake. It had been trembling for a week.

Within a week the cone had grown to 500 feet. In ten weeks it was 1,100 feet. From its crater masses of vapor rose three miles.

Vesuvius Flared up Again

Old volcanoes that flare into renewed activity are not a new phenomenon. Vesuvius is the classic example. But the volcano born under a man's feet is probably beyond human experience. Certainly few men have lived to tell such a story as Dionisio's.

I met Dionisio just three weeks after his run for his life. I asked what he thought of *El Monstruo*—such is the Tarascan Indians' name for the fire-breathing monster known to the world as Paricutin Volcano.

Dionisio had little interest in volcanology. All that concerned him was his private calamity. Not content with engulfing his farm, the monster now crept on his home.

Half a mile away a column of lava was being channeled through the valley. Dionisio's palm-thatched cabin and half-dozen fruit trees were doomed.

A government inspector tried to cheer Dionisio with word that the Republic would relocate him on another farm. The Indian remained disconsolate. This was his birthplace, the only place he knew. Away from it he was sure to be unhappy. He wanted only a miracle that would re-establish the world of February 19, 1943.

His neighbors prayed for that miracle. I saw them when lava had advanced within a few hundred feet of their own acres (page 132). With the simple faith of Indians they dug with spades 20-foot crosses into the turf.

AP from Press Ass'n

Puffs from Paricutin, as from a Locomotive, Time the Explosions Six Seconds Apart

Gas from molten lava bubbles through the crater like carbon dioxide from a bottle of soda water.

Mexico's Belt of Fire Is a Chain of Volcanoes Stretching Almost from Coast to Coast

Paricutín is the only one in activity. A few are quiescent; most are extinct. Underlying the Paricutín region, a lava reservoir of undetermined depth makes every property holder the potential owner of a live volcano. Mexico City, which can see dormant Popocatepetl, 45 miles away, receives ashes from Paricutín, 200 miles distant. Paricutín village is abandoned; Uruapan and Parangaricutiro carry on.

To prayers and crosses alike the red giant was deaf.

To some more sophisticated than Dionisio the volcano breathed fortune. Among them were the truck drivers at Uruapan, the city nearest to the volcano (page 151).

To reach it we went from Mexico City by automobile to Morelia, famed for its magnificent old Spanish architecture, and then to Uruapan.

The highways were perfect. There was no shortage of either gasoline or tires, and often we rolled along at the legal limit of 80 kilometers to the hour. That translated into miles—50—is not so fast, but it is quite fast enough in Mexico, where stray burros and cows make themselves perfectly at home on the road.

From Uruapan bus and automobile passengers to Paricutín transferred to sturdier truck. Drivers loaded their vans to capacity—sometimes 25 persons to a truck—and charged all that traffic would bear.

The Dusty, Bumpy Road to Paricutín

The road to Paricutín was worth every cent they asked. Our party—five friends from Mexico, my wife, and I—never had a more painful ride. Up and down hill our truck charged like a bronco.

Road dust lay inches deep. Dripping from spinning wheels, it looked fluid. To parched mouth and nostrils it was anything but fluid. We covered our noses with handkerchiefs. Before long we were coated gray.

As we neared our goal, volcanic dust covered the underbrush like black snow.

From a distance we could hear the rumble of the tortured earth and see the smoky plume of steam, gas, and ash towering more than three miles (page 134).

The trail wound through desolate pines tapped for turpentine. Leaving this grove, we entered a clearing dotted with live oaks. At first impression it looked like a hill pasture in Kentucky.

Then I became aware of the cone itself, now in full view. It had reared its head some 800 feet above the cornfield. (Months later it was 1,500 feet and still growing.)

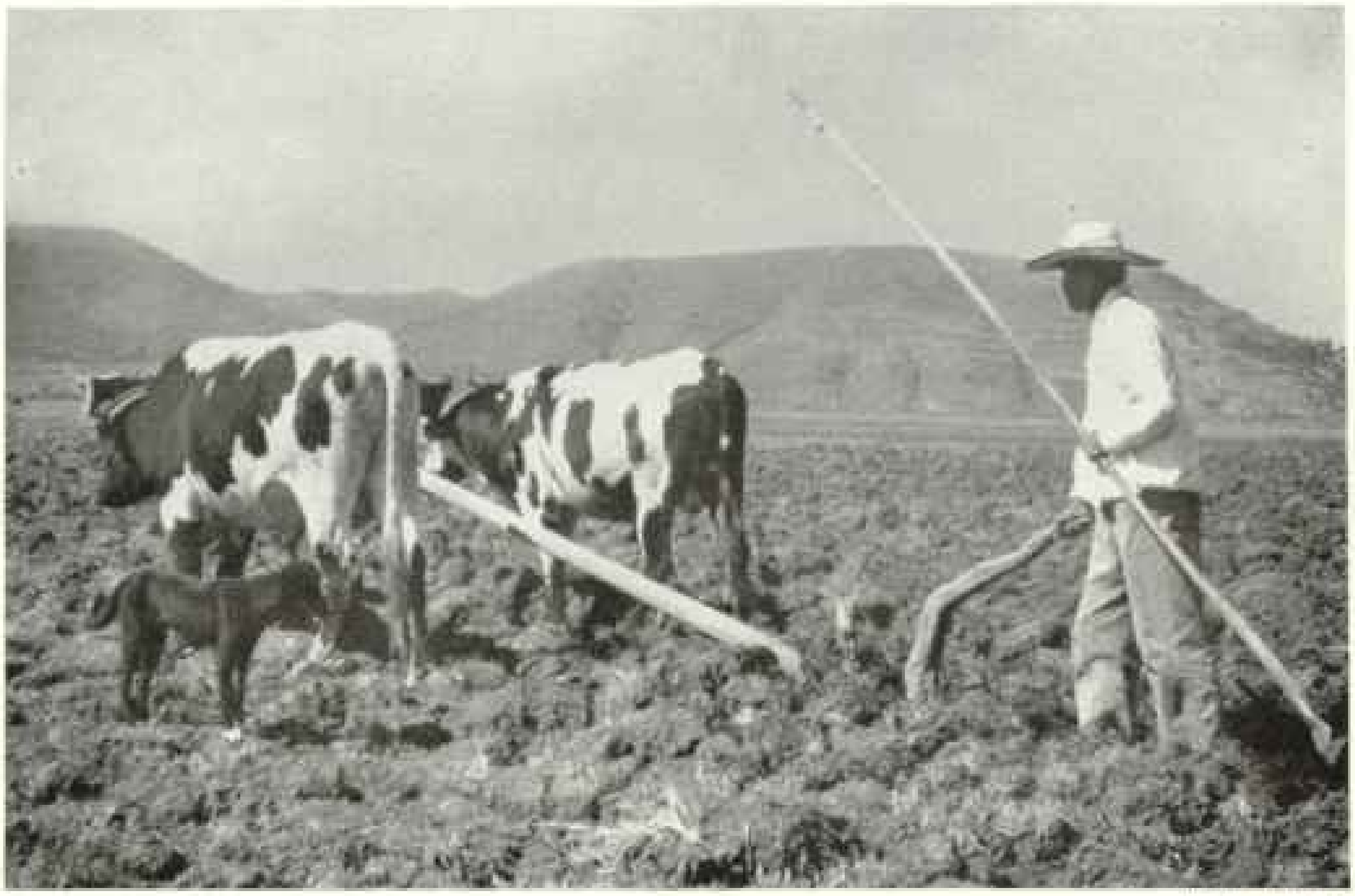
From the crater poured the smoke of 10,000 factory chimneys. On an average of every six seconds it exploded a hurricane of rocks. From the distance they seemed a flock of blackbirds escaping from an inferno.

Stones shot up fanwise some 3,500 feet. Then the barrage, losing momentum, fell crashing. At the end of its flight, trees were denuded. Fallen from the sky, fiery boulders rolled like snowballs down the cone (Plate VIII).

The orchestration for this display was an ominous sound I had never heard before. A friend described it as the "voice of the surf in a terrible storm, the roll of thunder, and the roar of cannon rolled into one."

A Hot, Stony Glacier Gulps Trees

Surrounding the cone, a lava field blanketed almost two square miles. (Last November the figure was more than ten square miles.) Slowly but inexorably the lava wall advanced,



Charles B. Beery

A Plowman Like This Indian Was Dionisio Pulido, Whose Field Spouted a Volcano

Near Paricutin the farmer guides his oxen with the goad. Would he be surprised if the earth rumbled and fumes poured out! On February 20, 1943, Dionisio was so frightened when his cornfield erupted that he ran the two miles to his village (page 129).

pushing out an irregular cliff like face some 20 feet high. Here and there it swallowed a smoldering tree (page 148).

I had imagined that the lava would flow like molasses from an overturned jug, as at times it does. But at its front the flow broke off hard chunks, tossed them forward, and then occupied the gap. Peeling off, the fragments exposed a glowing, molten interior.

My wife's diary, written on the spot, describes the scene:

"Masses of lava, acres of it, are encroaching on the peaceful countryside in an immense sea of what looks like clinkers from the furnace of the earth. They smell the same as clinkers, hot and dry, sharp in the nostrils. A moving, crackling sea of piled-up, fantastic shapes, with the cherry red of molten lava showing in the cracks and fissures."

Leading to the buried cornfield was a bit of the road which Dionisio had traveled.

Hawkers Swarm on Carnival Grounds

It was strange to tread a road that soon no one would tread again. Advancing lava would bury it forever. In days to come no one would take the trouble to dig up Dionisio's little road as others have unearthed rich Pompeii.

Like the truck drivers, country people had gathered to cater to us sightseers. They made a gathering like that at a country fair. Carrying red earthenware jugs of water, saleswomen went about hawking, "*Agua! Agua!*" Others, trafficking in oranges, limes, and muskmelons, plaintively cried, "*Frutas! Melones!*"

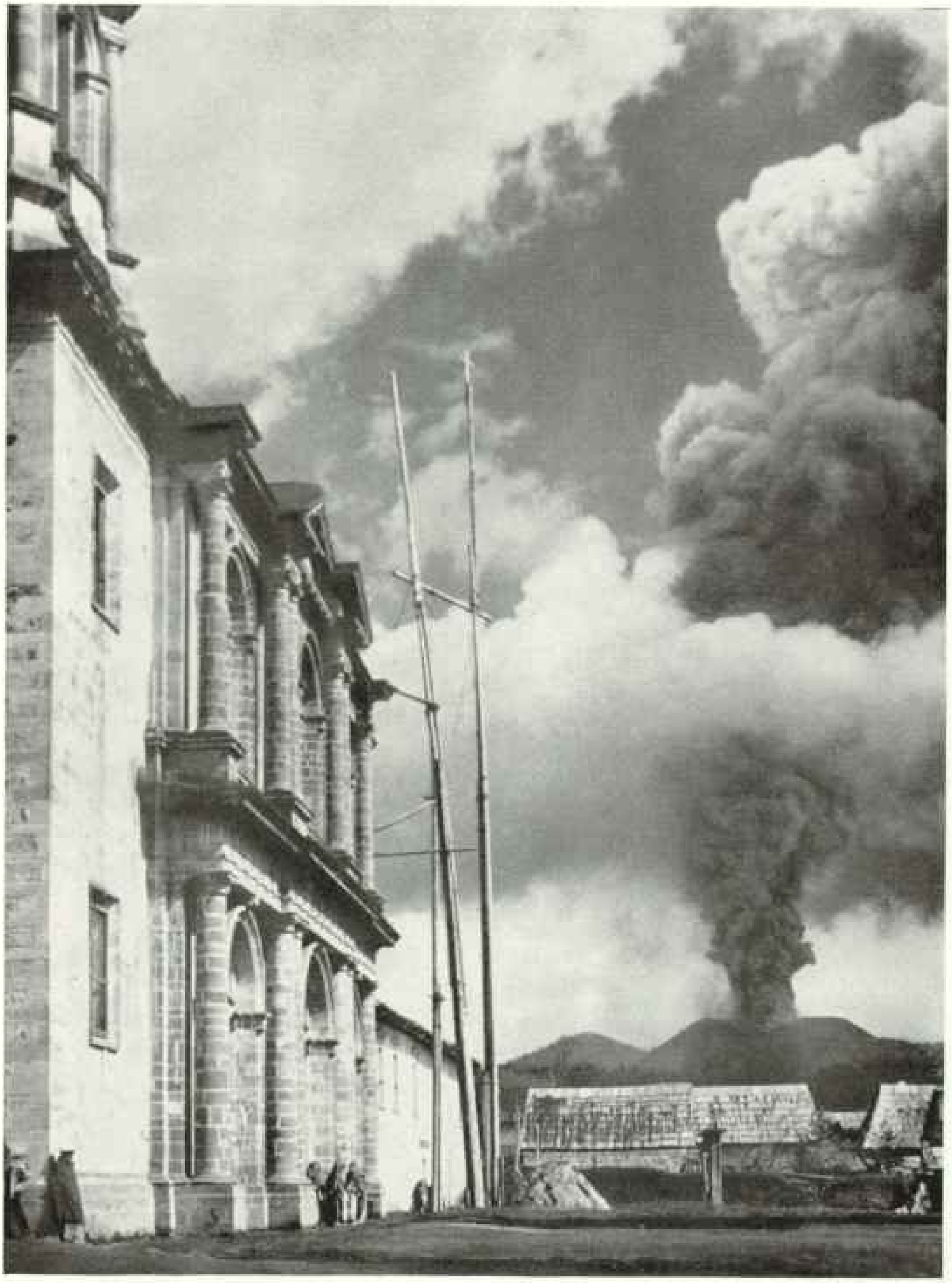
Some sold their wares from lean-tos made of pine boughs.

A few had tents. Such a one was the enterprising Indian who tempted us with "hot dogs," tamales, and bottled soft drinks. A dark glance rewarded our refusal.

Our lunch was already packed. That evening we ate it by the light of Paricutin's fires.

Night Turns on the Fireworks

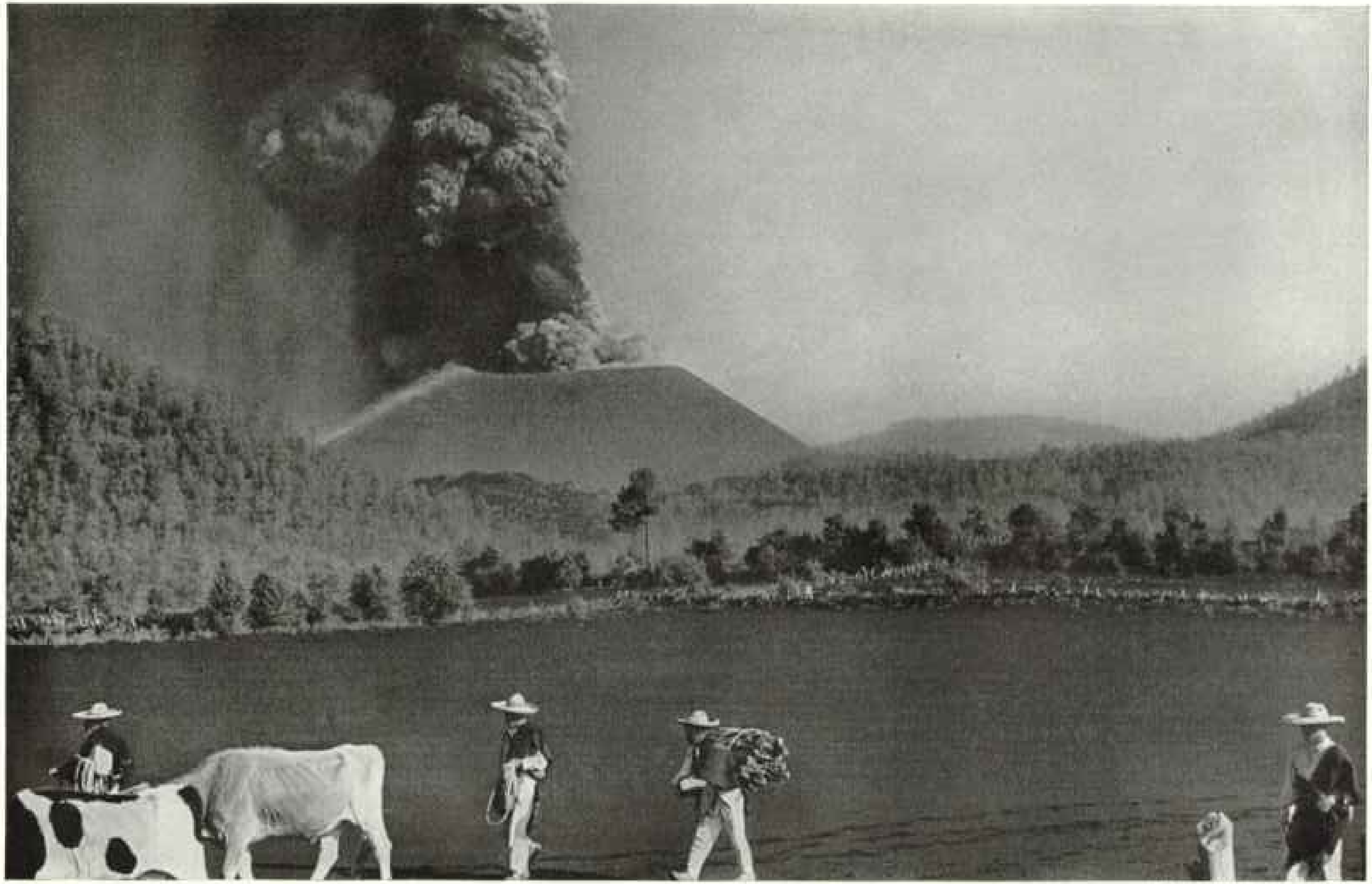
Night painted the volcano with dreadful colors (pages 146, 150). Gray by day, the cone now glowed incandescently. Like liquid fire, streams of red-hot boulders cascaded down the slopes. Daytime's black column of vapor was a seething, golden flame. From the crater a fountain of red stars showered up as from a gigantic Fourth of July Roman candle. By night the "blackbirds" were red-hot bursts of tracer shells (page 145).



AP from Press Ass'n

Bewildered Indians of Parangaricutiro Cling to Their Church as a Bulwark

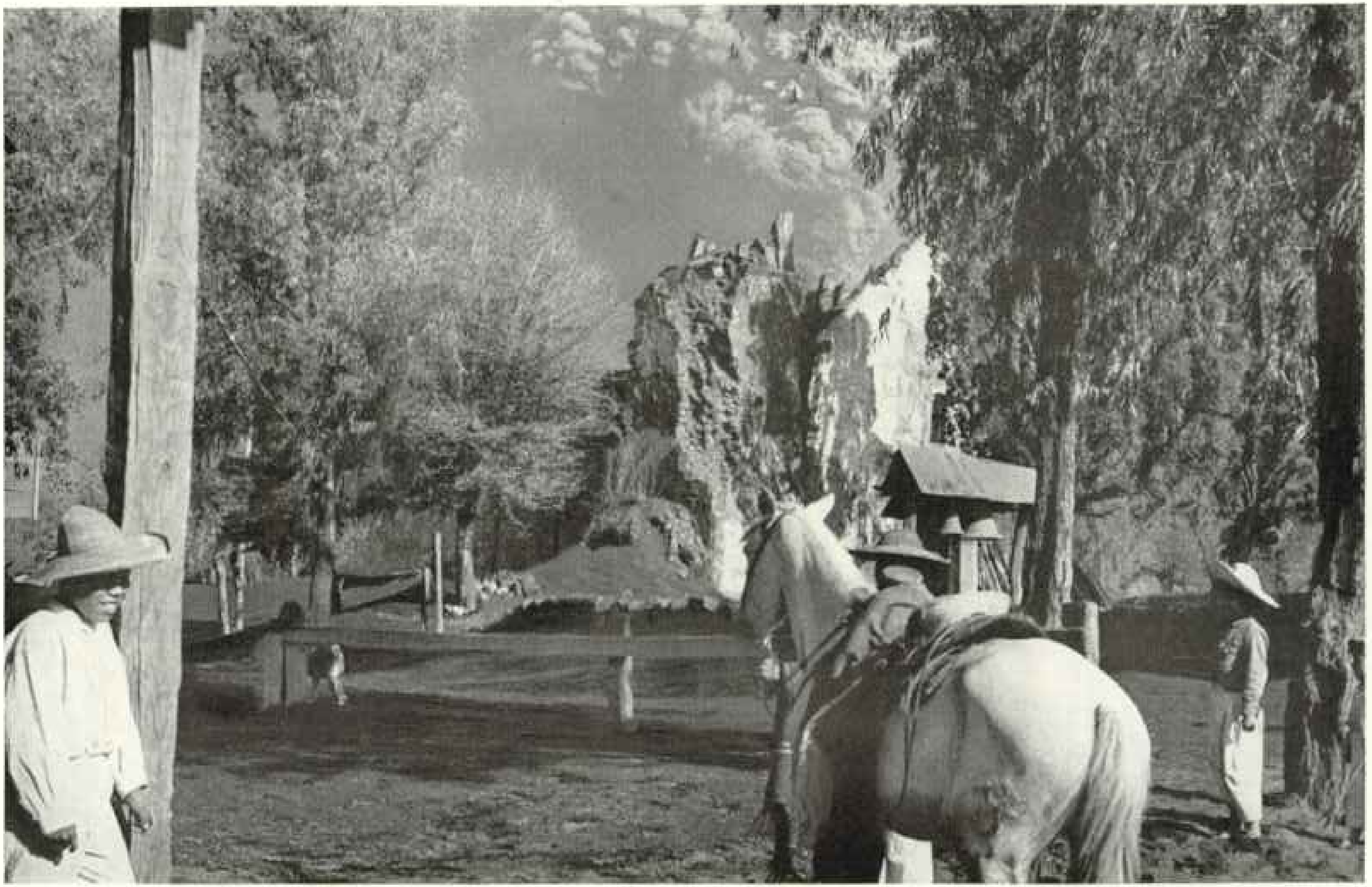
From the scaffolding, one pole surmounted by a cross, fireworks splutter during religious festivals. A heap of ash stands just below the roof from which it was swept. This town, at last reports, was still inhabited. Some residents who had moved away have returned.



© Rudolph E. V. Boesler de Villiers

Without a Sidelong Glance at "the Monster," Indians Drive Their Oxen across a Black Sea of Ash

A year ago this wasteland was a farm. Some one had carefully fenced it with spiny agave plants, akin to those used in making tequila and twine. Old volcanic cones flank Paricutín. The Tarascans are walking from Paricutín village. One carries firewood.



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Paricutin's Church Tower Is a Crumbling Heap of Adobe Destroyed by Earthquake Accompanying the Eruption

Here the volcano resembles a blazing oil refinery. Two miles from the crater, ash sprinkles the churchyard, but trees remain green. Church bells are set in an earthquake-proof belfry on the ground. Indians, animals, and bells, as well as the church's saints, have all been evacuated.

What had been a black field of heaving lava was now an immense grate of coals, with embers glowing between its bars. Like a boiling gruel, lava puffed up jets of fire.

Night added to the terror of the explosions. Though assured we stood in no danger of one immense, concentrated blast, we could not repress thoughts of destructive volcanoes that had suddenly blown their heads off. Bible lessons of my youth called to mind that Pillar of Fire, beacon of the Children of Israel. An engineer to whom I spoke this thought reacted differently.

"What a wanton waste of so much heat and energy!" he commented. "That squandered power is enough to heat every city in the Union for a dozen years. But no one can get near it, much less harness it."

Indeed, we kept our distance, a respectful mile.

Dead Volcanoes Now Cinder Heaps

It was time to go. As we turned our backs on the golden fountain, the stars shone serenely above the pines.

On the road back we saw the ghosts of extinct volcanoes. From a commanding prominence during daylight hours, I had counted 27 of the hundreds of old cones in this field. Some were large, others small. Some were joined in a row. Some were so old they were covered with trees. A few bare cinder heaps appeared not to have changed a particle since their fires died.

It was a weird landscape, one that might have been lifted from moon to earth.

Old lava beds chasmed and ridged the terrain.

In such a rough country I marveled to see Indians in bare feet. How calloused their soles must be! The stoutest pair of shoes, it seemed, would soon be cut to pieces.

There had been no rain since October, and the ground was dry.

In the rainy season the country turns green as if by magic. Flowers and grasses hide the old lava. Cattle grow fat again. In the few arable fields, corn and beans flourish.

But now a black Sahara stifled life. Eventually the new minerals will refresh the soil, and the land will bloom as never before.

Uruapan Sweeps and Hoes a Black Rain

At last we were back in Uruapan!

Poor Uruapan! Not so long ago it was called the Vale of Flowers! Now its 20,000 residents endlessly swept dust from walks, patios, and roofs. They were fearful of the day when the rain of ash would be too deep for brooms—yes, even for the hoes some of them were using. Street lights were turned on in dusty daylight.

One of the city's largest industries is lacquer work. Proudly the proprietor of a small factory told me: "Our designs are made by artists. Then we put on coat after coat of lacquer."

Sadly he pointed to an array of shelves in his patio. It was empty. There in ash-free days finished works are set to dry in the sun.

At the End of the Trail—a Bath!

However, lacquer's ill wind blew a godsend to the hotel trade. The proprietor of our stopping place told us he had spent two years learning the business in Texas before he rebuilt the present hotel.

"Went American," he said in English, "to get your language. Also I wanted some of your hotel ideas. See,"—pointing to his dining room—"my *comedor* has signs in English."

And there they were—signs announcing meal hours.

When the rush to Paricutin began, he had a new hotel, and many of the rooms had baths. And did our dusty party welcome a bath!

Speculating on postwar travel, more men than our host wonder how long Paricutin will continue. Already the Mexican Government has built a shorter, better road.

No one can guess how long El Monstruo will remain alive. Today its 1,500-foot cone tops most of its extinguished neighbors. Still it grows and grows. Will it eventually dwell, snow-clad head in the upper air, with giant Orizaba (Citlaltepec) and Popocatepetl?

Dionisio and His Saints Are Gone

At any rate, a fresh lava vent broke out last June, ruining Paricutin's sleek contours. From the new vent came a lava river flowing at about 70 feet an hour. Subsequently it slowed down, and the major crater, repairing the break, restored the volcano's original symmetry (page 147).

Meanwhile, Dionisio Pulido and his neighbors, their farms, homes, and church destroyed, are refugees. A brigade of army trucks carried them and their poor belongings to a neighboring hacienda. They refused to make the trip without their saints. To oblige them, Gen. Lázaro Cárdenas improvised a shrine. There he placed altar, bells, and images from Paricutin's church. Having them, the Indians feel less like total strangers.

Paricutin has presented an unprecedented opportunity for scientific study of a volcano's birth. Almost from its first wisp volcanologists have attended the infant. At the end they will probably be there observing its death.

Kodachrome by Richard H. Stewart

Old Mexico's "China Girl" Smiles at a "Cowboy" in a Convent Garden

A favorite costume of Mexican women is the China Poblana (left). Legend tells that the original was designed by a Chinese princess, sold into slavery in Mexico by pirates. Bought by a Pueblo couple, she later inherited their fortune, which she spent to help the poor.

Kodachrome by Richard H. Stewart

Wayfarers Six Miles Distant Can Hear the Mellow Tones from Bells of the Cathedral of Mexico

Dome-capped towers of Mexico City's "St. Peter's" look down on the Zócalo, largest plaza in the Republic. Most of the stones in the Cathedral are from an ancient Aztec temple. At right is the National Palace, which houses many government offices, including those of President Manuel Avila Camacho.

Kodachrome by Richard H. Stewart

Under the Coat of Arms of the Artillery School, Cadets of Mexico's "West Point" Stand at Attention

More than a century old, the Colegio Militar originally was in the palace of the Fortress of Chapultepec. With a yearly enrollment of some 1,000 students, the school trains artillery and engineering officers. Statuary and inscriptions commemorate cadets who died in the war with the United States in 1847.

Kodachrome by Richard H. Stewart

Mexico City's Statesmen, Business Leaders, Literary Men Seek Relaxation in Cuernavaca, Semitropical Resort Town

Mexican Girls Admire the Iron Gate and Inner Court of a Mexico City House

Kodachromes by Richard H. Stewart

Colonial Saints and a Girl in Ranch Costume Turn Back Time in a Grassy Court

Men and Vehicles of Mexico City's Modern Fire Department Line Up for Inspection

Kodachrome by Richard H. Stewart

Rivera Murals at Cuernavaca, Gift of Former U. S. Ambassador Dwight Morrow, Portray Conquistadors and Early Mexican Patriots

Kodachrome by Charles R. Berry

Nature's Most Awe-inspiring Spectacle—a Volcano Is Born

An Indian, plowing his field in the state of Michoacan, was witness to the birth of this new crater in February, 1943. With terrific force red-hot rocks hurtle a thousand feet into the air.

Kodachrome by Richard H. Stewart

This Matador's Colorful Costume Puts to Shame the Women's More Somber Attire

Lorenzo Garza, of Monterrey, is one of Mexico's most popular bullfighters. Here he chats with admiring Americans before entering the ring in Mexico City.

One of the men who know most about Paricutin is Dr. William F. Foshag, Curator of Mineralogy, Smithsonian Institution. At times of its greatest activity he has devoted two and a half months to study on location.

To him the NATIONAL GEOGRAPHIC MAGAZINE presented a series of questions, asking him to explain, in nontechnical terms, what goes on down below.

Along the "Belt of Fire"

"The fact that Paricutin spouts fire does not mean the earth's interior is molten, as it is assumed to have been when the globe was young," Dr. Foshag said. "Earthquake waves registered on seismographs indicate that the outer shell of the earth, some 1,800 miles thick, is solid rock.

"However, there is a magma chamber, or reservoir of molten rock, underlying the entire Paricutin region. Thought to be some 100 miles long, it has been there since Pleistocene times, perhaps 100,000 years ago. At various times this reservoir, having found a safety valve, has built up hundreds of volcanic cones. After brief activity they have died.

"Paricutin is the latest manifestation of volcanicity in this area, which has been called the Belt of Fire. It is definitely a part of the arc of volcanoes extending along the Pacific's shores from the Andes to Alaska,* the Aleutians, Kamchatka, Japan, and Java.

"In spite of exceptional opportunities it cannot be said we have added greatly to the store of knowledge.

"Of course we have learned a few details. But volcanoes have been studied the world over. The evidence about their birth always has been available for study in the rocks. Those who could read them could deduce what had taken place.

Up from the Depths, Gas Blows an Opening

"There are various theories to explain the presence of the molten rock below Paricutin. Other than to say that pressure plays a dominant part, I shall not go into these theories here.

"The immense weight of the crust riding above the magma chamber exerts a tremendous squeeze on the gases released from the molten rock. They constantly seek an escape. Wherever they find a channel of weakness they follow it.

"It is assumed that such a channel is provided by a fault, or fracture, in the earth's crust. However, the volcanism at Paricutin itself is the only evidence of such a fracture or intersection of fractures there. The crack or channel leading to the surface becomes the volcano's crater.

"You may accurately compare the volcano with an uncapped bottle of soda water. Gases escape from the magma chamber with the regularity of carbon dioxide bubbling up from the bottom of the bottle. These gases are accountable for Paricutin's fireworks.

"Gas causes the crater's explosive puffs approximately every six seconds. Gas, charging through the lava in the crater, explodes it into dust and ashes. Gas puffs up the cinders, the rock froth frozen into clinkers as porous as coke. Gas explosions send fragments of lava—which we call bombs—flying from the crater.

"Some of these fiery objects have been tossed up a maximum of 4,120 feet. This measurement may be calculated fairly accurately by timing their descent. The longest fall, 16 seconds, when checked against the acceleration of gravity, gives the distance.

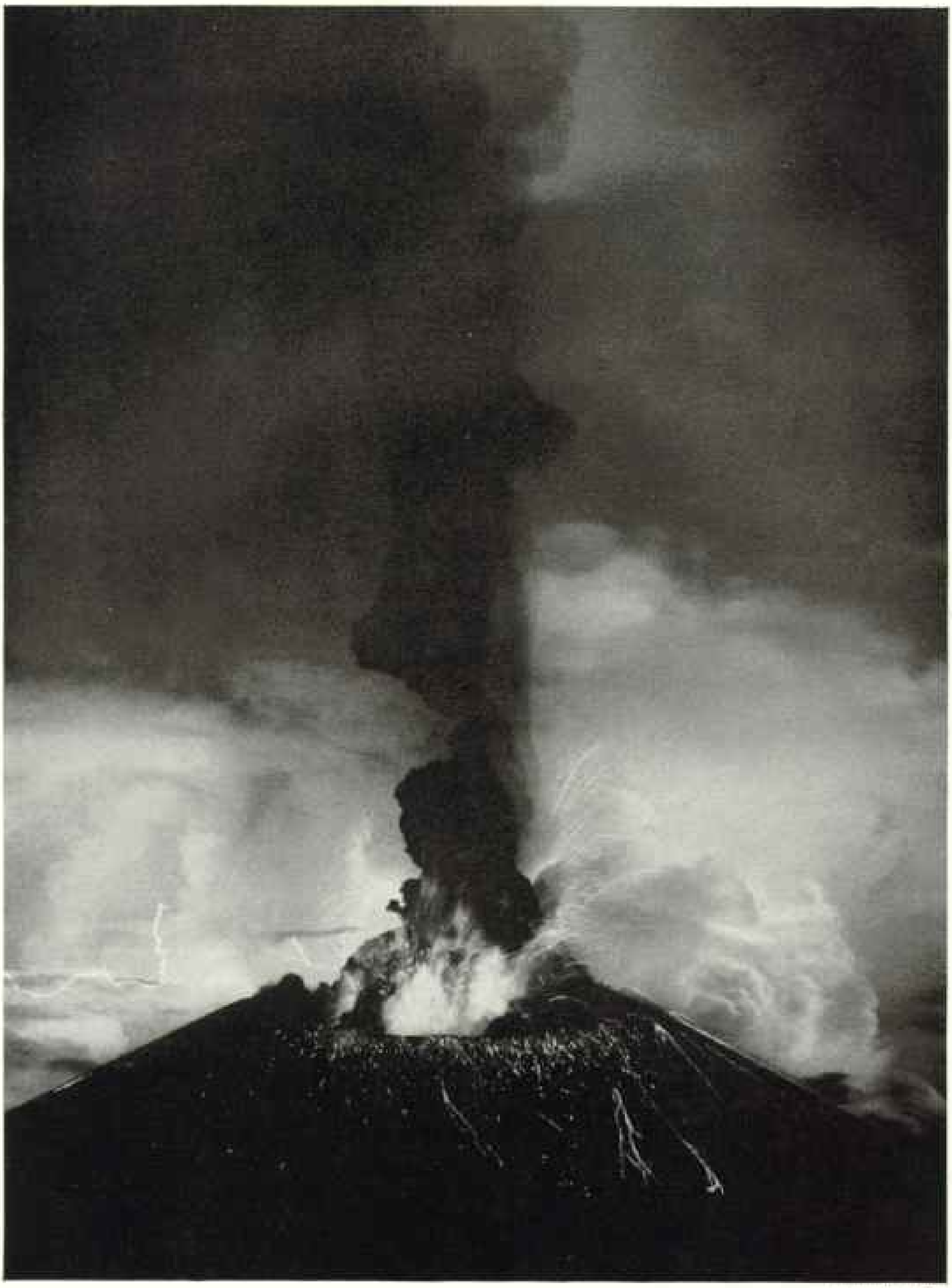
"Fishes" Fly Like the "Blackbirds"

"The eyes that saw the apparent 'blackbirds' flying from the crater were not deceived. Ejected lava fragments take curious forms. On some days they are bird-shaped. At other times they are fish-shaped. Sometimes the bombs are T's, boomerangs, clubs, or hammers. Exposed to the air, they freeze in these shapes. At the foot of the cone a 25-foot 'fish' was found. At times solid rock torn from its throat is belched up by the volcano.

"It is interesting to watch Paricutin build its cone from fallen bombs, cinders, and ashes. At first the volcano gained height rapidly; but as its base broadened, more material was required and altitude was gained slowly. You may watch an analogous process by inverting the sand in an hourglass. My own method is to set the camera at a given spot at the same hour daily and take the record.

"Paricutin has been remarkable for its indefatigable industry. It has not ceased work for an instant. The amount of solid material—lava, cinders, and ashes—which it ejects on the average minute is 2,700 tons. If one day's ejected material were steel it would be enough to build, say, 1,440 heavy destroyers—one for each minute. By the middle of last September the volcano had laid down 1,960,000,000 cubic yards of solids.

* See "Valley of Ten Thousand Smokes: National Geographic Society Explorations in the Katmai District of Alaska," by Robert F. Griggs, NATIONAL GEOGRAPHIC MAGAZINE, January, 1917; also "An Account of the Discovery and Exploration of the Most Wonderful Volcanic Region in the World," February, 1918; and "Our Greatest National Monument: The National Geographic Society Completes its Explorations in the Valley of Ten Thousand Smokes," September, 1921.



Gustavo G. Ramos

At Dusk a Sable Plume of Dust Rises above an Incandescent Shower of Stones

Looking down into the crater's mouth from a near-by ridge, one appreciates why volcanologists cannot examine Paricutin's throat. Lightning, flashing arcs, and bursting gas bubbles create such spectacular displays at times that spectators applaud (page 156). Here fiery stones cascade down the cone, leaving bright wakes.

Papa and Baby Ride, but Barefoot Mama Walks the Ash-sprinkled Road from Paricutín

A time-worn Mexican jest, invented to answer the visitor's inevitable question, rewarded the photographer's wife when she asked this Tarascan, "Why don't you let your wife ride?" "Oh," he replied, "she has no burro."

"I have been asked if this stupendous outpouring does not create an empty cistern within the earth from which it came. The answer is no. The magma chamber, many miles long, is constantly making a readjustment of its liquid content to compensate for materials shot away. Possibly there has been a subsidence of the earth's crust over this area, but it has been too slight to be evident.

The Crater Repairs Its Cone

"A question still puzzling some persons who have seen Paricutín is whether lava emerges from the crater or sides of the cone. The only lava coming out of the crater is blown out; it does not flow out. Lava seeks the easiest exit. It requires less force to create a vent near the base than to raise the heavy column to the summit.

"At various times there have been ten distinct vents in Paricutín's sides. Last March three were flowing at once. In June a lava flow created what many regarded as a second crater. This false crater was formed when the north side of the cone rode out on the back of the lava. Soon the cone built itself anew. Any break in its symmetry is quickly repaired.

"In November a small secondary cone poured out lava.

"Paricutín's lava is viscous, or sticky. It flows somewhat like a glacier. Hawaiian volcanoes, on the other hand, emit a lava so thin it flows almost like a river. This type of lava builds a cone sloping not much more than three degrees, there being no binder of ash or cinders. Paricutín's angle of repose, the natural slope of the materials in its cone, is around 30 degrees.

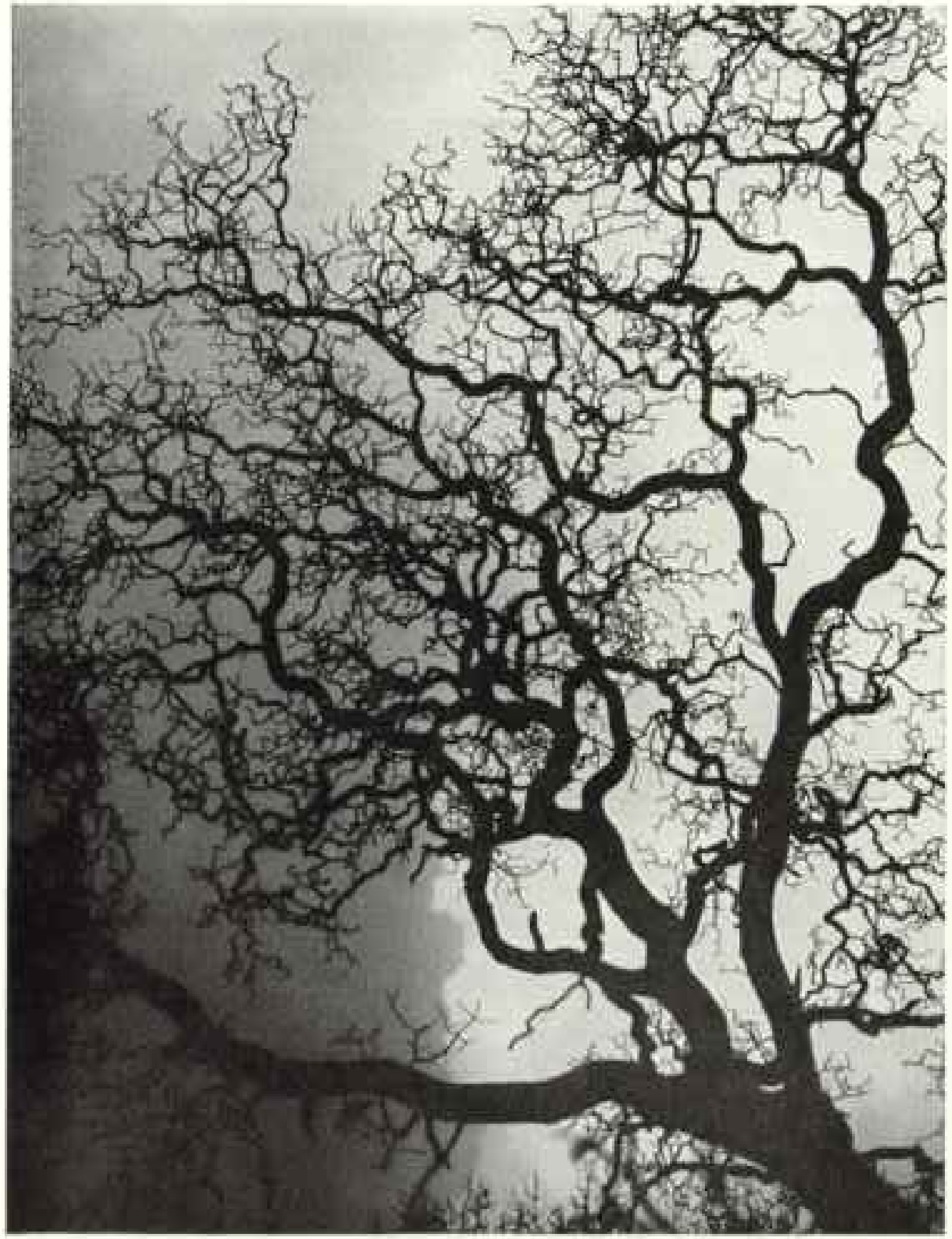
"Some spectators erroneously regard the 3,000-foot candle lighting the crater by night as pure flame. We call it flame for want of a better word, but it is actually incandescent lava fragments shot into the sky. True flame

A Carpet of Black Ashes, Broken by Jagged, Freshly Made Rocks, Covers the Lava Field

Though the edge of this flow is a month and a half old, fumaroles still exhale gases. White spots are salts left by the acids of fumaroles. Fallen fragments raise dust slides on the cone. A cloudburst of ash descends on the left.

Bombs of Falling Lava Raise Dust Clouds on the Slope—Winds Distribute Ashes Unevenly, Making the Cone Lopsided

Day by day Paricutin builds a loftier house. As the cone grows, it follows its angle of repose, or natural slope (page 147). Measurement shows a little less than 30 degrees. Ahead, ash covers the hummocky lava field.



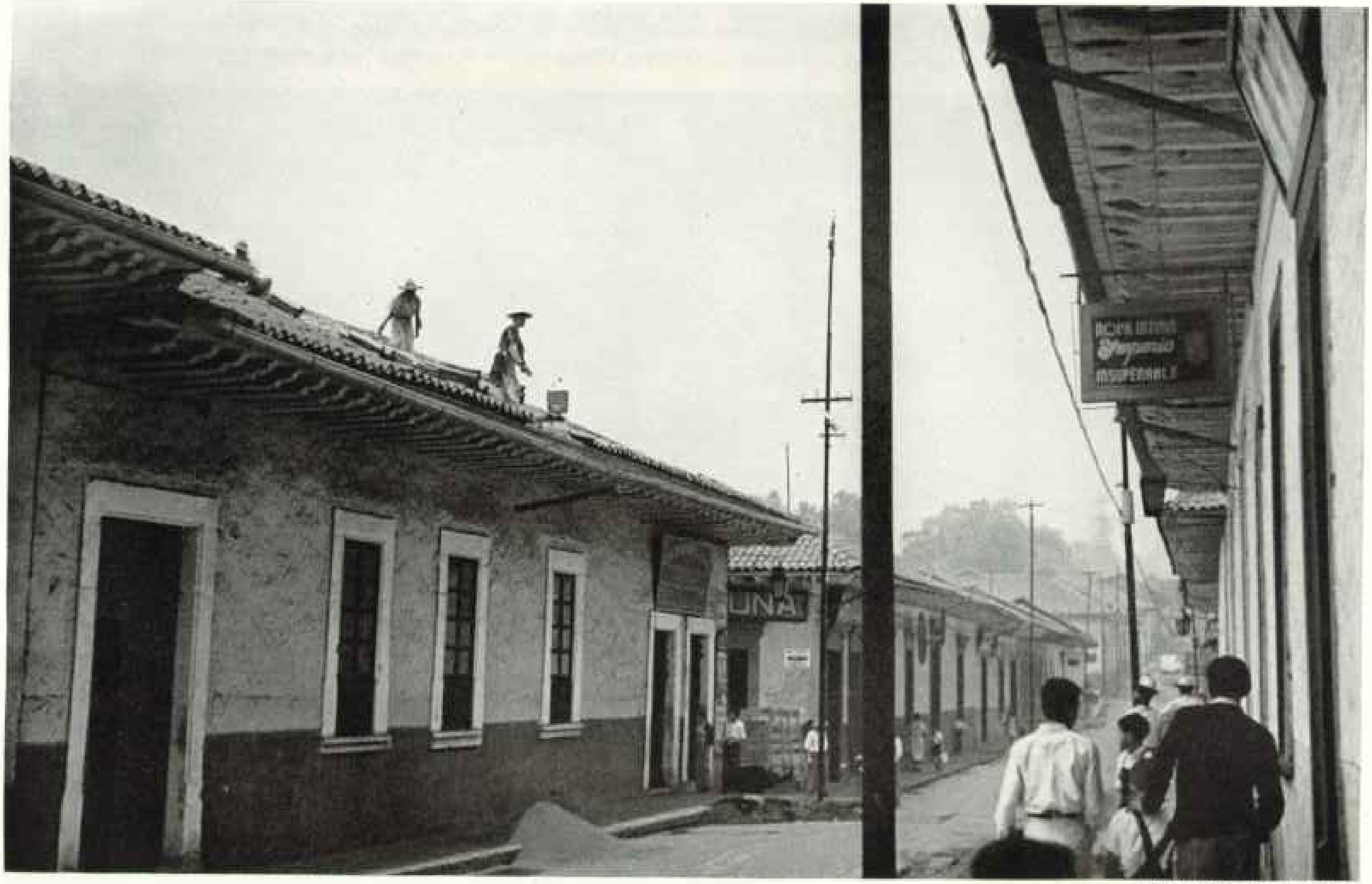
Its Leaves Seared by Gas and Ash, This Tree Is Dead

Bare limbs epitomize the desolation around Paricutin. Among the pines near by, the turpentine industry is ruined. Ash instead of pitch fills the pots. Mineral-rich lava and ash eventually will nourish new forests (page 156).

Rafael Garcia from Black star

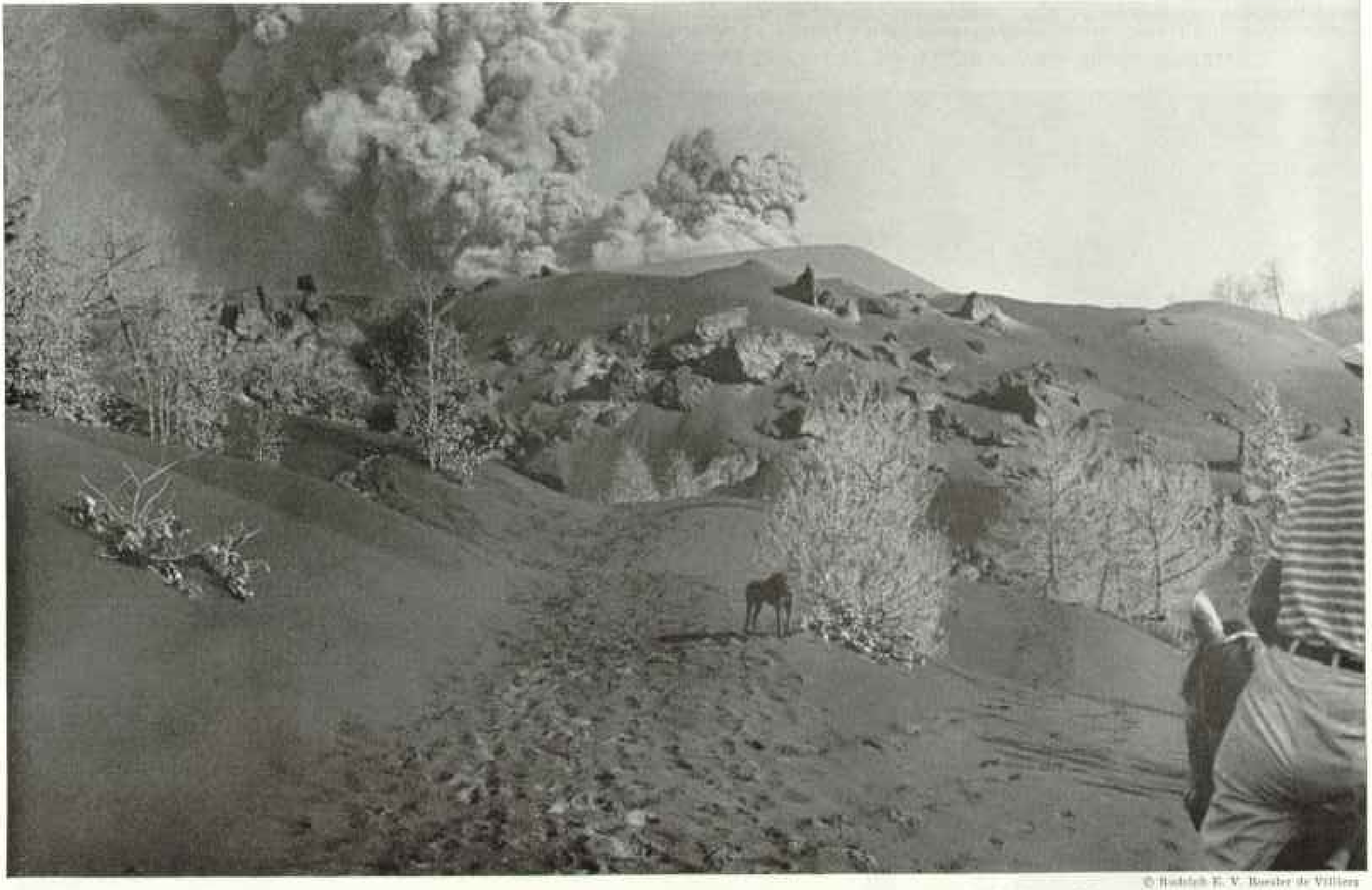
Horses Drinking at a Trough Ignore Night's Fountain of Fire

Slopes of the cone, which smoldered by day, now gleam incandescently. Day's pillar of dust is lost in the blackness. In its place is a fiery stream some 1,500 feet high. Another 1,500 feet of glow is invisible to the camera.



Dusty Uruapan, Once the "Vale of Flowers," Retiles a Roof Cracked by the Weight of Ashes Blown 15 Miles

On the curb a heap of dust indicates how much has fallen since the previous cleaning. In the alley a truck removes volcanic debris. Beyond it is the lacquer shop where the author found work halted by ashes (page 136). Street lights are lit when dust obscures the day. *Ropa Intima* advertises underwear.



A Violent Wind Bends Parícutín's Plume Even as an Explosion Sends a Fresh Column Skyward

As his master marvels, a dog turns his back on the scene. In a trail leading to the foot of the lava flow, sightseers have left their footprints as if on black snow. Like dark icebergs, lava peaks stick out from the sea of volcanic dust. Strangled with ash, the shrubbery is dead.

Nothing Astounds the Burros—Beside a Corral Fence a Pair Graze Contentedly on the Little Vegetation That's Left

This was a part of Paricutin before the village was abandoned. Grass was gone, and now the shrubbery. Ash covers the lot. If the wind shifts, the dust will blacken the washing on the line. Lava flows just beyond the trees to the left. The volcano's "owner" lived in such a hut near by.

Gladys Miller Green

Across the Fertile Fields of Michoacan a Fuming Wall of Lava Creeps Like a Glacier

When Alaska's Mount Katmai blew up in 1912, ash fell over northwestern America. Had such an eruption occurred in New York City, Albany would have seen the column of steam, Chicago would have heard the explosion. Faraway Algeria observed the dust veil. See *The Valley of Ten Thousand Smokes*, by Robert F. Griggs, published by the National Geographic Society.

Mrs. Ralph Gallarno

A Tarascan Family Reads the Volcano's Omens of Their Future

"How long will this last?" they asked. The answer was important, for ash threatened to destroy feeding grounds of chickens, goats, burros, and oxen. Not long after this picture was taken, the family and its neighbors had to move (page 136).

does not exist, because there is no combustion save perhaps that of a little hydrogen in the crater.

"By the same reasoning the black column ascending by day is not smoke. Again we call it smoke, but it is actually steam, gas, and ashes.

Flashing Arcs a Glorious Display

"Steam, released from the molten rock, is the principal constituent of the 'smoke' column. High in the air, it condenses (page 130). It cannot be proved that it has anything to do with the rains.

"Sometimes the dust column behaves like a thunder cloud. Laden with static electricity generated by moving particles, it discharges a flash accompanied by thunder. On some days this display occurs every one to five minutes. On other days it is absent.

"A rare phenomenon, first recorded at Vesuvius in 1906, is the flashing arc—a band of yellow light flashing out of the crater at lightning speed. Such an arc appears only when the volcano is in violent eruption.

"At first the dust cloud lights up with a fine glow. Then the arc leaps out of the crater. A tremendous, noisy explosion follows. The arc is caused by compression and, perhaps, ionization. I have seen the compression rings leap

into the sky. This sight is quite rare. When it does occur, the interval between explosions is about 15 minutes.

"Nearly everyone observing Paricutin wants to know its temperature. We cannot climb the cone and stick a thermometer into the crater. However, red-hot lava a mile from its vent has registered 1,090° Centigrade (1,994° Fahrenheit). Material ejected directly out of the crater cannot be much hotter. Its temperature may be determined approximately by the optical pyrometer, the instrument which the steelmaker uses to determine the heat of molten metal in his furnace. By matching the metal's color against a scale on the filament, he gets the temperature.

A Year-old Volcano Is Aged

"I am frequently asked how long Paricutin will continue. It is quite impossible to say. Geologists are surprised that it has erupted as long as it has. The history of this region is that of many small volcanoes which evidently did not last long. If they built their cones at the same rate of speed as Paricutin, they died within a few weeks.

"I am of the opinion that when Paricutin finally ceases activity, it will never resume. That was the way of its neighbors.

"Although it is 50 miles from Paricutin, extinct Jorullo is what we call a companion volcano. Breaking out in 1759, it lasted only seven months. It apparently was connected with Paricutin's reservoir, for their lavas are the same. Jorullo's record, kept by a priest, corresponds with events at Paricutin.

"Only five miles from Paricutin is Tancitaro, a large cone which, strange to say, was not connected with Paricutin's magma chamber. Tancitaro existed in a remote epoch.

"Most everybody understands that fertility will eventually succeed Paricutin's desolation, which at present is extending over an area of some 35 miles' diameter. The principal reason lava breaks down into such fertile soil is that it is composed of fresh rock which has not been leached of its constituents. For example, Paricutin's lava contains 8 percent iron. There is a minor amount of potash. Fumaroles, the small gas spouts from the flowing lava, discharge nitrogenous fumes.

Ash Helps Make Good Soil

"Where small amounts of the ash are plowed under, they prove beneficial almost immediately. The ash helps to make good soil, both from the physical and chemical standpoints.

"Other than the soil, nothing is being enriched by the volcano. The possibility of diamonds being created in the intense heat is, to answer many inquiries, none whatsoever. Nor is there a useful outpouring of metalliferous ores.

"Hydrogen sulphide, as well as chlorine, is given off by the fumaroles, but Paricutin has not reached the sulphur-making stage.

"The two gases named are, of course, poisonous, but not in lethal concentrations.

"So far, Paricutin has not caused any fatalities among the human population. An American woman visitor was the only casualty. She received broken ribs when a shed beneath which she had taken refuge collapsed during an ash fall.

"This ash is, incidentally, quite cold to the touch after it has fallen from the chill upper air. It drifts as far as Mexico City, 200 miles away. The ash is ruinous to a woman's complexion. After a few days in it, she begins to look like a coal miner.

"I have been most interested in observing Paricutin's effect on animal life. Animals show none of the awe with which men regard the volcano. The illustrations selected for this article bear striking witness to domestic animals' indifference. I have seen spiders weaving webs in the volcanic ash.

"During Paricutin's earlier days, squirrels and birds were as common as ever. We observed a number of casualties among the birds; here and there a broken wing or a body torn by a flying rock. Yet other birds flew around unconcernedly. Now the seeds on which they feed have disappeared, and so they have disappeared, too. Buzzards still patrol the skies.

"Deer and rabbits migrated when plant life died. With them went the coyotes.

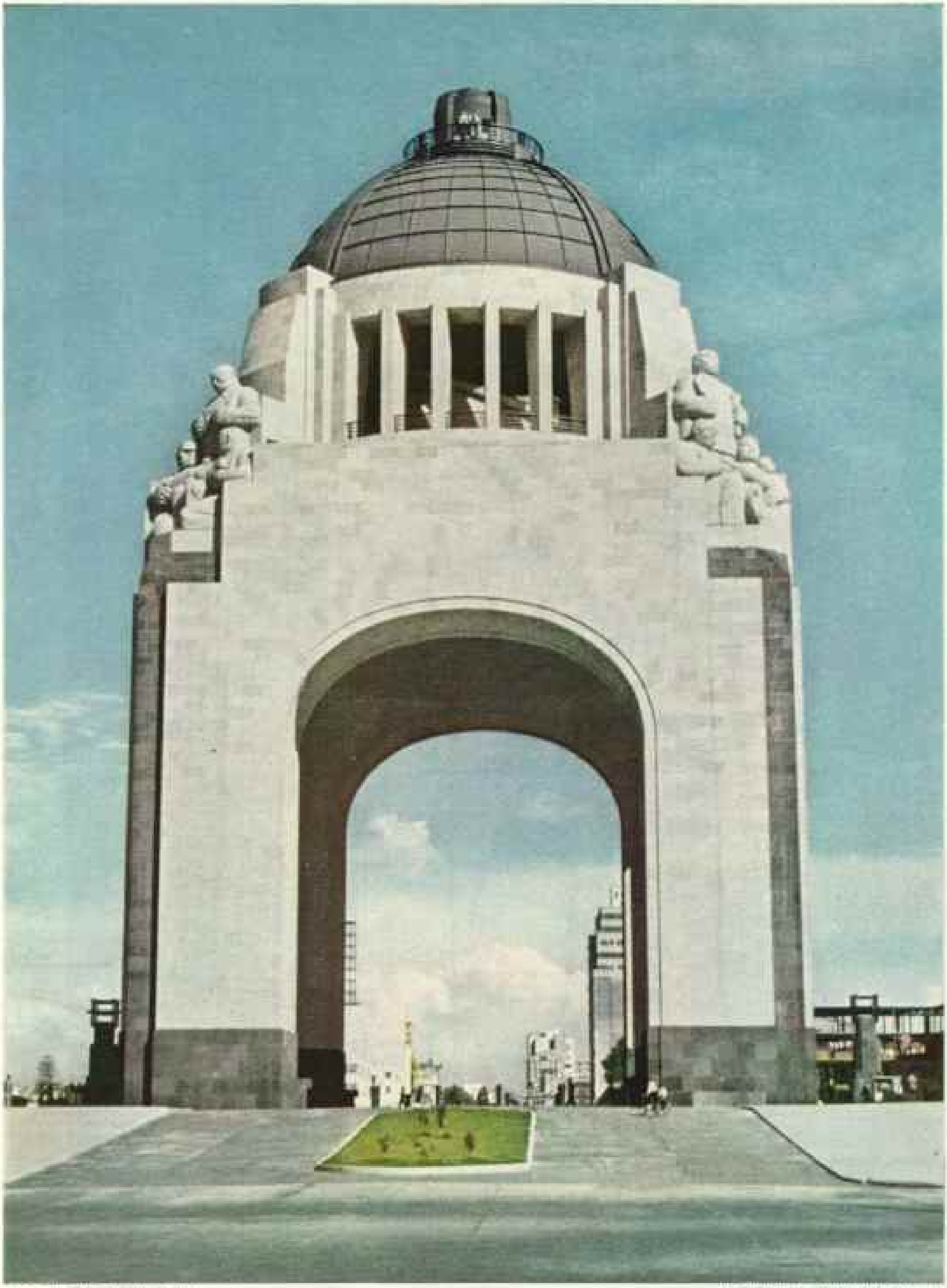
People Applaud "Greatest Show on Earth"

"In my opinion, Paricutin is the greatest show on earth. It is, I believe, just as spectacular as Vesuvius ever was, and in its more violent phases it is better. When Vesuvius was making a tremendous display in 1790, a mineralogist had paintings made of it. These show nothing to compare with Paricutin.

"You should see Paricutin when gas bubbles burst in the lava high in the crater. Such an explosion sends out a fiery umbrella.

"Last June there were spectacular blasts, and the hills rolled with thunder. Houses and the ground shook. There was a cascade like Niagara's. People came from 20 miles away to see what was going on.

"On August 1 the fireworks became so spectacular that spectators burst into applause. Think of that: people applauding a volcano!"



 Kodachrome by Richard H. Stewart

What Might Have Been Mexico's Capitol Became a Monument

Started in 1908, the massive arch of steel, copper, and bronze was designed as the central part of a new Capitol building. A revolution halted construction and the building never was finished. Now this Mexico City landmark, near the Columbus Monument, frames a street of the Capital City's modernistic buildings.

Kodachrome by Richard H. Stewart

Mexico City's Palace of Fine Arts Sank Five Feet Below Its Original Level

Begun by Diaz in 1900, the ornate building was not completed until 1934. When half-finished, it started to subside in the spongy subsoil. Thousands of barrels of concrete were pumped beneath it to form a foundation table. Within the palace are an opera house, concert and lecture hall, museum, and art gallery.

 Kodachrome by Richard H. Stewart

Agile Dancers Whirl Around a Sombrero in the *Jarabe Tapatio*

The Mexican national dance is a feat in acrobatics. Real test of the girl's skill comes when she steps in and out of the hat brim without disturbing it.

 Kodachrome from Mexican Government Tourist Department

Serenade for a Lovely Senorita at the Rancho El Blanco

Once part of Cortés' estate, this dude ranch near Mexico City suggests the old hacienda, including a guitar-strumming cowboy and his raven-tressed lady.

Kodachrome by Richard H. Stewart

Flat-bottomed Boats Carry Visitors Through Xochimilco's Canals, Past Floating Islands and Blazing Gardens

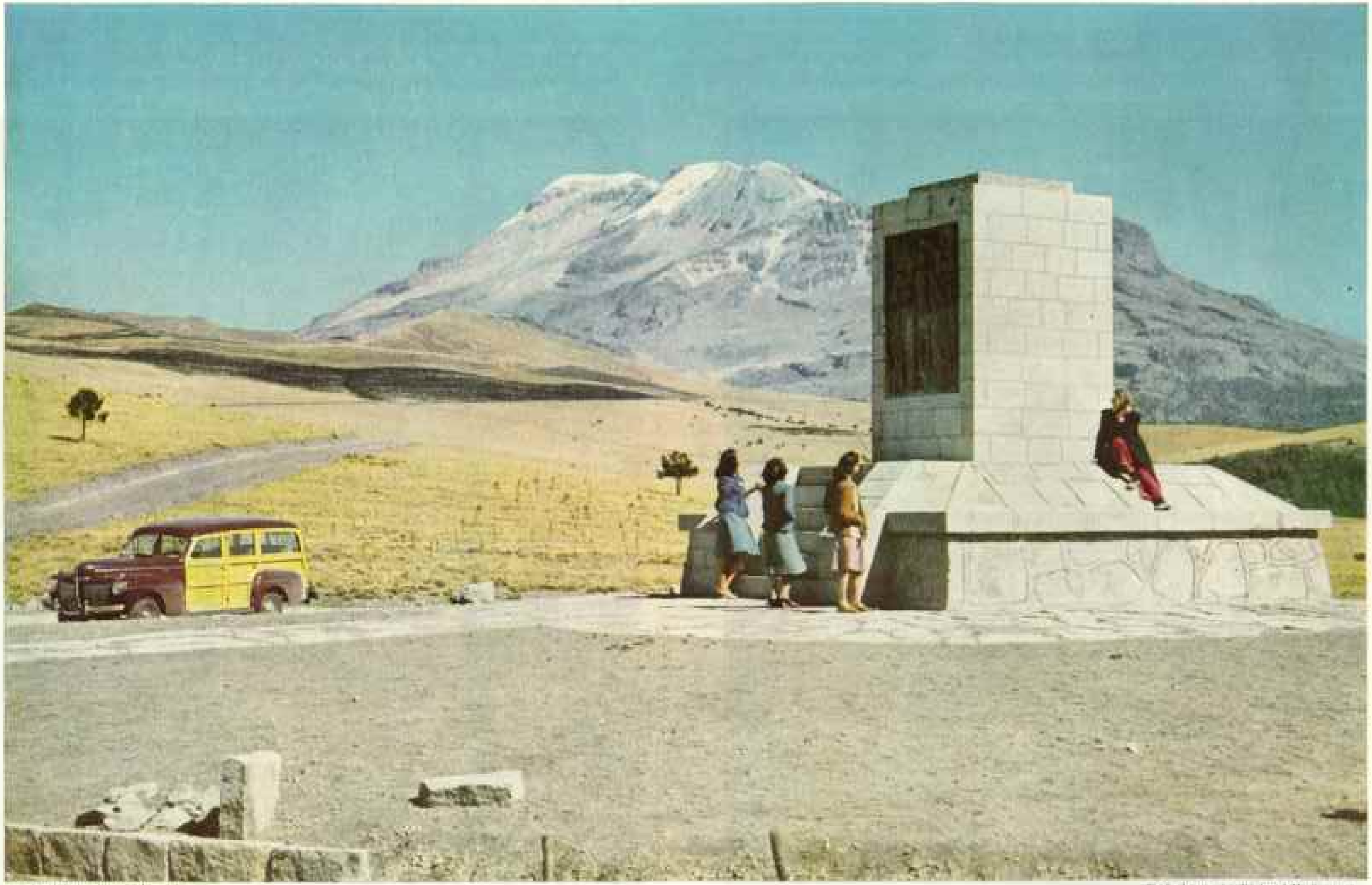
Names of the craft are worked in flowers. Dating from Aztec times, Xochimilco is still the flower and produce garden of Mexico City. The gardens originally were floating mats of interlaced twigs, thick enough to support a layer of earth, on which plants were set out. Eventually the gardens took root.

Pottery and Blooms Flash the Color Range of the Rainbow

Flower booths near the Palace of Fine Arts and on Avenida Hidalgo are best known to Mexico City's visitors. Xochimilco gardeners sell their finest blossoms in the Zócalo (Plate II) on Sunday mornings.

Centerpiece for His Blanket Is Mexico's Coat of Arms

The spread-winged eagle of good omen, strangling a serpent, also stands triumphant in the center of the Republic's flag. The symbol's history traces back to an old Aztec legend.



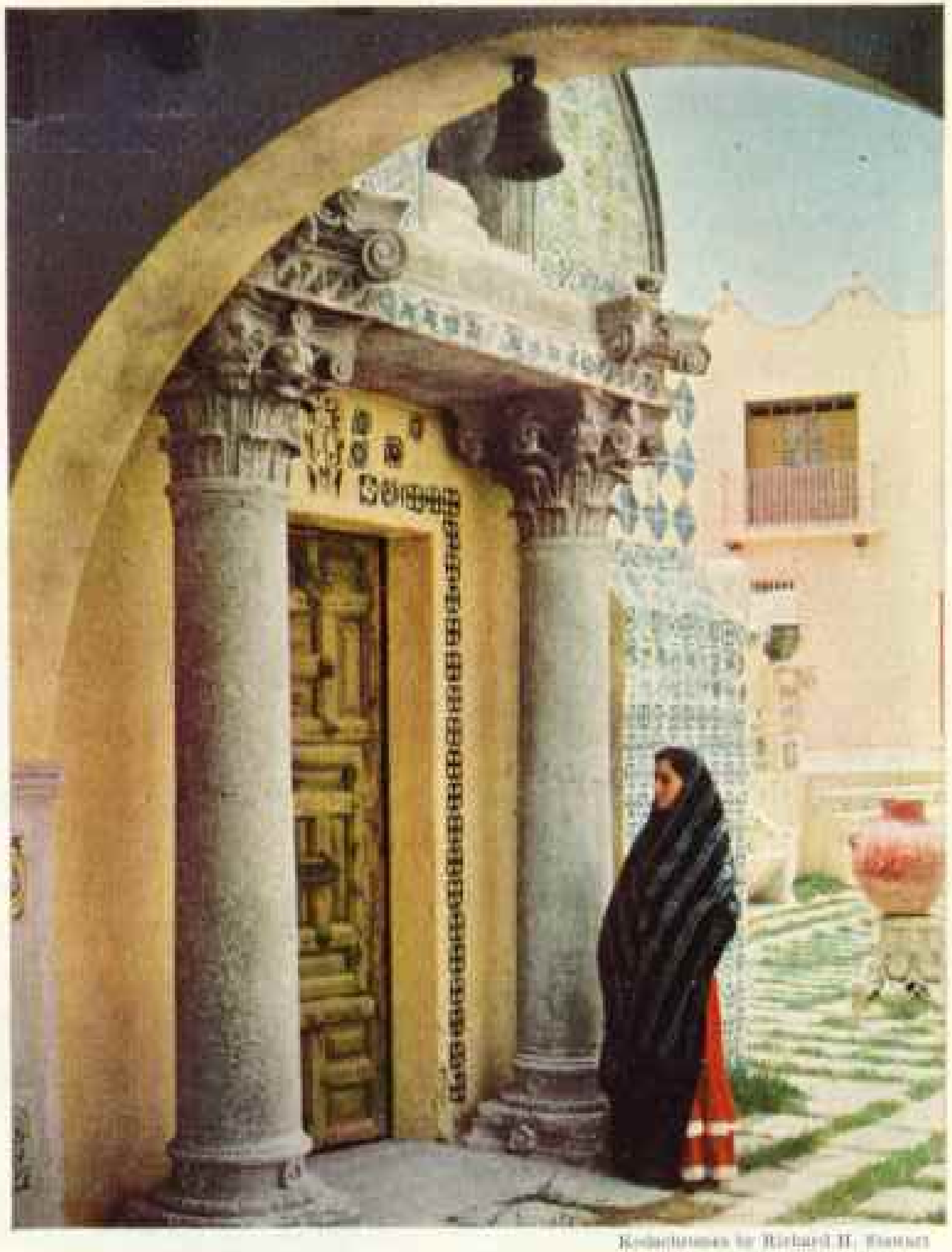
Kodachrome by Richard H. Stewart

In the Shadow of Popocatepetl and Iztaccihuatl Stands This Monument to the Conquistador, Hernando Cortés

The plaque on the memorial is a bas-relief in bronze of Cortés and his companions. The volcanic peak in background is Iztaccihuatl, which in Aztec means "White Woman." Popocatepetl, into whose crater Cortés' men descended to obtain sulphur for gunpowder, was behind the cameraman as he made this picture.

This Michoacan Girl's Costume Is for Brides Only

She stands in the patio of the Casa de los Delfines in a suburb of Mexico City. The famous colonial house now is a museum for Mexican antiquities and paintings.



Kodachromes by Richard H. Stewart

Century-old Tiles Brighten the Façade of a Colonial Chapel

Here at Casa de los Delfines, hundreds of colonial tiles are preserved. About 1650 they were made in Mexico in enormous numbers to decorate buildings. The woman wears a long shawl of cotton and wool.

Kodachrome by Richard H. Stewart

Old Tiles of the Chapel of San Antonio Abad Keep Their Brilliance Through the Years

Once they entirely covered the small building, which nestles at the foot of a convent in Churubusco, suburb of Mexico City. Modern tiles are extensively used inside and outside Mexican homes. Extent of tiling is considered a key to the owner's wealth and position.

Saboteur Mosquitoes

By Harry H. Stage *

IN WAR ZONE dispatches of your daily newspaper, you read of the mighty influence of a winged "fifth column."

Common traitor to all people, in all climes, the mosquito army has won and lost battles and turned the course of history many times through the centuries.

First of enemy powers to take to the air, mosquitoes are serving as a "ferry command" to carry malaria, yellow fever, filariasis, dengue, and other diseases to our men.†

As ever, the female of the species is deadlier than the male. By her artful, persistent tactics, she can lay low our fighting strength. In some highly malarial areas, if troops are unprotected from mosquito bites for a single night, 20 percent of them will develop malaria. Neglected a second night, another 10 percent will be incapacitated.

Just history repeating itself!

Mosquitoes Attacked Caesar, Napoleon

Julius Caesar's army suffered much from malaria during the Roman civil wars. One observer wrote:

"The unhealthy autumn spent in Apulia and near Brindisi had shattered the health of Caesar's whole army, which came from the unusually healthy regions of Gallia and Spain."

Napoleon's forces were ravaged by malaria. The disease ran rampant during the Chino-Japanese War of 1894-95. It was responsible for more than 5,000 deaths during the Spanish-American War.

Malaria dealt a terrific blow to British, French, and German troops alike in Macedonia during World War I. Campaigns were stalemated for months because troops of all nations were immobilized. From 1916 to 1918, among 124,000 British troops, there were 162,000 admissions to hospitals for malaria. Many of the patients re-entered several times.

This epidemic was one of the biggest medical surprises of the war, for virulent cases originated not only in low swamp country near the coast, but in mountains from 5,000 to 6,000 feet above sea level.

Not until a decade later was the mystery solved. Then Dr. Lewis W. Hackett, of the Rockefeller Foundation, and several European entomologists found seven distinct subspecies of *Anopheles maculipennis* in the Mediterranean area. Three of them, which breed in brackish coastal waters, carry malaria. That explained the presence of the disease along the coast. Four others which do not carry malaria live in the hill country and breed in fresh water.

But the entomologists found another species, *Anopheles superpictus*, which breeds in the pure waters of the hills and mountains, and is a dangerous malaria carrier. This was the mosquito responsible for the spread of the disease in the hill country.

The Italians failed to profit by this valuable discovery when they invaded Albania in 1939. To keep their troops from contracting malaria, they sent them into the hills, and *Anopheles superpictus* went to work on them.

More than one enemy has been deceived by this "paradoxical malaria."

Fighting Japs, Germans, and—Mosquitoes!

In the Philippines, our Army tried to cut down malaria by encamping on high ground, only to find a hill-stream breeder, *Anopheles minimus*, which at once infected our troops there.

Our men now in military service face an enemy as cunning and formidable as the Axis. Although the mosquito lines may be broken, they are rarely wiped out.

The Army, Navy, and Public Health Service control malaria in and about cantonments within the United States through drainage, filling, screening, and the use of larvicides and sprays.

In foreign lands such permanent control measures are not always feasible. The individual fighter must take certain precautions to protect himself. Wherever malaria is prevalent, he must avoid native towns after dusk, he must be exceedingly careful to arrange his bed net so no mosquito can touch him, and he must use mosquito repellents and other devices which our Government gives him.

In training, a soldier learns what to do, but in times of stress he may disregard the lowly mosquito and soon find himself a liability to his comrades.

Returning officers tell me that a friend of mine, Maj. Fred T. Bishopp, of the U. S. Marine Corps, side-stepped malaria for months while on Guadalcanal. Practically every other member of his battery was afflicted with the disease.

Major Bishopp's physical equipment was

* Senior Entomologist, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture.

† See "Healing Arts in Global War," by Albert W. Atwood. National Geographic Magazine, November, 1943.

U. S. Public Health Service

Mosquito Stowaways Die in a Fog of Pyrethrum on an Airliner

Mixed with sesame oil and Freon, a refrigerant with low boiling point, this modern aerosol insecticide is noninflammable and harmless to humans (page 177). At the push of a button it penetrates every corner, impelled by the Freon. Thus commercial air-transport companies bar invasion of disease-carrying mosquitoes from abroad and check the spread of other insects in the Western Hemisphere.

no better than that of his men, but he had been in an atmosphere of medical entomology from childhood through college. He had cultivated a healthy respect for Mrs. Anopheles and her friends.

So Fred, while hospitalized with a shoulder wound, gave aid to others in his battery who were suffering from acute attacks of malaria. Strong, well-trained, and well-equipped first-line fighters had been outwitted by the mosquito. They know now that it is just as necessary to beat the mosquito as it is to beat the Japs.

Routing the "Fifth Column" in the Army

Figures released by the Office of the Surgeon General show that malaria cases in the Army have decreased radically during the years. Between the Mexican and the Spanish-American wars, about 130 out of every 1,000 soldiers contracted malaria each year. In the last year of World War I, the rate had dropped to 3.9 cases per thousand.

By 1943 the level in continental United States had declined to less than 0.6 cases per 1,000 men—lowest ever recorded for the Army.

Today's global war greatly complicates the fight against mosquitoes because of the varied breeding habits of this universal enemy. In the words of Col. Paul F. Russell, of the Army Medical Corps:

"Larvae in lime sinks in Georgia, swamps of Panama, treetops of Trinidad, rain puddles of Liberia, springs of the Sahara, rocky river beds of Mesopotamia, water jars of Arabia, cisterns of Calcutta, irrigation channels of India, streams of Burma, rice fields of South China, and pools of New Guinea, all present distinct and yet common problems to medical and sanitary officers of the United States Army and Navy."

During the battle for Sicily, more American and British soldiers were put out of action by malaria than by weapons of the enemy.

That is why more than 250 entomologists are commissioned in our armed forces, and why their job is a grave responsibility.

An Allied school of malariology has been set up at the University of Algiers, under direction of Colonel Russell, former Rockefeller Foundation field director. Officers also take courses in malaria prevention, control, and treatment at schools in Oran, Bizerte, and Naples.

U. S. Public Health Service

Recipe for Mosquito Control: Squirt Half a Teacup of Fuel Oil into a Sewer Opening
Here in a southern city larvae of yellow fever carriers are destroyed in vast numbers by a mobile spraying unit. This quick and cheap method also checks the breeding of house mosquitoes.

Many of our men are bound to return from tropical theaters of war afflicted with mosquito-borne diseases which will be a menace to the health of our civilians here at home.

The success of the mosquito-control programs conducted by the Army, Navy, and Public Health Service is convincing proof that these insect pests can be conquered, and similar programs are being considered in postwar planning.

For many years the vacationist, before going to the mountains and seashore, equipped himself with sundry lotions and unctions to discourage mosquitoes from biting him. Actually, none afforded much relief. The entomologist gave him little help, since the idea of keeping mosquitoes away from one individual and forcing them to feed on another did not appeal particularly to this man of science.

War, however, has changed radically many of our cherished conceptions, among them this point of view. One of the first major requests made to the Bureau of Entomology and Plant Quarantine by the Office of the Surgeon General of the Army was for a mosquito repellent.

After testing several hundred materials, entomologists within a year were able to recommend three repellents safe for man to use liberally on his skin. All prevented mosquitoes from biting him for a few hours.

Formula 612, dimethyl phthalate, and Indalone proved to be far superior to all other materials, and these, especially the first two, met with favor in all parts of the world.

Last summer I had the fun of being a member of a party which tested these repellents in the Far North. On a four-day trek in tundra and muskeg country, we constantly had mosquitoes, *Aedes nearcticus* and *A. cataphylla*, in swarms of several hundred to a thousand about our heads.

We compared the use of head nets, gloves, and heavy clothing with the simple applications of repellents. At the end of the march, the group voted unanimously in favor of the repellent as protection from mosquitoes (pages 172 and 173).

Developing a Surprise Weapon

The Office of the Surgeon General also asked for a larvicide that was more effective and longer lasting than Paris green. The Army wanted a material which would kill malaria-carrying mosquito larvae for several weeks after it had been applied to breeding places. Such a larvicide must still be afloat after being subjected to torrential rains.

U. S. Army Signal Corps

In a New Guinea Jungle Laboratory, Army Medical Corps Men Study Mosquitoes

The sergeant at the microscope examines blood smears. Stomachs and salivary glands of *Anopheles* species are tested to see whether they carry malaria parasites. More than 250 entomologists are with the armed forces in the Southwest Pacific, China-Burma-India theater of operations, the Caribbean, and the Mediterranean.

This was an exceedingly difficult order to fill. Enthusiastic entomologists and chemists set to work, however, and within a year information was gathered on a new insecticide, which greatly exceeds Paris green in efficacy. This material, also, can be used effectively against adult mosquitoes. Mrs. Anopheles and her close relatives are surely due for a big surprise along several battle fronts.

The most concerted peacetime fight against any one species of mosquito was undertaken against *Anopheles gambiae* in Brazil, where the Government of that country, aided by the Rockefeller Foundation, succeeded in driving it from the Continent of South America.

Anopheles gambiae was discovered in Natal, in northeastern Brazil, early in 1930, by R. C. Shannon, of the Foundation. Mr. Shannon first regarded his find as a new species, but upon referring to a classification key he identified it as the African species known to be one of the most efficient and dangerous malaria vectors in the world.

Until that moment this mosquito was unknown outside of Africa, the Arabian peninsula, and certain neighboring islands. It doubtless hitchhiked to America either by airplane or by ship from Dakar. The discovery was immediately reported to the Brazilian authorities, but before they had time to do much about it an exceedingly severe epidemic of malaria broke out (Plate VI).

From 1930 until 1939 this mosquito spread rather widely. Here and there entire populations were stricken with malaria, which, for that disease, was highly fatal. During 1938 and 1939, 14,000 deaths were reported.

Brazil asked the Rockefeller Foundation for aid in driving out *gambiae*, although few thought such a herculean task possible. The eminent malariologist, M. A. Barber, said:

"There is no doubt that this invasion of

U. S. Public Health Service

"No Fooling! Take Your Quinine Pills Right Now"

The doctor takes no chances as he distributes a daily dose to a family near Savannah, Georgia, in a malarial area. Such preventive measures suppress fever symptoms if medicine is taken in early evening. Quinine remains in the blood stream only about 12 hours; the Anopheles mosquito, which carries malaria, generally bites only after dark. This family is urged to sleep in screened rooms, dry up small pools of water, and spray larger breeding places with crude oil.

gambiae threatens the Americas with a catastrophe in comparison with which ordinary pestilence, conflagration, and even war are but small and temporary calamities. *Gambiae* literally enters into the very veins of a country and may remain to plague it for centuries. Even the penetration of yellow fever into the Orient might be a lesser evil, because its vector is domestic and more easily controlled."

Within 19 months, in September, 1940, the last *gambiae* was driven out of South America. This extermination of an insect from a continent was accomplished under the direction of Dr. Fred L. Soper at an expenditure of approximately two million dollars, a feat that is one of the rarest in entomological history and a classic demonstration of species sanitation in malaria control.

To rout *Anopheles gambiae*, the Brazilian Government mustered an army of 2,000 doctors, technicians, inspectors, guards, and laborers. Fumigation posts were set up on all roads leading from the infested area. Breeding places were systematically eliminated, or treated with larvicide.

The region was mapped from the air so no pools or ponds would be overlooked. All automobiles, boats, and airplanes leaving the area were disinfested.

3,000 *Gambiae* Die in One Room

Adult mosquitoes were hunted down in houses and killed with insecticide sprays. Shannon writes that "on one occasion 3,000 adult *gambiae* were killed in a single room." *Gambiae*, like *Aedes aegypti*, is strongly attracted to human habitations. This method of attack would have been utterly useless in the control of a nondomestic mosquito such as *Anopheles bellator* of Trinidid.

In less than a year *gambiae* spread had been stopped, and the mosquitoes have been

U. S. Public Health Service

Aerial "Gas" Attack Annihilates an Army of Malaria Mosquitoes near Decatur, Alabama

Here in Tennessee Valley Authority territory, flooding of lowlands by new dams created many breeding places for mosquitoes. In its control program, TVA dusts 75 tons of Paris green by plane every year. Half a pound of the poison is enough for an acre. It is mixed with powdered soapstone for dusting in a ratio of about 1 to 4.

U. S. Navy Official

"Under Wraps," Seabees Outwit Their Most Feared Foe, the Mosquito, as They Build a Road at a Southwest Pacific Base

Malaria, unchecked, rolls up huge casualty lists and prolongs the war. That's why Army and Navy take such rigid control measures. Mosquitoes more than once halted the building of the Burma Road. American scientists fought the pests there in a struggle as intense as in the building of the Panama Canal.

David A. Tutzone

Do Mosquitoes Like White, Black, or Khaki Shirts—or Bare Backs—Best? Army Found Out

In a 30-second period, 30 mosquitoes alighted on the khaki, 15 on the black, and four on the white. Then one man removed his shirt. In half a minute, 90 mosquitoes arrived to dine! The test was made near the Arctic Circle last summer (page 167).

pushed back to main river valleys and narrow coastal strongholds. In a few more months they were annihilated.

Anopheles gambiae in Africa remains, nevertheless, a constant threat to the Western Hemisphere. This mosquito could close the Panama Canal.

It has been found several times on planes arriving at Natal in the last two years; hence the continued need for treating all planes from Africa with a highly lethal spray before they land in South America (page 166).

Within the last 20 years great strides have been made in various parts of the world in our war against the mosquitoes, especially those that transmit malaria and yellow fever.

Great credit is due the Rockefeller Foundation, which has stimulated interest and provided funds for the fundamental research. It has also conducted many test programs demonstrating the practicability of disease control.

Mosquitoes Devastated Pontine Marshes

In our own Southern States and Puerto Rico, in Mexico, Central America, South America, Africa, India, Ceylon, the Philippines, Palestine, and southern Europe the Foundation has cooperated with the respective governments by lending the services of members of its field staff.

The tremendous power that mosquitoes may have over a nation for centuries was forcibly impressed upon me when I stood, in July, 1930, on the edge of the Pontine Marshes, a short distance from Rome, and gazed upon a deserted landscape. Here I beheld an expanse of waste land which I could not comprehend.*

The soil had every appearance of fertility, there seemed to be no vital lack of rain, and yet there was no sign of permanent habitation. Mud houses of a temporary character were scattered here and there over the countryside, but even these crude shelters were deserted.

Next day, while I was visiting Dr. Hackett, only foreign malariologist Mussolini allowed to remain in Italy, he related the tragic story of that expanse of waste land which lies at the doors of Rome. The Roman Campagna

* See, in the National Geographic Magazine, "Story and the Legends of the Pontine Marshes," and "Redemption of the Pontine Marshes," April, 1924, and August, 1934, respectively.

Tennis Moore

Army Picks Its Favorite Mosquito Repellent by Actual Field Tests

Repellent A was smeared on right arms, B on left; C on right legs, D on left. The chemicals were applied at different times of the day and under varying weather conditions. The type finally chosen is effective for 2 or 3 hours. Testers in the Far North last summer preferred the repellents to head nets, gloves, and other protective attire.

had been abandoned because it was midsummer. As they had done since about 1640, the natives vacated the malaria-stricken area during the months of June through September.

From early times, he told me, this fertile country was used for pasture lands and forest, and even had some prosperous towns. But Rome had declined, and the marshes increased in extent. Attempts to settle there failed and a general exodus and subsequent desolation resulted.

The real key to this mystery, which had seemed supernatural for centuries, was malaria directly, the mosquito indirectly.

Yes, it was with some pride that Dr. Hackett pointed to the Roman Campagna as an excellent example of the power with which a mosquito wore down all human resistance—a pardonable pride because he and several European colleagues, after years of study, solved some of the mysteries of malaria in Europe and began to blast the anopheline mosquito out of existence.

Thanks to Dr. Hackett's studies and to those of his able Italian associate, Missiroli, the far-reaching activities of the Rockefeller Foundation, and the Italian Government, the country surrounding the Eternal City became populated with industrious farmers, who were able to exist there only because the malaria-carrying mosquito had been banished.

In the days of Caesar Augustus (27 B. C. to 14 A. D.) Rome had a population of more than a million, but not until a decade or so ago did Rome again reach a population of that size. Is it possible that the Anopheles mosquito had succeeded for centuries in limiting the population of Rome?

We can only hope that the aftermath of the present war will not allow a reversion to the desolation witnessed in 1930. Already the Germans are reported to have flooded the Pontine Marshes—the first step to illness by malaria.

Pest of the Northwest Indians

The history of our own Pacific Northwest was influenced by fevers, of which malaria contributed its share.

A few years ago, while C. M. Gjullin and I were studying the mosquito fauna of Oregon and Washington, we learned that severe epidemics of chills and fever, or ague, and even intermittent fever, as malaria was commonly called by early historians, raged with such virulence in the lower Columbia River Valley

U. S. Navy, Official

His Spray Will Prevent Many an Attack of Malaria at this Southwest Pacific Base

From the U. S. Marine sergeant's "gun" emerges a mist of kerosene, to coat the swamp near his island camp and smother and poison countless mosquito larvae (Plate II). Thirty gallons of oil cover an acre of water effectively.

in 1829 that thousands of Indians and scores of whites died from the disease.

Sir James Douglas, on his second visit to the Columbia, wrote: "October 11, 1830. A dreadfully fatal intermittent fever broke out in the lower parts of this river about 11 weeks ago, which has depopulated the country. Villages which had afforded from one to 200 effective warriors are totally gone; not a soul remains! I am one of the few persons among the Hudson Bay Company's people who have stood it, and sometimes I think even I have got a 'shake' and can hardly consider myself out of danger, as the weather is yet very hot."

The mosquito ferry command had started a "softening up" of the natives of the Oregon country which later made possible an almost unopposed settlement by the white man.

Malaria on a Railroad

From 1920 until 1930 I was employed by the "Cotton Belt Railroad" as an entomologist. This system serves Missouri, southern Arkansas, northern Louisiana, and eastern Texas, where malaria is prevalent everywhere.

Most of my early training was there under the direction of H. W. Van Hovenberg, sanitary engineer. So far as I've been able to learn, I was the only entomologist so employed in the continental United States. For several years the St. Louis Southwestern Railway was the only railroad that conducted a malaria-control program.

Soon after our arrival in Arkansas, my wife planned a bridge party one Thursday afternoon in return for several courtesies extended to her. When invited, one woman was considerably dismayed.

"Oh, honey," she explained, "I can't come on Thursday. That's my chill day."

To tell the story of the cause and prevention of malaria, we equipped an elaborate car, named "The Anopheles," with models and exhibits, and visited every city and town on the line where malaria existed.

Malaria control on the "Cotton Belt" came to an abrupt end on July 1, 1930, as the effects of the business depression reached the South. However, in ten years the annual admissions for malaria to the railroad company's hospital had been reduced from 100 per thousand employees to less than three per thousand.

Volume of freight in one town of 1,000 increased 20 percent in one year, bringing to the railroad additional revenue which paid the malaria-control budget for a whole year.

Because the men in this town were able to work regularly, free from malaria, they produced more.

Knowledge of Mosquitoes Is Recent

Prior to 1880 little was known concerning the biology and habits of any of the mosquitoes. First conspicuous achievement came in 1879, when Sir Patrick Manson demonstrated that filaria, worms which cause certain types of elephantiasis, develop in the body of a mosquito. In elephantiasis the skin becomes thick and rough like an elephant's hide, and the part of the body affected is enormously enlarged (Plate I).

In 1892 Dr. L. O. Howard, later chief of the United States Department of Agriculture's Bureau of Entomology for 33 years, suggested applying kerosene to water to kill mosquito larvae—a method which to this day is one of the most economical and effective means of controlling certain species.

Soon after, Ross, Grassi, Bastianelli, Bignami, Celli, Manson, and others proved that Anopheles mosquitoes are transmitting agents of malaria. Sensational proof of the mosquito's role in carrying this disease occurred when two cases of malaria were produced in England by the bites of *Anopheles maculipennis* mosquitoes that had previously fed in Italy on persons sick with the disease.

Finding the Cause of Yellow Fever

Research in yellow fever and the part mosquitoes play in the transmission of the disease fell into two phases, each distinguished by a historic discovery. The first began in 1900, when Maj. Walter Reed and his associates, Carroll, Agramonte, and Lazear, fastened the guilt of yellow fever on the dainty but vicious little *Aedes aegypti* (Plate V).

The second started in 1928, when Dr. Adrian Stokes, Dr. J. H. Bauer, and N. P. Hudson proved that a species of monkey was susceptible to yellow fever, and therefore useful as an experimental animal for determining whether a person ever had the disease.

As early as 1901 Malcolm Watson began his successful malaria-mosquito control work in Malaya. About the same time General Gorgas freed Habana from yellow fever. Subsequently he and J. A. Le Prince controlled the Anopheles and *Aedes aegypti* mosquitoes on the Isthmus of Panama, thus making the Panama Canal possible.

In 1910 W. B. Herms and Harold F. Gray directed the first malaria-mosquito control work in the United States at Penryn, California. In December, 1935, it was my pleasure to attend in Berkeley a fitting commemoration of the twenty-fifth anniversary of my friends' achievement.

It seems likely that the old-time devastating epidemics of yellow fever are a thing of the past, because of the vaccine that medical men have developed as a result of the research performed with monkeys and subsequently with white mice.

Millions of inoculations of the newest type of yellow fever vaccine have been given our troops, without which they could not carry on in certain theaters of the present war.

A sudden outbreak of jungle yellow fever, a new type of the disease, in 1928 in Brazil, occurred where *Aedes aegypti* was not found. This presented a new problem, solved a decade later.

Graham Fairchild, a member of the Rockefeller Foundation staff sent to Brazil on the trail of the jungle killers, writes:

"We collected ticks, sand flies, and other biting insects, but most of our efforts were concentrated on mosquitoes. We vaccinated two assistants and sent them into the woods with nets and cyanide bottles.

"They sat quietly by turns with their trousers rolled up, and caught in small tubes all the insects that came to bite them. Another boy ranged the jungle, collecting larvae from pools and puddles, from Bromelias, and from shells and husks of fallen fruits."

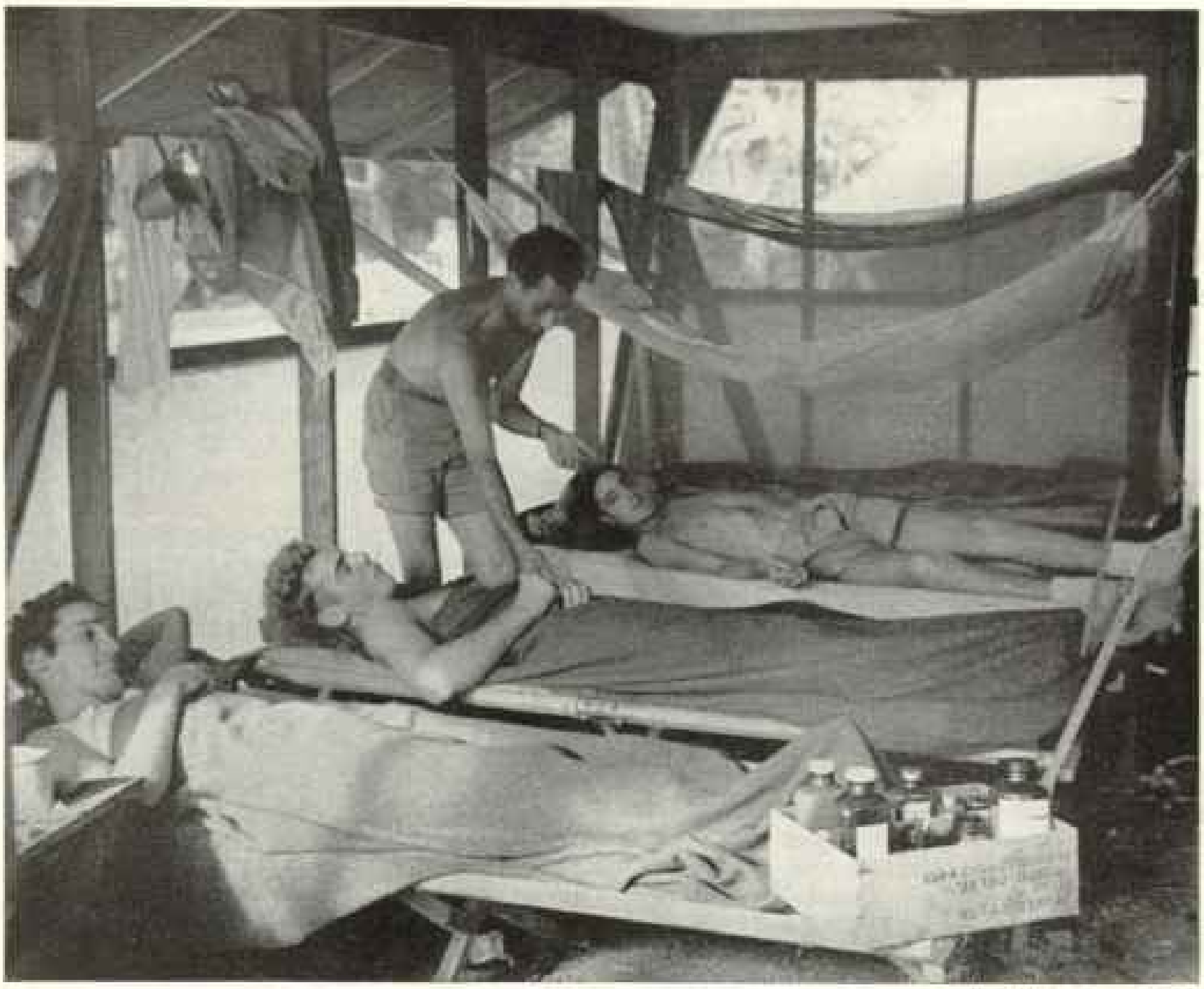
In the end the mosquito again proved the culprit. The investigators determined that three species, *Haemagogus capricornii*, *Aedes leucocelaenus*, and a species of *Sabethes* comprise a ferry command between certain jungle animals and man in South America.

In central Africa, where *Aedes aegypti* is scarce, *A. simpsoni* was found to be the villain. *Culex thalassius*, *Mansonia uniformis*, and others have also been incriminated.

It is extremely important that we learn who the additional members of the air transport command are. Densely populated parts of China, India, and adjacent islands are as yet free of yellow fever, but *Aedes aegypti* at least is already there. Other carriers may be present, and the stage is set for the introduction of the yellow-fever virus.

An individual who has been bitten by an infected mosquito in South America or Africa may travel by air to Asia, and even to Australia, before recognizable symptoms of the fever develop.

Dengue is an acute tropical disease, attended by high fever, skin eruptions, and severe pains in the head and limbs. It is of considerable military importance, because it could easily incapacitate an army in a short time.



U. S. Marine Corps, official

"Skeeter Beaters" Fight Side by Side with Marines and Infantry in Southwest Pacific

Here on Guadalcanal, a member of a malaria-control unit examines servicemen who suspect they have malaria. Headache, extreme fatigue, and fever or chills are advance signs. The enemy, malaria-carrying mosquitoes, outnumbers the Japs by many thousands to one. Waves of winged marauders staged day and night raids until the antimalaria units exterminated them by the million.

Fortunately its attack is of short duration, and seldom fatal. It results from infection carried by *Aedes aegypti* and *A. albipictus*. Dengue has occurred in vast epidemics in southern Europe, Formosa (Taiwan), Australia, our own Gulf Coast States, and elsewhere. And in Hawaii, where mosquitoes were unknown until 1826, a severe epidemic of dengue has occurred recently.

Dengue attended the fall of Bataan. Moreover, whenever there is an epidemic of dengue, yellow fever may be just around the corner. Unfortunately no satisfactory method of immunization against dengue has been developed.

That day in 1879 when a mosquito was incriminated as a carrier of a worm that causes filariasis in man was important to entomologists. Although the parasite does not always harm the human system, it frequently causes disorders and abnormalities. In certain parts of the world one might meet a man with one leg several times the size of the other, or a woman with an enormous foot. The disease is called elephantiasis.

The mosquito most active in the spread of filariasis is *Culex quinquefasciatus* (Plate I); other important carriers are *Culex pipiens*, *Aedes aegypti*, *A. scutellaris*, *Anopheles stephensi*, and about 20 others. They work most vigorously in tropical and subtropical countries, although some of them carry the hair-like worms in isolated localities in the southeastern United States.

Mosquitoes and Sleeping Sickness

Scientists have found mosquitoes which spread other kinds of filariasis, such as the heartworm of dogs. Although usually confined to China and Japan, this disease has been found in Europe, Africa, and to a very limited extent in the United States.

Within the last twenty years epidemics of a

U. S. D. A. by Knoll

With a Puff of Aerosol the Corporal Says, "Goodnight—Don't Let the Skeeters Bite"

In infested areas mosquitoes sneak into screened pup tents when the soldiers enter; so when a squad turns in, the Sanitary Corps man squirts insecticide under each flap, killing the mosquitoes inside. Last man to retire takes the spray gun with him. Together with repellent ointments, this new pyrethrum method will prove a boon to campers, hunters, and seashore vacationists.

baffling disease called sleeping sickness, or encephalitis, have occurred in the United States. Epidemics of a similiar disease contracted by horses also have broken out.

Mosquitoes were long suspected. In 1933 Brig. Gen. R. A. Kelser used *Aedes aegypti* to transmit the disease occurring in horses. In the next ten years several workers proved the ability of other mosquitoes to transmit the disease, at least under laboratory conditions. W. McD. Hammond and associated scientists isolated the virus from wild *Culex tarsalis* mosquitoes caught in the Yakima Valley, Washington.

New Fine-fog Spray Gets Results

Although this mosquito is seldom discovered in large numbers, one or two of its larvae can be found in almost every pond and puddle west of the Mississippi River.

A new weapon against insects is a fine-fog insecticide, result of an idea originated by Lyle D. Goodhue and W. N. Sullivan, colleagues in the Bureau of Entomology and Plant Quarantine. The insecticide, dissolved in a highly volatile solvent, is put up in a container that keeps the mixture under high pressure. When released, the solvent evaporates almost instantly, leaving tiny particles of the insecticide suspended in the air as an aerosol, or fog.

This fine suspension is harmless to men and animals, and noninflammable, but it is fatal to insects. One puff, containing a particle of the toxic principle of pyrethrum, smaller than a mustard seed, will kill every mosquito in 1,000 cubic feet of space in 5 minutes (pages 166 and 167).

Our entomologists at Orlando, Florida, discovered the power of this new insecticide when they demonstrated it in the laboratory behind closed doors. A few hours later they were

David A. Talmon

Arctic Siesta! 400 Baffled Mosquitoes Fail to Get a Bite

Capt. Sidney Fierst, Army Medical Corps, naps in the Far North. He was one of a group of scientists and soldiers who traveled close to the Arctic Circle last summer to test Army mosquito head nets, gloves, clothing, and repellents. Often as many as a thousand persistent mosquitoes (*Aedes nearcticus* and *Aedes cataphylla*) buzzed around the heads of the testers.

chagrined to discover that their test colony of mosquitoes two or three rooms away had succumbed.

Enormous numbers of containers of this aerosol, or "bombs" as they are usually called, are being manufactured exclusively for use of our men on the fighting fronts wherever malaria is prevalent. These "bombs" may save more American lives than any other single invention of the war.

Mosquitoes Preferred Pigs to Scientists

While assisting Barber in Stuttgart, Arkansas, in 1921, Ted Hayne and I rigged up several small enclosures as traps to test whether the mosquitoes preferred the blood of man or animals. In one enclosure we placed a small pig, in another a calf, in a third ourselves, and the fourth was left vacant to serve as a check.

We had considerable difficulty in explaining to the local people the soundness of such a "scientific experiment." The laugh was on us, too, when they learned that the anophelines preferred the pig to us. I must say in quick defense, however, that the calf and we were also very popular hosts.

And, in passing, I pay homage to Ted, who gave his life in Africa eight years later, a victim of yellow fever, the disease on which he was working.

Another time we were examining a cabin belonging to a Negro family. With chloroform tubes we gathered the adult mosquitoes that we found resting on the walls and ceiling, in closets, and under furniture. As we progressed through the cabin, we called out the species and sex of the specimen captured.

A rare find always caused an exclamation, and so when Ted called out suddenly from across the room that he saw an *Anopheles crucians* male, it was of interest not only to Barber and myself, but to the old colored mammy, who with hands on her hips reared back and exclaimed, "Lordy, ain't dat man got good eyes!"

There are nearly 2,000 known species of mosquitoes. Of these more than 200 belong to the genus *Anopheles*, the ferry command of malaria. Only about a fourth of the species in this genus are efficient carriers of the disease. Many of the others may on rare occasion transmit the *Plasmodium* of malaria, but for practical control purposes they may be ignored.

Anophelines are essentially tropical and subtropical, although *Anopheles maculipennis* oc-

curs throughout the temperate regions and, with *A. punctipennis*, is not uncommon in Alaska.

Different species of anophelines have greatly different habits. Control of malaria in a particular area can be effected by directing attention to the species ferrying the disease and ignoring all others. This practice is called species sanitation.

One of the daddies of all mosquitoes, at least in size, is *Psorophora ciliata*, which breeds widely in the eastern United States, from Mexico to Canada (page 193). It is often called the gallinipper.

Almost twice as large as the house mosquito, it is adorned with bands of black and white hairs, which, under the microscope, are truly beautiful. This species is almost beneficial, because its red, inch-long larvae feed on other species of mosquitoes. Those experiencing its bite, however, may differ with me as to its benefits.

Aedes taeniorhynchus breeds in southern salt marshes. *Aedes vexans* is widespread, particularly across the northern half of the United States, and frequently occurs in myriads in flood plains in late spring or early summer. I have taken numbers of full-grown *Aedes nigripes* larvae only a few miles from the Arctic Circle, where the water is never many degrees above freezing.

Harpagomyia genurostris adults, residents of Malaya, get their meals by seizing an ant of the genus *Crematogaster* and taking the food from its mouth.

Child Marriage among Skeeters

Child marriage is common in *Opifex fuscus* in New Zealand. The adult male seizes the female pupa before she has emerged from the saline rock pools, assists in her emergence, and mates with her while she is still in her pupal skin.

I gained my first experience in mosquito control at Sodus Bay, New York, on Lake Ontario in 1915. It was here I became acquainted with *Mansonia perturbans*, whose larval and pupal habits are unique in the biology of mosquitoes. This species is a severe biter and therefore should be given priority whenever suppressive measures are developed.

Larvicides as ordinarily applied are worthless against these mosquitoes, and any amount of ordinary inspection for the larvae will be unsuccessful. Dr. E. P. Felt, then State entomologist of New York, who was directing my work, told me to cut chunks of floating cattails and wash them in a tub of water.

I found the larvae and pupae attached to the succulent roots of the cattails and other aquatic plants. They obtain oxygen from the roots of these plants and never appear at the surface of the water until they are ready to emerge as adults (page 193).

Mosquito Speed—75 Miles in 6 Weeks

The flight range of the various species of mosquitoes differs greatly. Most of the anophelines travel short distances—say, a mile or two from their breeding grounds. Some of the salt-marsh breeders fly great distances. *Aedes squamiger* in the vicinity of San Francisco Bay, for example, has covered a distance of 75 miles after traveling six weeks.

My associates, C. M. Gjullin and W. W. Yates, and I once obtained some specific information on the flight range and longevity of *Aedes vexans* and *A. lateralis* in the lower Columbia River Valley. Young adults in large numbers were stained with aqueous solutions of eosin and methyl blue before they began to migrate from their breeding grounds, an island in the Columbia River.

Within 24 hours "red" and "blue" mosquitoes were recaptured on the mainland a mile away, where they had traveled both with and against the wind currents. Several days later stained individuals were recaptured four miles distant. The oldest stained specimen recovered was a female taken 53 days after her red bath.

We have learned that eggs of *Aedes vexans* and *A. lateralis* may even remain viable on the ground for five years if not flooded (page 193).

In the United States mosquito control was first undertaken on a large scale in New Jersey under the leadership of J. B. Smith and T. J. Headlee. In the years that followed, several types of heavy specialized machinery were developed for the express purpose of exterminating mosquitoes.

I know of no insect that appears more often in entomological literature than the mosquito. I try to record a bibliography of them for a periodical, *Mosquito News*. More that 400 different papers, large and small, throughout the world, devoted to mosquitoes, are listed annually. There are three flourishing State mosquito-control associations in the United States, in New Jersey, Florida, and California.

The mosquito ferry command has met determined opposition from all fronts at last.

God made the star-hung skies for us,
The whispering trees, the hills, and lakes.
Of course he made mosquitoes, too—
But everybody makes mistakes.

Life Story of the Mosquito

By Graham Fairchild *

ONE of my earliest experiences with mosquitoes occurred when as a youngster I was returning from Barro Colorado Island in the Canal Zone. On leaving, I noticed a small boil on my leg, which grew progressively more painful. I finally went to the ship's doctor to have it treated. After applying a compress, he extracted from the wound a disgusting white grub nearly half an inch long.

On arriving in Washington, I told my entomologist friends of my experience. They were much annoyed with me for not allowing the grub to finish its career in my leg! It was the larva of the human botfly (*Dermatobia hominis*), an insect then rare in collections.

The adult female, which looks much like an overgrown bluebottle fly, hovers about animals and people in the woods. It does not bite, but comes only to seek mosquitoes and other small flies. These the botfly catches carefully in flight, without injuring them, and glues its slender eggs to the sides and bottoms of their abdomens (Color Plate VIII).

It even seems able to gauge the "pay load" each can carry. On small mosquitoes it will deposit only a few eggs, but to large flies it will attach fifty or more.

When a mosquito bearing these eggs lights on a man or an animal, the body warmth causes the young larvae to crawl out and drop to the skin. They soon burrow in and in a few months grow to maturity, crawl out, drop on the ground, and pupate.

Years later when I went to Brazil to study mosquitoes, I became only too well acquainted with this nuisance. It is a serious pest to Brazilian cattle, rendering some hides worthless and seriously detracting from the value of others. Each grub leaves a hole in the skin. We often saw cattle with backs and shoulders one mass of lumps from the grubs.

Wild animals are also attacked. We obtained a number of grubs from the tail of an ocelot.

Of course, the biggest nuisance was to ourselves. I remember extracting eight young grubs from my ankle on one occasion, and later found others in my scalp and back (page 190).

Of all the winged pests, mosquitoes are the most widely distributed. There is scarcely a spot on the globe where mosquitoes do not take their toll of blood and sleepless hours.

People who come from places notorious for mosquitoes are sometimes proud of the size and viciousness of their native product. Many times I have listened to spirited debates on the relative nuisance value of Alaska and New Jersey mosquitoes.

To prove the superiority of the Louisiana breed, a New Orleans friend told of being awakened one hot night by the voices of two large mosquitoes, discussing whether they should eat him immediately or carry him away. The first proposal won, for, as its proponent said, "If we try to carry him off, one of the big fellows will take him away from us."

People have immortalized these nuisances by naming places after them. There is a Mosquito Mountain in Maine and several states have Mosquito Creeks.

One mosquito looks pretty much like another to most people. Indeed, even those who have made a life study of them are not always able to agree on just what a particular specimen may be.

Mosquito Portraits Done from Life

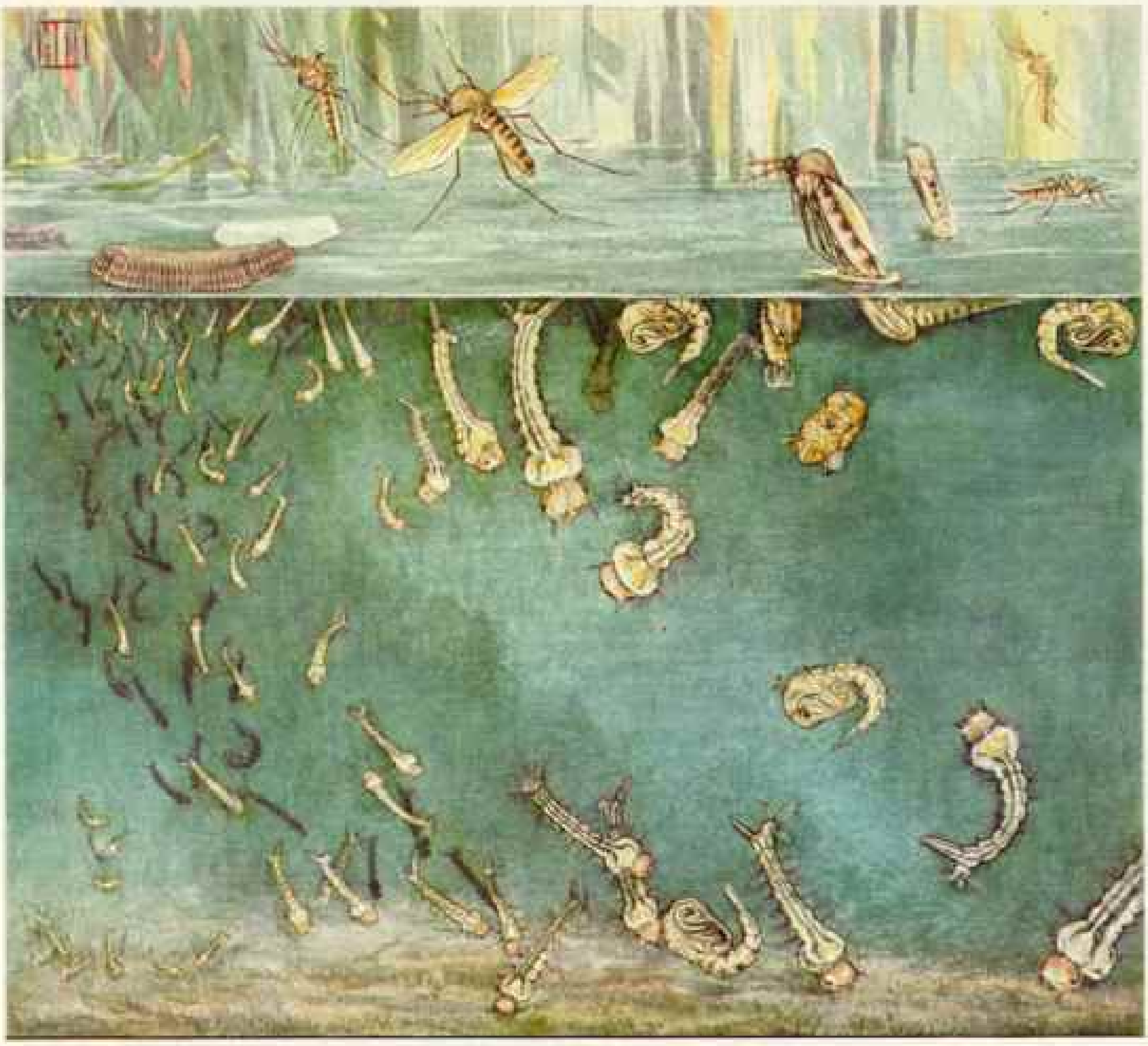
The accompanying color series of mosquitoes, painted exclusively for the National Geographic Magazine, graphically depicts some of the more interesting and important members of the vast mosquito family. Extreme accuracy of detail characterizes each painting. Even the hairs on legs and antennae of each mosquito are accurately drawn. To paint such exact reproductions required months of first-hand observations. Small breeding pools were set up in the studio, so that the entire life cycle of mosquitoes could be carefully observed.

As the painting progressed, Dr. Alan Stone, entomologist of the Bureau of Entomology and Plant Quarantine, Department of Agriculture, carefully checked each detail to assure precision.

Mosquitoes belong to the most primitive division of flies, a division which includes the crane flies; the sand flies; the black flies, or buffalo gnats of the north woods; the punkies, or "no-see-ums"; and several other groups.

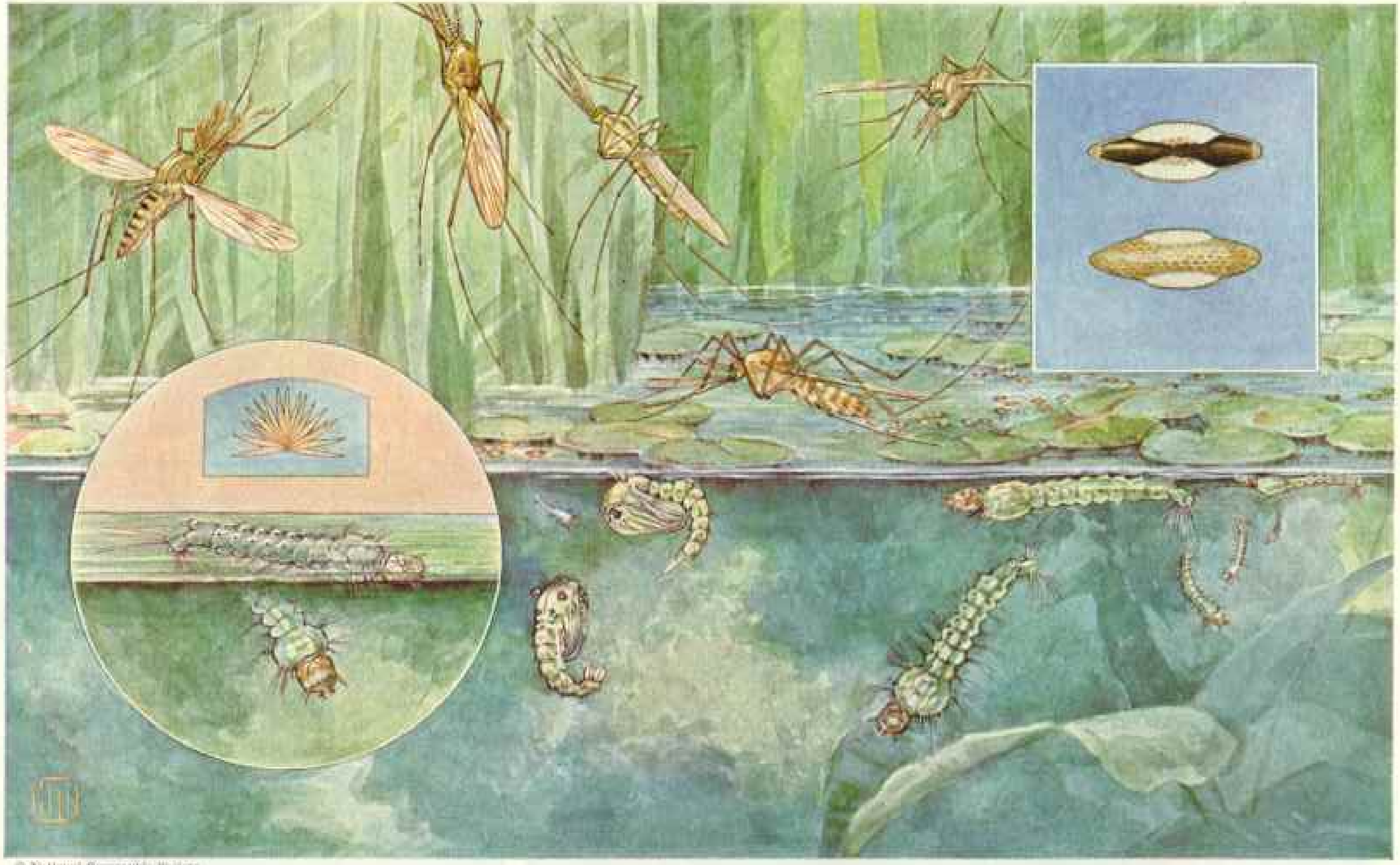
Mosquitoes may be distinguished from their relatives by their slender bodies, long legs, and long, biting beaks. These are flexible tubes containing slender lancelike organs attached at the base to a powerful suction pump. Their bodies and wings are clothed with scales (Plate IV and page 191).

* Formerly a medical entomologist with the Gorgas Memorial Laboratory in Panama, Dr. Graham Fairchild is now a First Lieutenant in the Sanitary Corps, Army of the United States, working on new insect repellents and insecticides.



Clean Up That Rubbish Pile! Mosquitoes Breed in Old Tin Cans

Bassinet for southern house mosquito's babies may be a barrel or old bottle. The female lays a raft of 150 eggs (upper left). *Culex quinquefasciatus* is one of the species in the Tropics which spread elephantiasis.

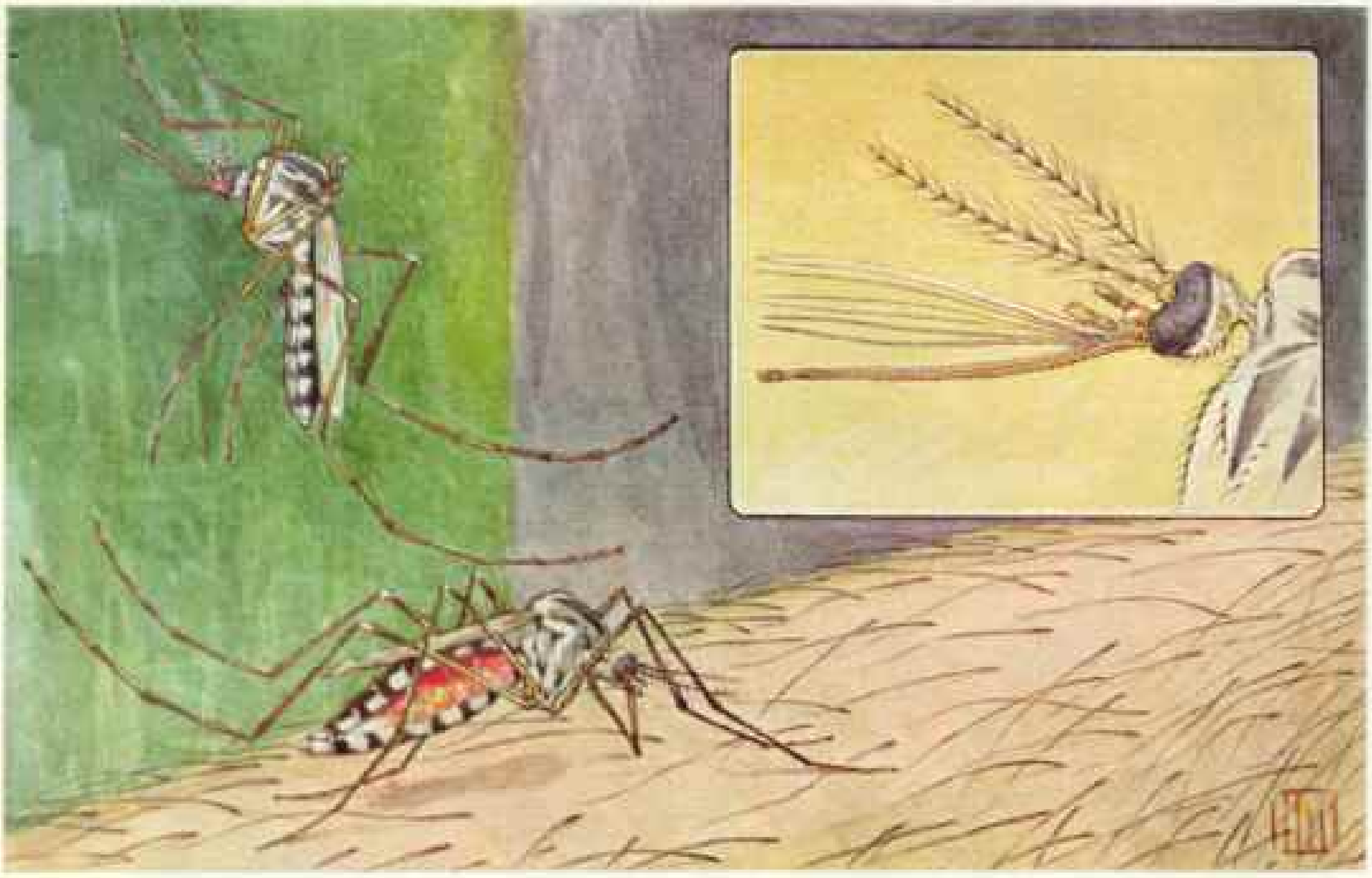


In a Quiet Pool, Nature Produces a Ferry Command for the Spread of Malaria

Here the female of the common malaria mosquito, *Anopheles quadrimaculatus*, lays her eggs singly. Insert, upper right, shows them greatly enlarged. Within two days they hatch into tiny wigglers. Eight days later the full-grown larvae (inset) become pupae (center), much like a butterfly's chrysalis. In another two days, the back of the pupal shell splits and the young, full-grown mosquito emerges, ready for its nuisance raids (see Plate V). Crude oil spread on such pools smothers and poisons the pupae and wigglers, which must come to the surface to breathe through their tails. An effective and cheaper larvicide is Paris green.

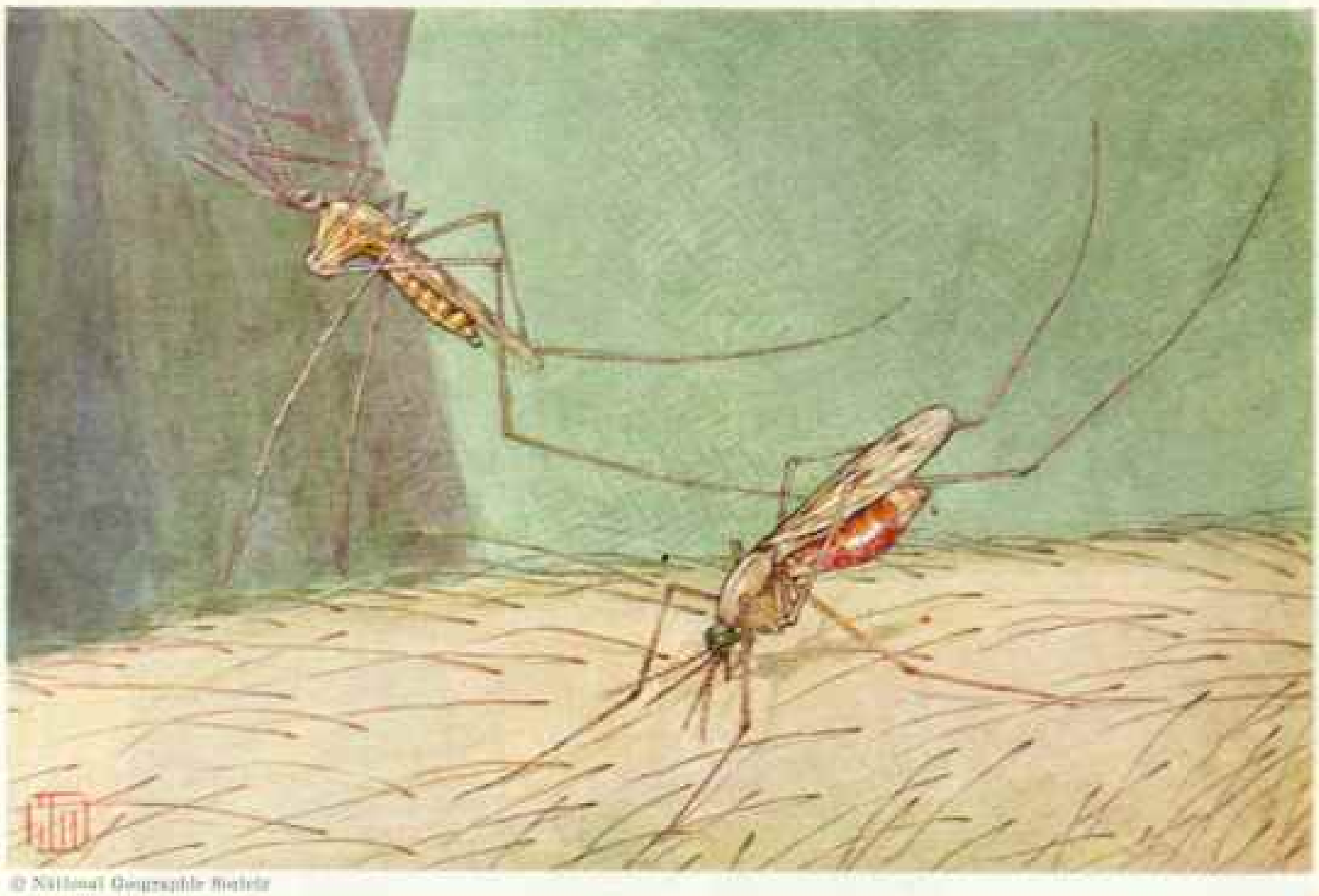
Forest-loving Mosquitoes Lay Their Eggs in Water-filled Leaves of Tropical Plants or Tree Holes

A Trinidad malaria carrier lives only in bromeliads attached to trees. A cannibal type, *Megarhinus splendens*, breeds in bamboo trunks in Malaya. Since it eats the larvae of other mosquitoes but does not bite man, it has been introduced into the Fiji Islands to help exterminate a harmful species there. Starting lower left, clockwise: *Megarhinus hypoptes*, *Orthopodomyia fascipes*, *Aedes terreni*, *Sabethoides chloropterus*, *Limatus durhamii*, *Aedes mediovittatus*, *Aedes fulvithorax*, *Sabethes cyaneus*, *Culex metempsytus*, all female, and *Megarhinus haemorrhoidalis* (female and plumed male). Extreme right, *Wyeomyia melanocephala* (female).



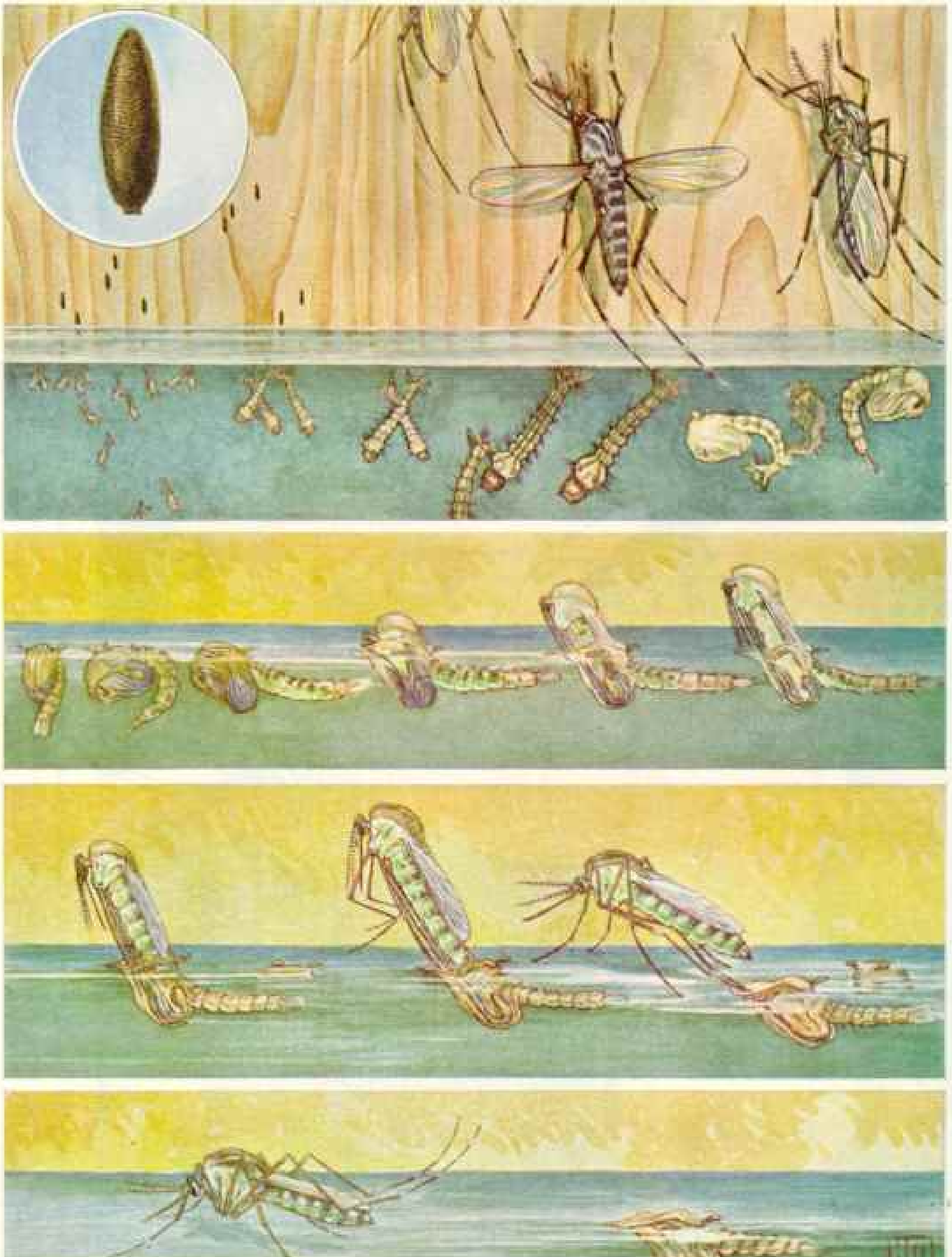
Ouch! A Mosquito Darts Her Stinger into a Man's Arm

Inset shows the mosquito's dagger and blood-sucking tube, with protecting hairs above. (*Aedes atropalpus.*)



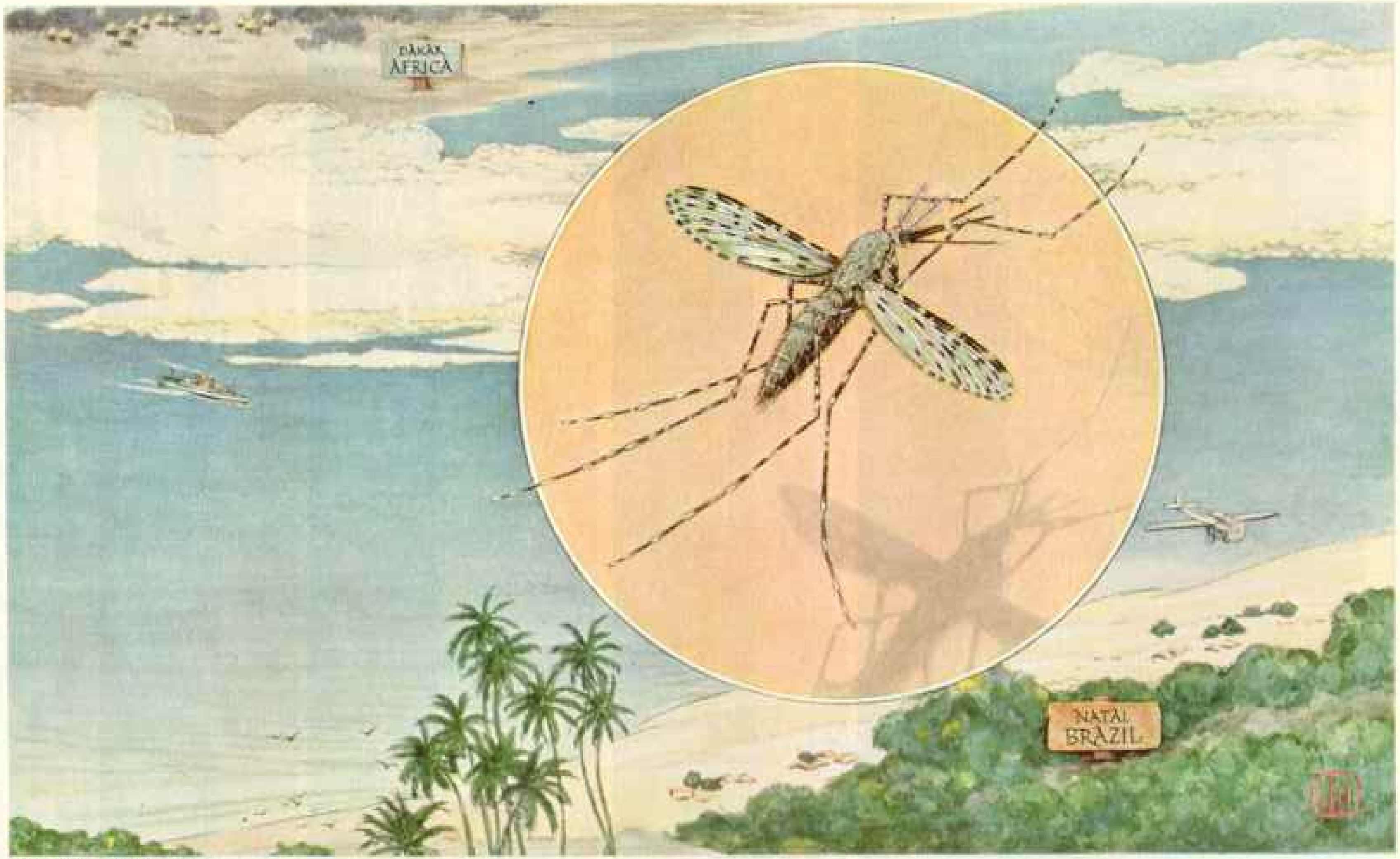
If That Skeeter Stands on Her Head, Beware! It's Mrs. Anopheles

In exchange for a sip of human blood, *Anopheles quadrimaculatus* may leave a malaria parasite acquired while stinging a malaria patient. Her bite is harmless unless she has tasted infected blood. Females only have a mouth fitted for biting.



Birth of the Dainty but Vicious *Aedes aegypti*, Carrier of Yellow Fever

Upper panel shows female (right) laying eggs close to the water in a rain barrel (enlarged egg in inset). Immediately below, larvae, "hanging by their tails," breathe air at the surface; pupae to the right. The three lower panels portray the emergence of the mosquito from pupa to winged saboteur.

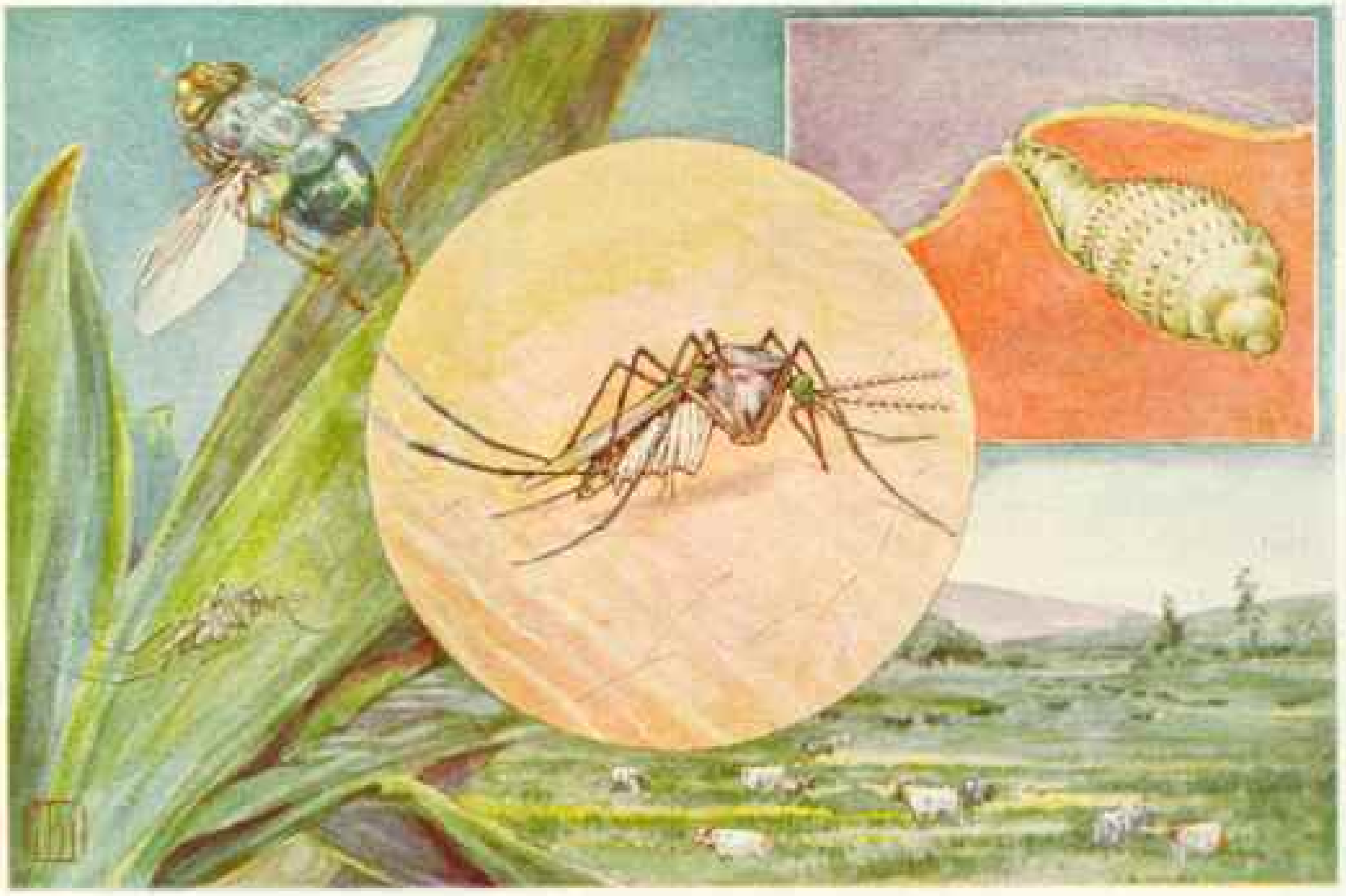


From Dakar, Africa, This Malaria Carrier Hitchhiked 1,865 Miles across the Ocean to Brazil, by Airplane or Ship

Discovered in Natal in 1930, the rapidly multiplying *Anopheles gambiae*, whose home is in Africa, caused 14,000 deaths from malaria in northeast Brazil during 1938–39. Then the Brazilian Government and the Rockefeller Foundation put an army of 2,000 doctors, technicians, and other workers in the field. In a dramatic 19-month fight, the intruder from overseas was exterminated in the Western Hemisphere. Ever since, planes from Africa have been treated with a lethal spray before landing in South America, to kill any mosquito stowaways.

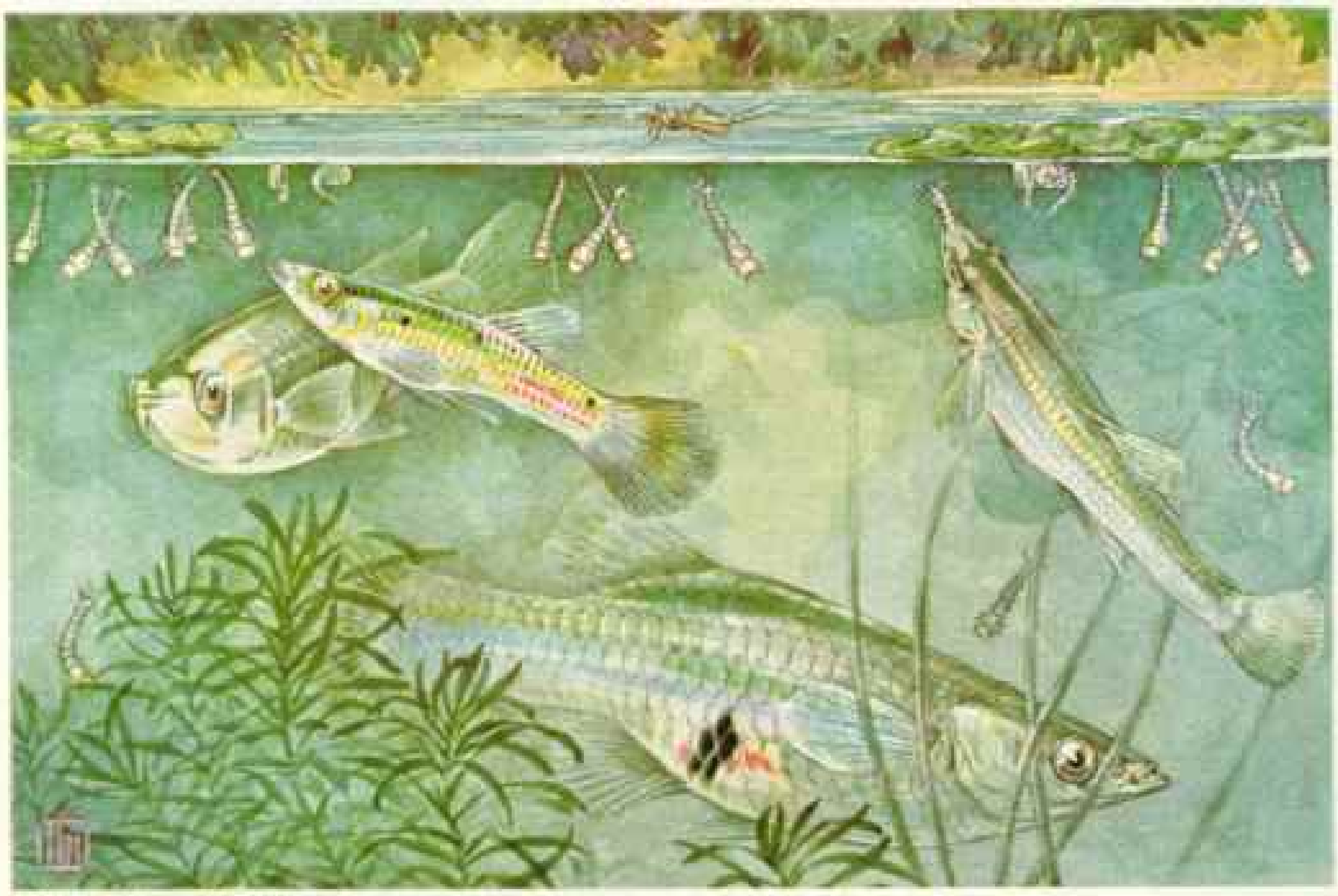
Ever Slap a Skeeter at the Seashore? Here Is Where the Villains Come From

These salt-marsh mosquitoes (*Aedes sollicitans*) lay their eggs on damp ground, to hatch when high tides cover them. The newly hatched wigglers grow in the water, for all mosquito larvae are aquatic. They are called wigglers because of the way they swim. Larvae have changed to pupae in lower right. When the adult mosquitoes emerge, they will head for the nearest summer resort. Every seaside vacationer knows what they do when they get there.



Insect Triple Play: Botfly, to Mosquito, to Man's Arm!

The botfly (*Dermatobia hominis*, upper left) captures a mosquito (*Psorophora ferox*) and lays eggs under its belly. When the mosquito is "on target" (center insert), body warmth causes eggs to hatch. Larvae burrow beneath skin (upper right) and grow, causing painful sores.



To Control Mosquitoes, Keep Guppies (left) and Top Minnows (right) in Your Pond

Minnows (*Gambusia affinis*), from southeastern United States, now eat wigglers in many tropic areas.

Sand flies, black flies, and punkies also bite, but the first can be recognized by their smaller size and hairy wings, the second by their stout bodies, short legs and proboscis, and absence of scales, and the last by their tiny size, seldom as much as an eighth of an inch long. The crane flies, although resembling enormous mosquitoes, do not bite.

Mosquitoes are divided into two main groups: those which do not bite, of interest only to a specialist; and those which do bite, of interest to nearly everyone in some degree.

Mosquito Tastes First, Then Draws Blood

Only the female mosquito bites, but it is scarcely worth while to try to segregate the sexes before swatting them! First the female selects a likely spot, perhaps over some small vein, then presses the tubular portion of her proboscis closely against the skin and drives in the cutting lancelets (Plate IV).

If the spot seems not to yield results, she may pull her knives out and try again. When she has "struck oil," she injects saliva into the wound. Some students believe that this saliva is an irritant causing swelling and an increased flow of blood to the area around the bite; others that it prevents clotting of blood and makes it possible for the insect to suck it up more easily.

People who live in badly infested places may become relatively immune to the bites of their native pests. This immunity, however, seems not to hold for imported varieties.

After a year of bites by Goiaz mosquitoes, to which I had become almost insensible, I exposed myself to the lancelets of some other kinds in Paraná. The results were both surprising and painful, for my legs became so swollen I could scarcely walk.

Apparently people differ greatly in their reactions to the bites, and the same person may be more sensitive at some times than at others. A story told about an expedition on the Amazon illustrates this point.

As long as the Indian paddlers ate their own food, they were not troubled by the hordes of mosquitoes and black flies, but when their supplies gave out and they were fed the white man's rations, they immediately began to suffer as much as he.

The song of the mosquito, surpassed only by the buzz of the dentist's drill in unpleasant suggestion, is not yet entirely understood. The vibration of the wings, reaching perhaps 500 strokes to the second, probably has much to do with it, but that is apparently not the whole story. The wings may be removed without entirely stopping the hum.

Response to sounds seems well developed in mosquitoes, especially in the males, though the sound range is not great. Swarms of male mosquitoes were seen to drop to the ground when certain tones were played near them. A machine which makes a loud buzz of a given pitch attracts them to an electrified screen, where they are killed. The sense of hearing is thought to be located in the base of the antennae, the feathery shaft catching the sound waves as a radio antenna catches the radio waves.

Like many other insects, mosquitoes pass through four distinct stages during their lives: egg, larva or wiggler, pupa, and adult. The eggs are laid singly or in groups, and in innumerable places.

The southern house mosquito (*Culex quinquefasciatus*) lays its eggs in clusters of 150 at a time (Plate I). The eggs, glued together, float on their ends in a raft. They are laid on the water in rain barrels, discarded tin cans, cisterns, gutters—wherever a little water collects.

In warm weather the eggs hatch in one to three days, and the young wigglers swim about in the water. As the larvae must have air, they are provided at the rear of their bodies with long tubes with which they pierce the surface film (page 192). Hanging thus, they seem suspended by their tails! Oil floating on the water effectively clogs the breathing tubes and suffocates the larvae.

Wigglers feed on small organisms and dissolved foods in the water and grow rapidly, reaching their full growth, under favorable conditions, in seven to ten days.

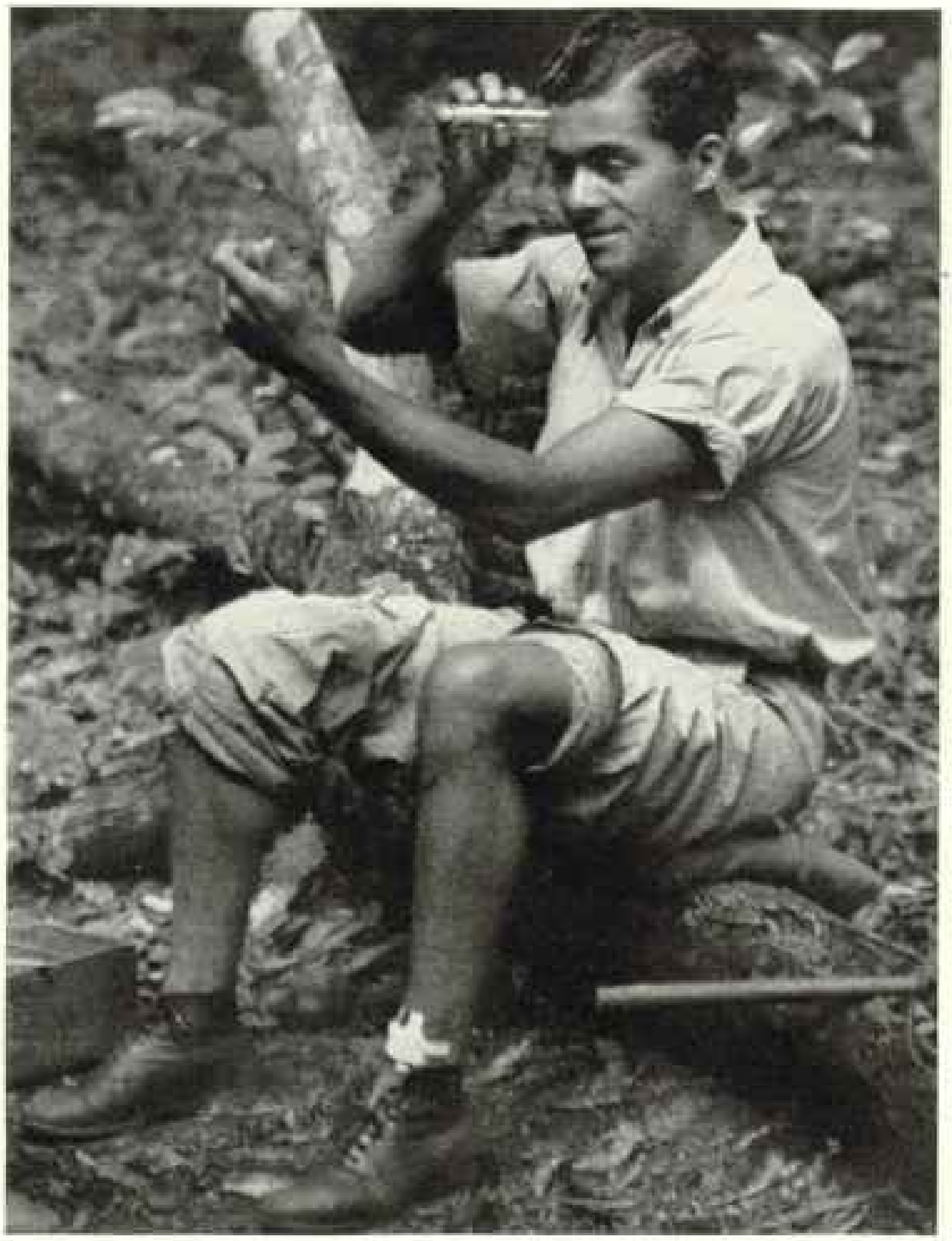
Since all insects have a stiff and unyielding covering, they must shed it from time to time to allow for growth. In mosquitoes this is done during the larval period, when shedding is easier because there are fewer complicated structures such as wings and legs.

Small mosquitoes, therefore, are not the young of bigger ones. When they reach the winged state, they grow no more.

A Skeeter Is Born

Most mosquito wigglers shed their skins four times in the larval stage. The last molt gives rise to the pupa, which is quite different in appearance from the larva. Though able to swim about actively, the pupa takes no food and prefers to float quietly at the surface of the water (Plate II).

During the pupal period, which generally lasts only a few days, the tissues of the larva break down into a sort of soup. The structures of the adult mosquito develop from this unorganized mass. This is one of the most amazing processes in Nature.



Graham Fairchild

With Tube and Mirror, an Entomologist Traps Mosquitoes in a Brazilian Jungle

When a pest alights on his forehead, its reflection shows him where to clap the tube. This collector is a member of a Rockefeller Foundation expedition seeking sources of a yellow fever outbreak near Rio de Janeiro. The bandage on his leg covers a boil caused by a botfly larva which has burrowed into the flesh (Plate VIII and page 180).

As the mosquito takes form within the pupal skin, the pupa becomes lighter and lighter until it floats with most of its back out of water. Drawing in air through two breathing tubes in the top of the pupa, the unborn mosquito blows itself up until the outer skin splits down the back (Plate V and page 192).

The adult then works its way up and out through the opening. Using the empty pupa skin as a raft, it rests on the surface of the water until its wings become strong enough to support flight.

Generally within a day or so the female mosquito finds a mate, and after its nuptials goes in search of a meal. The house mosquito seems to prefer human blood, but this is by no means true of all varieties. Most, but not all, females require a blood meal in order to lay fertile eggs.

When blood is not available, most mosquitoes can get along on nectar from flowers or the juices of rotting fruits. After digesting her meal, the female searches out a suitable place and lays her eggs. The next generation repeats the life cycle.

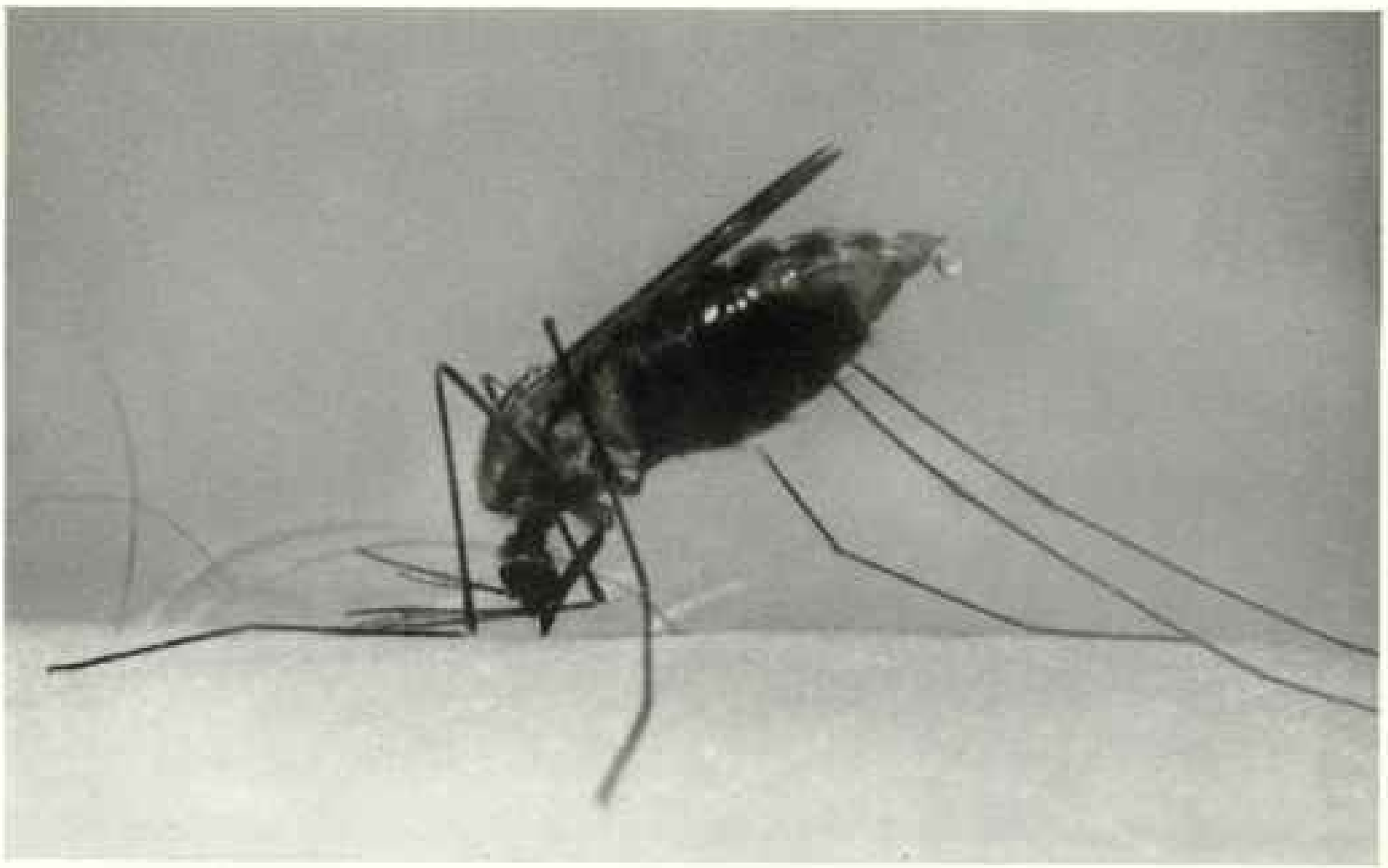
In warm countries breeding is almost or quite continuous throughout the year. But in the north the fertilized females seek cellars, attics, barns, or other hiding places which are cool, moist, and dark, to pass the winter in comparative quiet.

The males are rather short-lived, and in the case of the common house mosquito (*Culex pipiens*), all die when cold weather comes. In the spring the females come out, seek a meal, lay their eggs, and the cycle is begun all over again.

The yellow fever mosquito (*Aedesaegypti*), even more domestic than the house mosquito, is seldom found far from human habitation. Larvae have been found in the bowls and tanks of toilets in unoccupied hotel rooms, in flower vases, in water pitchers, and even in the water wells in jars of library paste.

"Yellow Jack" Lurks in Trash Heaps

In the eighties, the French company attempting to build a Panama canal was frustrated by "yellow jack." Thousands of workmen died. Hospital nurses, unaware of the source of yellow fever, kept potted plants in



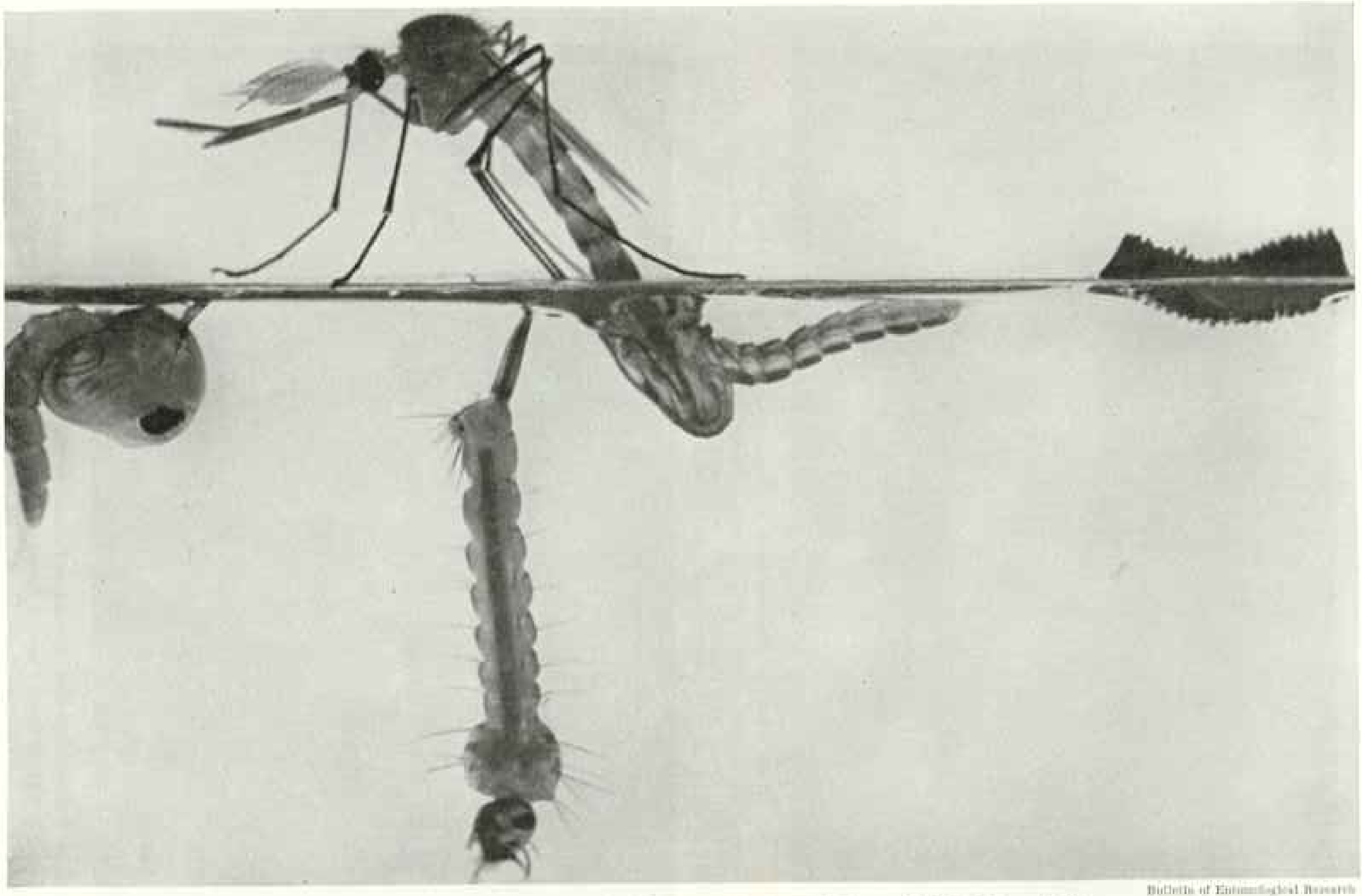
Beak Deep in Human Skin, a Malaria Carrier Drinks Her Fill

Quadrimaculatus, like all members of the malaria-spreading Anopheles family, assumes this tilted pose when biting (Plate IV and page 195). Her abdomen is dark red and full of blood down to the last three segments. Blood is her natural food. A drop of intestinal fluid is leaving the tip of her abdomen.

U. S. Public Health Service

To Cure Paresis, Doctors Expose a Patient to the Bites of Malaria-carrying Mosquitoes

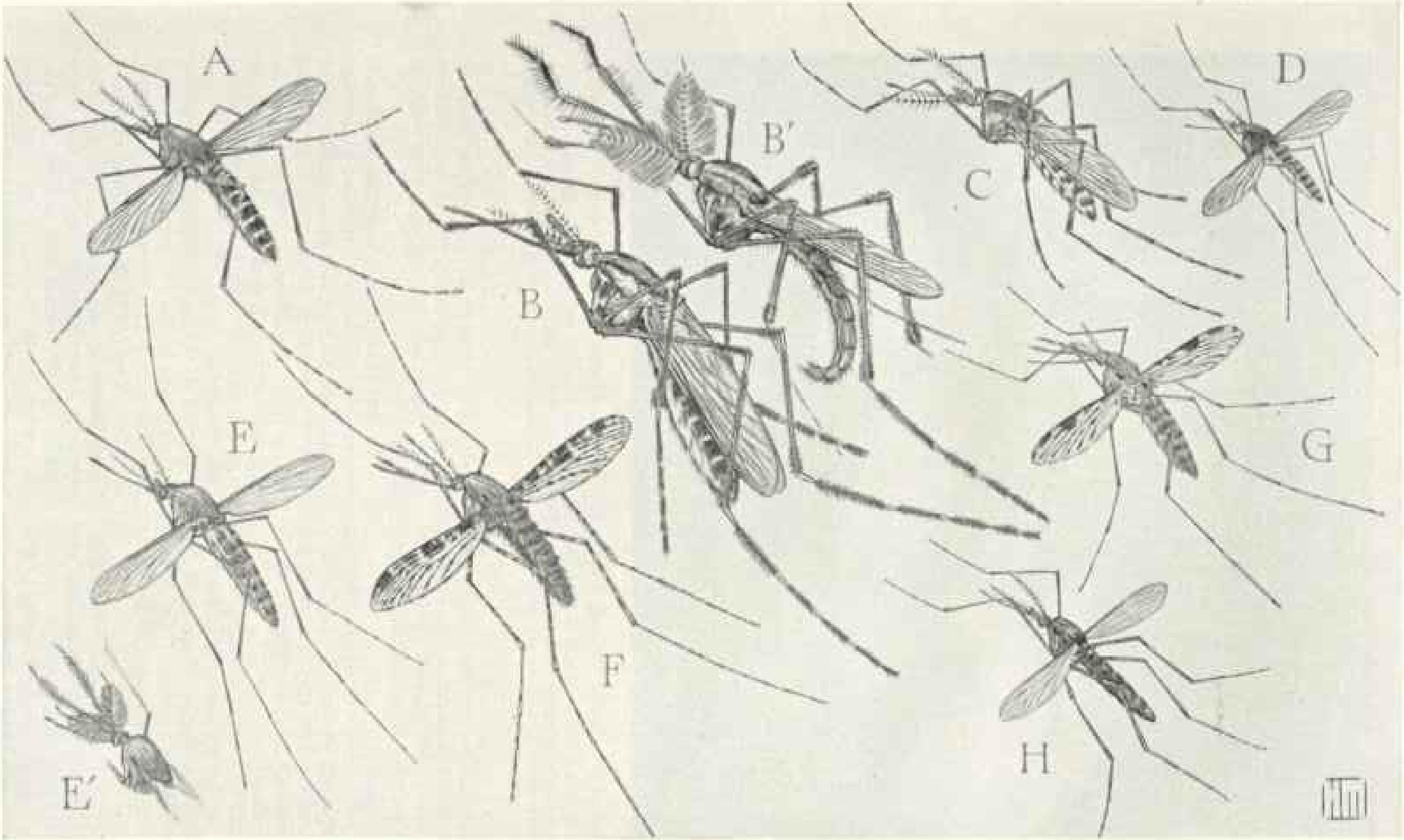
Each jar, with its opening pressed against the sufferer's leg, imprisons a mosquito. Their bites infect their victim with malaria. The resulting high fever counteracts the paresis. Then the patient must be treated for malaria (page 195).



Bulletin of Entomological Research

Life Story of the Southern House Mosquito Is Revealed in This Remarkable Enlarged Photograph

Compare the camera's record of the birth of *Culex quinquefasciatus* with Plate I. An adult male with plumed antennae emerges from his pupal cast at the surface of the water. At right, a raft of newly laid eggs. Larva, or wiggler (left center), "hangs by its tail" through which it breathes. Fully developed pupa at left.



Faithful in Detail Even to Hairs on Legs and Antennae, This Painting Shows Seven Mosquito Species, 5 Times Life-size

Biggest of all mosquitoes is the hard-biting Gallinipper (*Psorophora ciliata*), whose cannibal larvae feed on smaller species. Like other mosquitoes, the male (B') is distinguished from the female (B) by his plumed antennae. *Aedes vexans* (A) lays her eggs in bottom lands where flood waters, even five years later, will hatch them (page 179). Larvae of *Mansonia perturbans* (C) attach their air tubes to underwater cattail roots and take oxygen from them. *Wyeomyia smithii* (D) lays her eggs in common pitcher plants, some of the larvae freezing up in winter and pupating in spring. *Culex quinquefasciatus* (female, E; male, E') is the southern house mosquito (Plate I). *Anopheles punctimacula* (F) is a malaria carrier of the Caribbean. *Anopheles albimanus* (G) was the chief enemy of the builders of the Panama Canal. *Haemagogus argyromeris* (H) breeds in tree holes of Panama.

U. S. Public Health Service

With a Sieve of Mesh-silk Bolting Cloth, He Strains Mosquito Larvae from the Water

These United States Public Health Service entomologists collect larvae and the tiny organisms on which they feed, in a favorite mosquito breeding place. The man at right holds a testing apparatus which tells whether the pond water is acid or alkaline. From their detailed studies, more effective mosquito-control measures may be devised.

the wards. The mosquitoes bred in large numbers in the water in the saucers under the pots. So abundant were the winged carriers that few persons who entered the hospital escaped contracting the disease.

The adult yellow fever mosquito does not survive cold weather, so that, unlike *Culex*, it does not hibernate. The eggs, however, will stand considerable cold, remaining fertile through the winter.

When mosquitoes carry a disease, the germ goes through part of its life cycle in the mosquito. It is really a disease of the mosquito, too, and a man cannot contract the disease unless he be bitten by an infected mosquito (Plate IV).

The *Anopheles*, or malaria mosquitoes, mostly prefer to breed in open water containing water plants and algae, such as shallow, weedy ponds, roadside ditches, swamps, and the margins of slow-running streams. Some kinds breed in swift streams, in the water in rotted-out holes in trees, and in water-holding plants, pots, cans, barrels, and other artificial containers.

The eggs are laid singly upon the water, and the wigglers, unlike those of most other mosquitoes, rest with their bodies parallel to the surface, where they do most of their feeding (Plate II). The adults, at least in the north, pass the winter in hollow logs, under bark, or in houses, cellars, or barns, as do those of the *Culex* mosquito.

Most of the mosquitoes which annoy us out of doors, such as the salt-marsh mosquitoes of New Jersey and other parts of our coast, those of the northern plains area, and the woodland kinds, belong to the genera *Aedes* and *Psorophora*. These generally breed in rain-water puddles, pools formed by melting snow in the spring, or in water left by high spring tides in the salt marshes (Plate VII).

Their eggs, like those of the yellow fever mosquito to which they are related, are not laid directly in the water but upon dry ground where pools have been before. Heavy rains filling the depressions cause the eggs to hatch.

Most northern kinds breed in puddles from thawing snow in the spring, and there is only one brood a year. The eggs, laid in summer and late spring, wait over until the next year to hatch. Sometimes, though, when the depressions where they lie are filled by heavy summer rains, the eggs do not hatch, seeming to need a cold treatment first.

Farther south and in desert regions, a brood of mosquitoes follows each heavy rain. Here the wiggler period is very short, sometimes less than two days, since this stage must be completed before the puddle dries up.

Eggs That Live Five Years

Not all the eggs hatch at once. If the first hatch is wiped out by a too-quick drying of the pool, others remain to perpetuate the species. The eggs of these dry-land mosquitoes are extraordinarily resistant to drying, sometimes remaining alive for five years under desert conditions.

In the rainy and heavily forested Tropics, many plants collect rain water and hold it for long periods. Brazil has a number of such plants belonging to the Bromeliaceae, relatives of the pineapple. They grow mostly on trees, like orchids, and collect water between the bases of their leaves (Plate III).

In this water a host of little animals may live—tree frogs, beetles, and flies. Many kinds of mosquitoes breed only in the plants.

Often after climbing 15 or 20 feet to reach these water caches, we found them infested with stinging ants, which drove us down considerably faster than we went up.

We used a rubber syringe with a long tube to suck out the water, then squirted it into bottles. In the laboratory we sorted out the wigglers from the other animal life. Sometimes these plants would hold nearly a gallon of water and several hundred wigglers.

The malaria-carrying mosquitoes belong to the genus *Anopheles*, but only a few of the many kinds are known to be carriers. Of these, some are much more dangerous than others. In the United States there are only eight kinds of Anopheles, and only two are of much importance as malaria carriers.

Adult Anopheles can generally be easily recognized by their spotted wings and by the fact that when biting they hold the proboscis in a nearly straight line with the body, not bent at an angle as with other mosquitoes (Plate IV). In Brazil they are called *mosquito prego*, or "nail mosquito," because they look like tiny nails driven into the skin at an angle.

Of recent years it has been found that the fever which accompanies malaria is beneficial in treating certain types of syphilis affecting the nervous system. For this purpose, certain kinds of Anopheles mosquitoes have been "domesticated," and are bred in quantity and allowed to become infected from malaria patients (page 191).

I once visited one of the malaria experiment stations of the Rockefeller Foundation in north Florida. Here several species of Anopheles were being bred in specially constructed cages for use in experiments on the relief of syphilis. Each cage was the size of a small chicken house and was made as comfortable as possible for its inmates. They had a tank of water to breed in, damp, shady resting places, and even air conditioning!

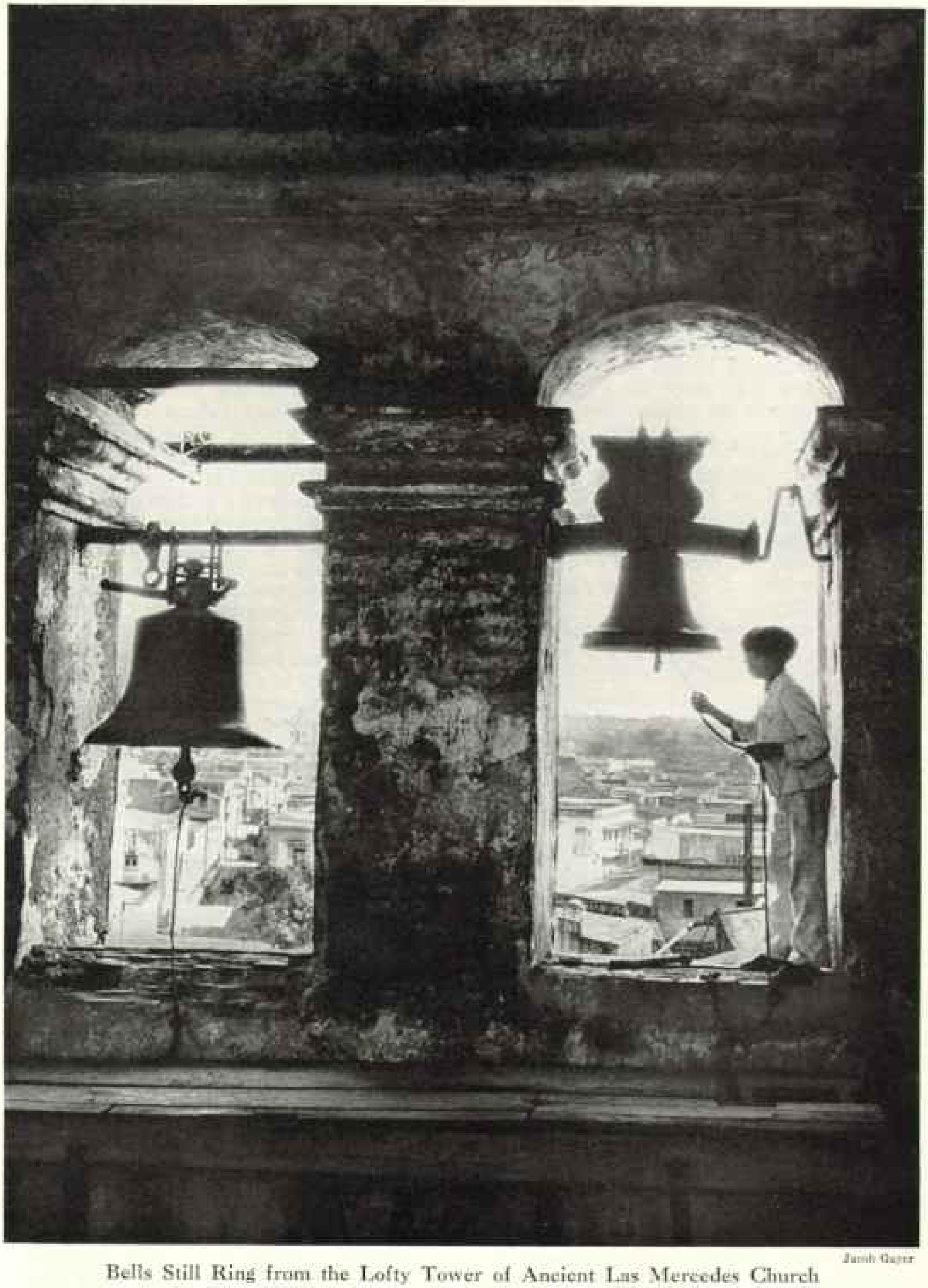
The man who cared for them collected the new-laid eggs every morning from the breeding tank and transferred them to special rearing pans. Here the larvae were allowed to grow in a hay infusion, rich in the microorganisms which form their food. They were also fed yeast, which seems to make them grow into bigger, healthier mosquitoes.

The attendant also looked carefully for dead or sick ones, since mosquitoes are subject to fungus diseases which, if allowed to get a start, may wipe out the colony. The pupae were taken from the rearing pans and placed in special hatching cages, from which the fledglings could easily be removed. Adults were either liberated with the colony or taken to the laboratory for use in the antisyphilis work.

An Uncomfortable Job—Feeding Domesticated Mosquitoes!

The catch in the otherwise interesting job of the attendant was that he furnished food for the mosquitoes, and there were many hundreds in each colony. He rolled up his trousers to the knees and his sleeves to the elbows while working in the colony, and let them go to it. He could not even have the satisfaction of swatting his tormentors! After a week or so, he told me, he got quite used to it.

Then these domesticated mosquitoes were taken to the laboratory and fed on a malaria patient. When the malaria organisms in their bodies had fully developed, the carriers were allowed to bite patients with syphilis, thus inoculating them with malaria. This method is considered by some doctors to be better than blood transfusions from one patient directly to another, since it avoids the danger of transmitting any disease but the malaria.



Jacob Gayer

Bells Still Ring from the Lofty Tower of Ancient Las Mercedes Church

Construction of this handsome temple was begun in Ciudad Trujillo in 1528. Its main altar is inlaid with silver reputedly taken from the mines of early Hispaniola. Beside the church is the ruined monastery of the Friars of Mercy, its founders.

The Land Columbus Loved

By Oliver P. Newman

With Illustrations by Staff Photographer B. Anthony Stewart

HISPANIOLA, "the land Columbus loved," is an island of contradictions. When you meet a friend in the western end you say, "Bonjour"; in the eastern end, "Buenos días." For Haiti speaks French, while the Dominican Republic clings to Spanish.

All over the island the wind blows from the south all day and from the north all night. The days are hot, the nights are cool.

In the hills a native will let his beard grow to cure malaria. In the city a graduate of Columbia will take out your tonsils.

American Marines were in the Dominican Republic for eight years and the effects of the occupation remain. Concluding a telephone conversation, a Dominican will say, "Bueno, all right, muy bien, O. K."

On a broad ridge overlooking Ciudad Trujillo, capital of the Dominican Republic, lies a big, modern airfield, where giant bombers, huge transports, and fighter craft swarm daily in their task of giving economic aid and security to the West Indies and the Panama Canal.

Below the airfield, on the edge of the silver-sparkling waters of the blue Caribbean, hidden away in the half-modernized town, are the first Christian church, the first cathedral, and the first pontifically established university of the Western Hemisphere.

Outside the Cathedral a 12-cylinder Packard will deposit its occupants. Inside, they will kneel before a crypt within which, Dominicans will tell you, lie the bones of the Great Discoverer (page 198).

Eastward 50 miles are thousands of acres of lush, green sugar cane, but in between lies a stretch of bleak, bare, wild, rocky, arid land. It is peopled only by wild goats but blanketed with cactus, abloom in the variegated colors of a Persian carpet.

Base of Spanish Explorers

At one end of the town stands a ceiba tree to which Columbus is reputed to have tied his ships. At the other rises a reproduction of the Washington Monument, 140 feet high.

Columbus must have loved the land, for he went back to it again and again, thereby setting in motion the long, colorful train of Spanish explorers who discovered, conquered, and colonized much of South America and the lower third of North America.

Cortez, Balboa, Pizarro, Ponce de León, De Soto, and other adventurers from Spain set out on some of their historic expeditions in the new little port of Santo Domingo, capital of the New World, founded by Bartolomé, brother of Christopher Columbus, in 1496 (map, page 200).

From the blood, courage, hopes, and energies of that great stream of world conquerors materialized the Dominican Republic. Hardy, fearless, careless rogues, rascals, scholars, cultured gentlemen, churchmen, younger sons of the noble and rich, all adventured into the new and exciting fields of opportunity for a hundred years before Jamestown—and stayed.

Today the descendants of the proud *conquistadores* carry on, their blood mingled with that of many peoples—Dutch, English, Syrian, German, French, African. But much of the culture of old Spain has survived. In two-thirds of the island (the Dominican Republic) the language remains, remarkably undefiled, and also the traditions, art, music, and habits the Spaniards brought.

The Dominicans had a tough time to survive. If they were not under assault from French or English invaders, they were attacked by pirates and, in between times, were torn by bitter quarrels.

When they finally gained their freedom in 1844, after years of uncertain relations with Spain and Haiti, their leaders continued to fight among themselves.

But they have survived. On February 27, 1944, they will celebrate their one-hundredth birthday, and through all their travail they have preserved their pride, their cheerfulness, their courtesy.

When two Dominican men meet on the street they doff their hats to each other. When cocktails are passed, the nearest Dominican lifts a glass off the tray and presents it to the friend at his elbow.

Promising young men in the more well-to-do families are groomed from childhood to go out into the world and hold their own in cultured circles. Perhaps there are five boys in the family. One is particularly alert and intelligent. All the other members of the family (including cousins and inlaws) sacrifice whatever is necessary to give the bright boy his chance.

In earlier years he was sent to the Sorbonne, to Heidelberg, to Vienna, to England. Latterly, the United States has been preferred.

In the Cathedral, Archbishop Pitini Holds One of Five Keys to the Columbus Crypt

Four other custodians are required to unlock the vault, as the remaining keys are held in government departments. Dimly behind the glass may be seen the box containing what every Dominican believes are the authentic remains of Cristóbal Colón—Spanish for Christopher Columbus (page 224).

English and French must be learned as a matter of course, along with history, the arts and sciences, political economy, government. Familiarity with literature—the best literature of all nations—is a must.

A few years ago a high officer of the Government happened to sit at a table at a country club dance with an American from Washington, an Army officer in the other war.

"Pardon me, Major," said the official, "but I have never had an opportunity to ask if, by any chance, you happened to attend the University of Virginia."

"Why, no, I did not," replied the major. "Why do you ask?"

"Well, whenever I meet anyone from the southeastern part of the United States, I always ask whether he attended the University of Virginia, in the hope that he may be able to add to my lore of Edgar Allan Poe."

The major's brows went up. "You are familiar with Poe?"

The official smiled. "Your second greatest poet."

"And our first?"

"Whitman, of course."

Then There Is Pedro, the Farmer

Naturally, this was not Pedro, the farmer, who has a little shack in the country, a cheerful wife, a child every year, a dozen chickens, a burro or two, a plantain tree, a patch of sugar cane, a couple of goats, and a machete (page 205). Pedro wouldn't know about Poe and Whitman, but neither would his counterpart in other countries.

But Pedro has lots of fun. His needs are few, his appetites and ambitions simple. The nanny goat provides milk for the babies, which come with unfailing regularity. The plantain tree almost literally drops his food into his lap. It grows and yields without requiring any attention. Its huge product—it is really a cooking banana—takes the place

Wire Ball Spins, Out Comes a Number, and a Nation Holds Its Breath

The national capital's Sunday lottery drawing is a major event to hopeful ticket holders and revenue-raising Government. As numbered balls drop out of the cage's spout, the girl reads them over the microphone. Throughout the Republic winning numbers will be posted on bulletin boards.

of potatoes, providing abundant starch (205).

Perhaps there are a couple of yuca (cassava) plants back of the house. If so, he has as much flour as he needs for his wife's baking.

If there is no coconut palm on his little plot of ground, there are plenty of others in the near-by woods. From the coconut he can drain a delicious drink when thirsty, and the family can eat its meat.

Burro Is School Bus

For transportation there's the burro, which can be bought for a dollar or two in the country and never has to be fed. The burro carries the children of school age to the near-by rural school on rainy days, the only limit to its load being the number that can climb aboard and stick.

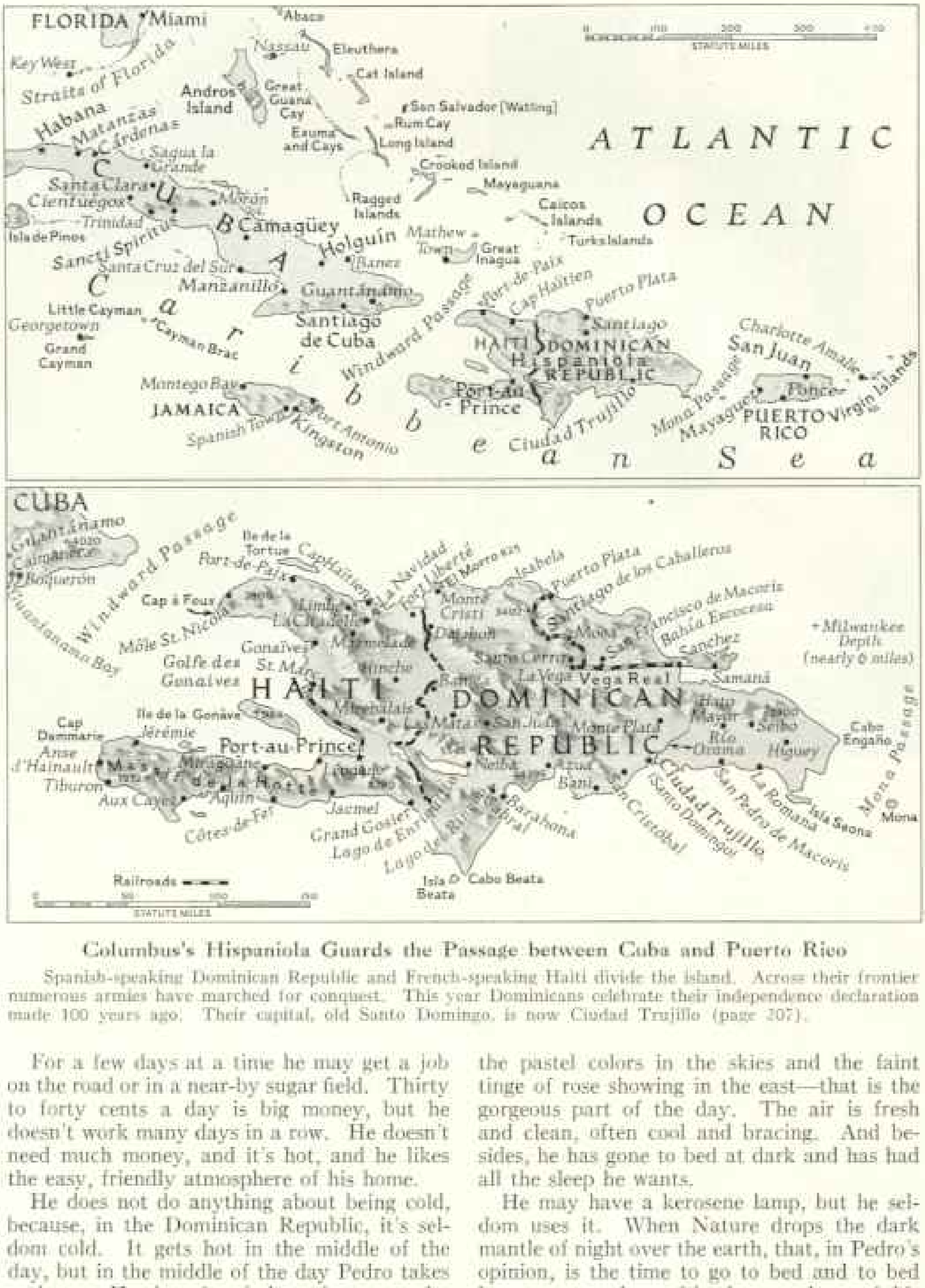
If Pedro has a charcoal pit in a corner of his little farm (which he probably has), two or three hours' work for two or three days a week give him a richly prized product for town dwellers not far away. He can get 30 cents for a gunny sack full of charcoal, and the sturdy burro can tote three or four sacks.

Going into town, Pedro will trudge alongside, barefooted, his legs covered by a worn pair of cotton pants, his torso bare, his trusty machete swinging from his belt.

Once a week (usually on Saturday, when the meat wagon goes around) Pedro can use some of his charcoal money for a piece of meat—beef, veal, or pork. Coming home, he will sit sidewise on the burro, dangle his bare feet over the side, swing his hunk of fresh meat on a string tied to a stick over his shoulder and, if it should be raining, cover his head and shoulders with the broad leaf from a wild palm.

The "Good Life" in the Tropics

To Pedro's mind, it is a pretty good life. He smiles almost all the time. He laughs often. He sings at his work.



Columbus's Hispaniola Guards the Passage between Cuba and Puerto Rico

Spanish-speaking Dominican Republic and French-speaking Haiti divide the island. Across their frontier numerous armies have marched for conquest. This year Dominicans celebrate their independence declaration made 100 years ago. Their capital, old Santo Domingo, is now Ciudad Trujillo (page 207).

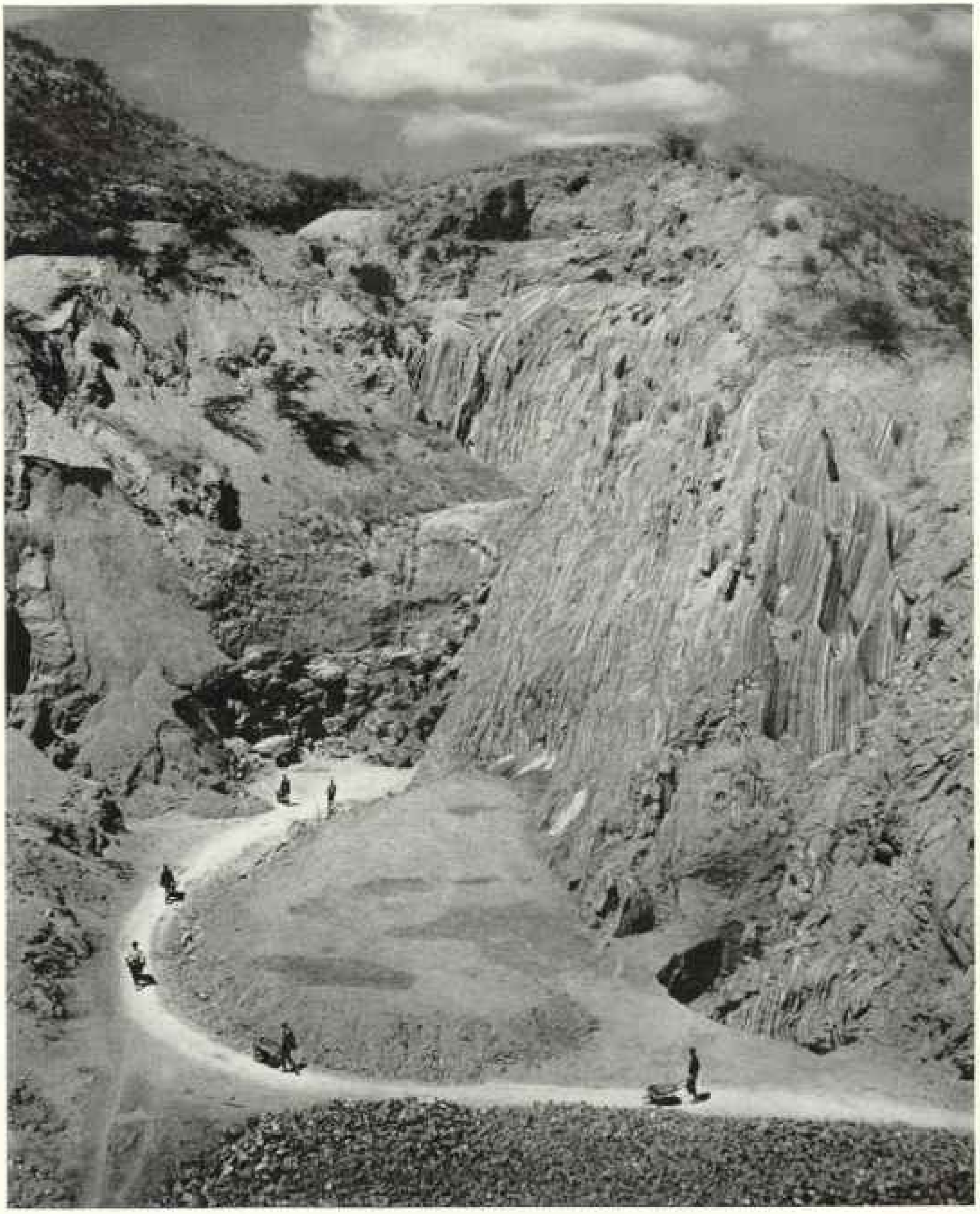
For a few days at a time he may get a job on the road or in a near-by sugar field. Thirty to forty cents a day is big money, but he doesn't work many days in a row. He doesn't need much money, and it's hot, and he likes the easy, friendly atmosphere of his home.

He does not do anything about being cold, because, in the Dominican Republic, it's seldom cold. It gets hot in the middle of the day, but in the middle of the day Pedro takes a siesta. He doesn't mind getting up early. His house may have no doors or windows—only openings. Light comes in early and wakes him up, so why not get up?

The early mornings, just at daylight, with the pastel colors in the skies and the faint tinge of rose showing in the east—that is the gorgeous part of the day. The air is fresh and clean, often cool and bracing. And besides, he has gone to bed at dark and has had all the sleep he wants.

He may have a kerosene lamp, but he seldom uses it. When Nature drops the dark mantle of night over the earth, that, in Pedro's opinion, is the time to go to bed and to bed he goes, together with the members of his family, all of whom arise at dawn, as he does.

In fact, Pedro has only one trouble that worries him very much. That is his fence posts. He needs a little fenced-off space for



To Fill West Indies Salt Shakers, a Wheelbarrow Brigade Quarries a Mountainside

Virtually all the landscape is salt. It is so pure and clear that Dominican jokers give ice-cube-size lumps to visiting innocents to cool their drinks. Near Cabral, the deposit was thrust up vertically from an ancient ocean bed, as shown by the perpendicular strata. Oil prospectors recently have made an enthusiastic search in this very vicinity. By driving short shafts into the salt, they have detected the odor of petroleum. A few miles away, Enriquillo is a 30-mile-long salt lake. Neighboring Haiti gets salt by evaporating sea water.

Burton Holmes from Galloway

Sighting Flat-topped El Morro (the Headland) from the Sea in 1493, Columbus Mistook It for a Small Island

Named for a patriot, Duarte Highway leads toward the city of Monte Cristi, whose harbor was discovered by Columbus toward the end of his first voyage. Tiny, faithful burros perform the chores of country people all over the Republic.

President Trujillo's Wife and Daughter Are Guests of Honor at a Party in the Capital

The daughter smiles at the extreme right. At the other arm of the same settee is Señora Trujillo. The President's brother, Secretary of War Hector Trujillo, stands before the door in the center. Former President M. J. Troncoso de la Concha, far left, and his wife, seated in the center of the settee, are parents of the former Dominican Ambassador to the United States.

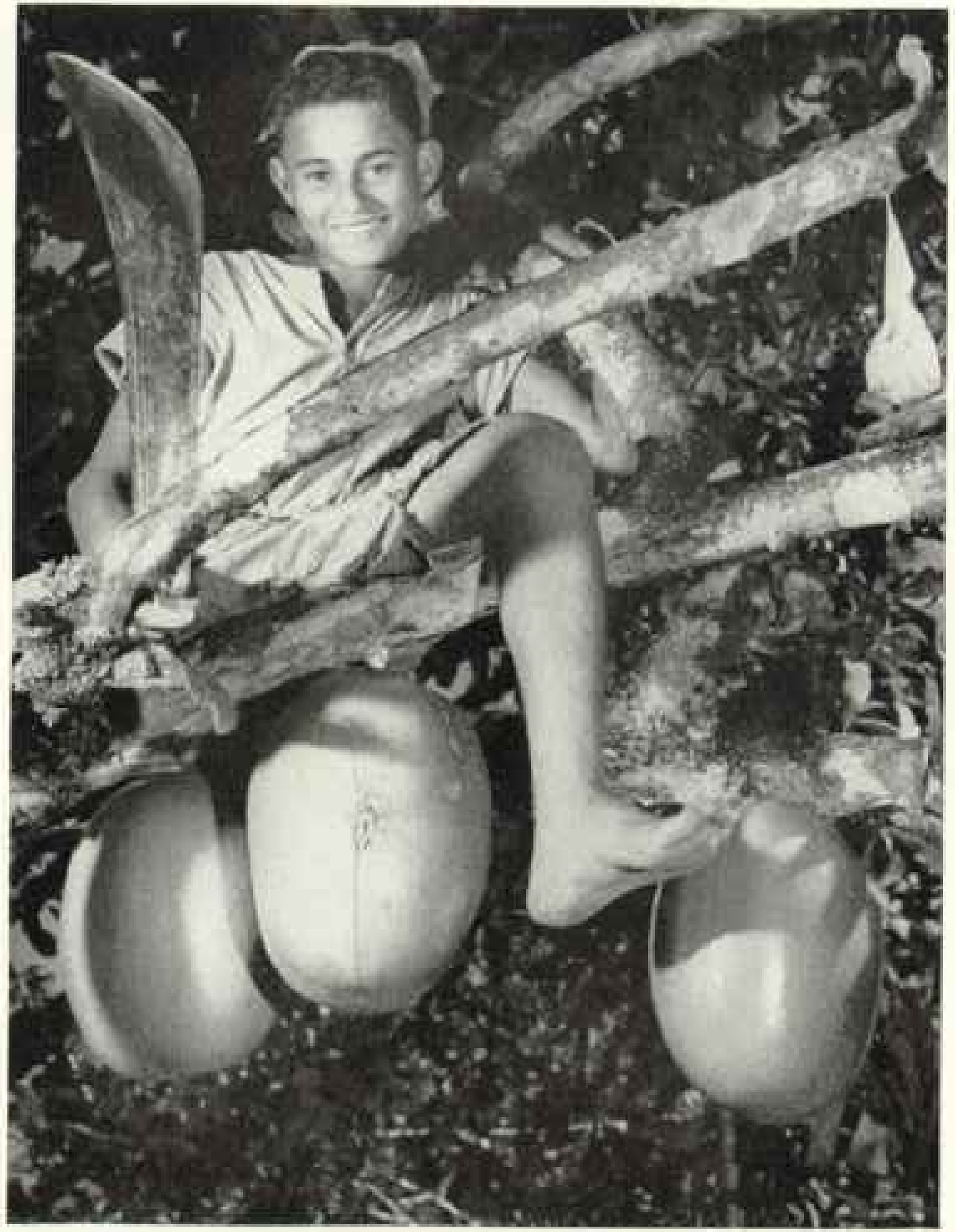
Jacob Gayer

Columbus Introduced Cane to the New World on His Second Voyage—Since His Day Sugar Has Been Hispaniola's Money Crop

So rich are some Dominican lands that cane will grow from the same roots ten years or more. In less fertile fields replanting is necessary about every three years. Imported Haitian labor harvests a good share of the crop. In this picture oxcarts load a jungle of cane just felled with machetes.

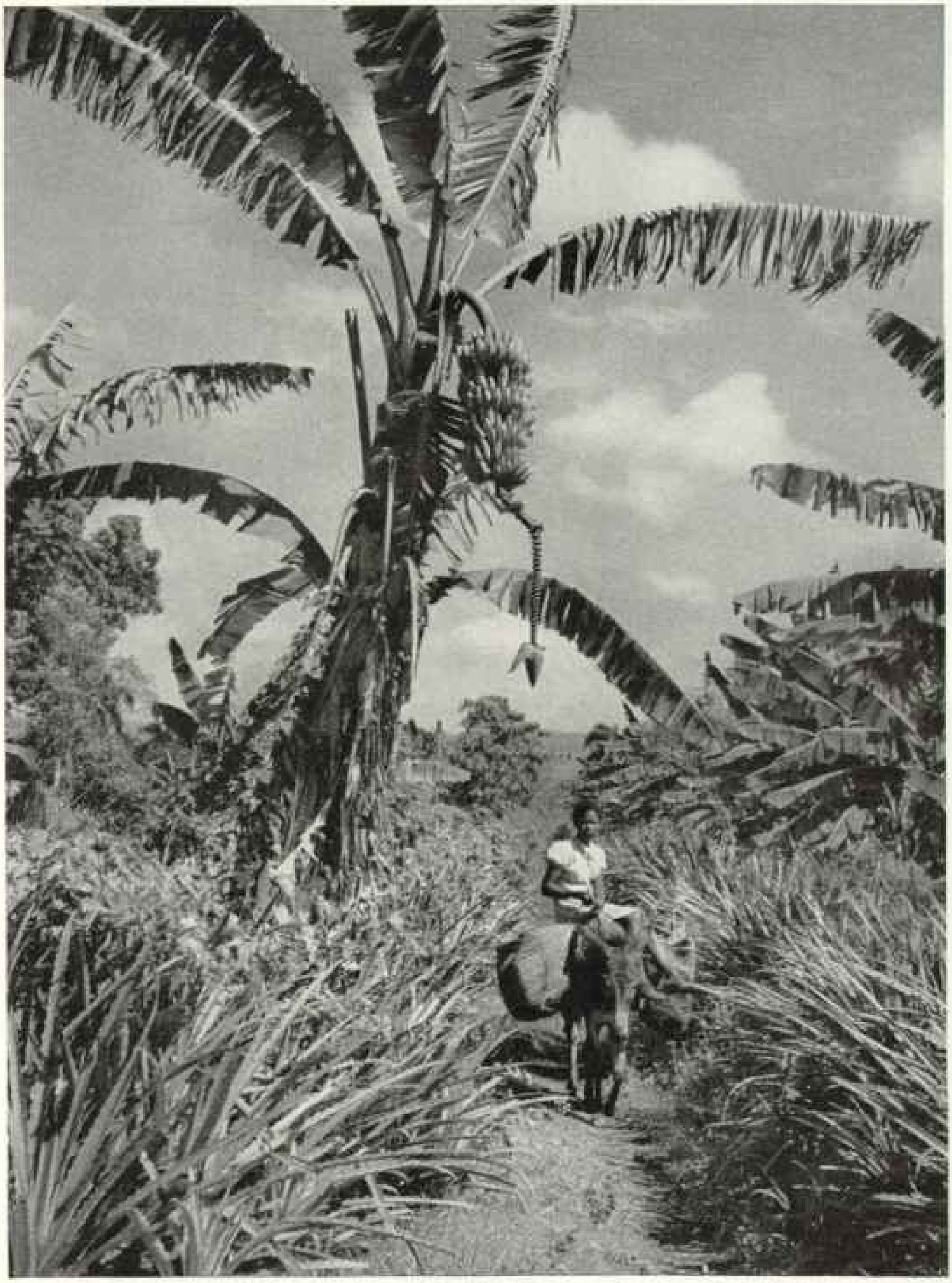
Buxom Ceres Offers the Fruits of a Bountiful Soil

Not the queen of southern "mammies" is she, but an outdoor vendor in San Cristóbal. In hand-hewn tray she holds oranges, onions, and plantains. The starchy, bananalike plantain serves as the Dominican's potato (page 198).



Watermelon-size Gourds Become Two-gallon Buckets

Dried and hardened, their shells are the small farmer's equivalent of the almost universal oil tin. The heavy fruit is a reminder of the cacao pod growing out of its tree trunk (Plate III). Machetes serve even in treetops.



Its Fruity "Fingers" Curling Up, a Bunch of Bananas Trails a Tail-like "Blossom"

Increased shipments are in prospect for banana-hungry North Americans. Greater need for tropical foods coincides with an easing of the shipping shortage. Banana plantations have been kept up in wartime, though some have had no market. Unlike tobacco and potatoes, bananas were the Old World's gift to the New.

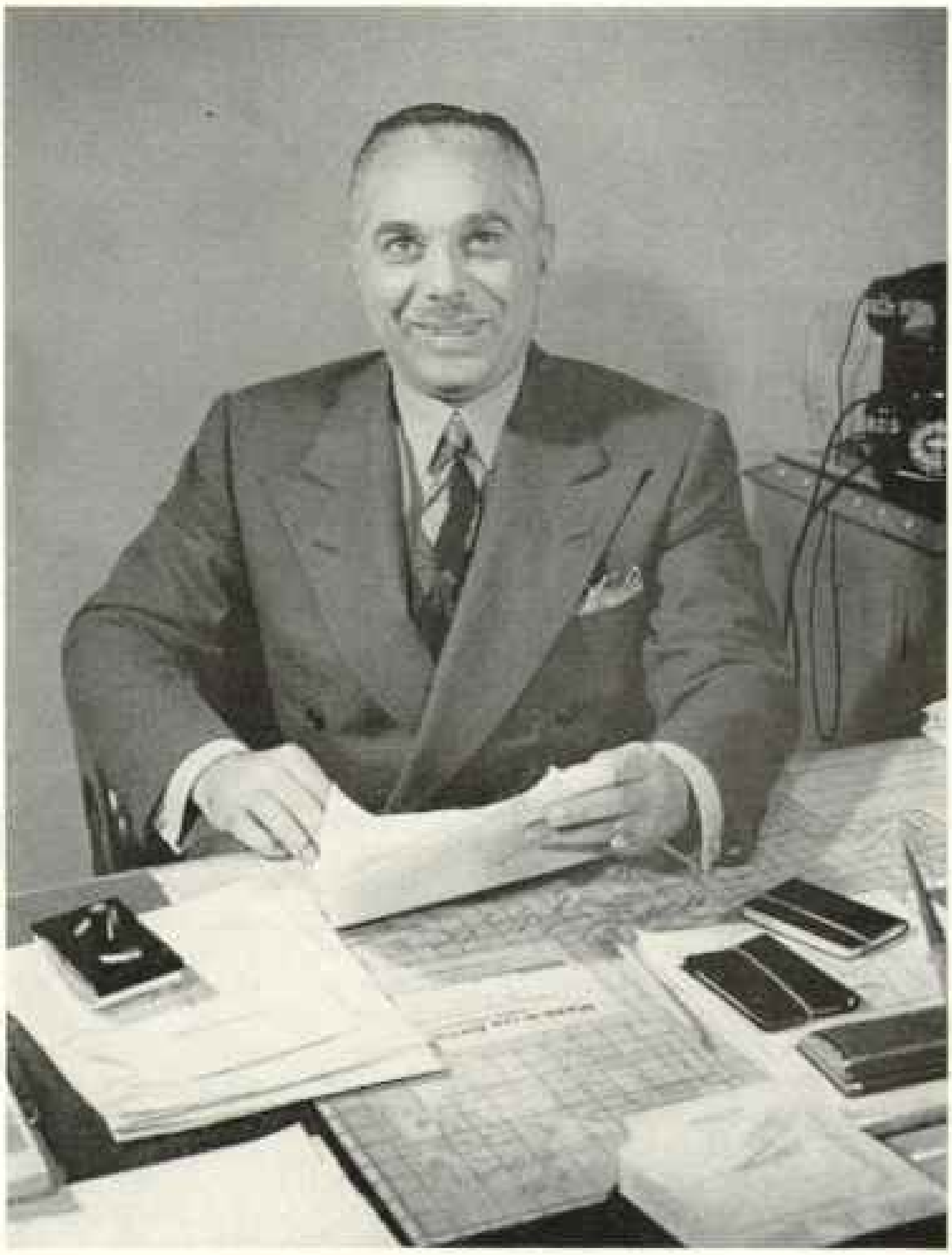
the burro, a pig or two, and the goats, but his fence posts insist on turning into trees.

Pedro sticks a post in the ground. He has probably cut it in a near-by wood. He trims it neatly and strings wire on it, and in a few weeks it is a tree again. The soil is so fertile, the climate so beneficent, the rainfall so ample that it takes root and puts out new branches. Pedro hacks the new growth off with his machete, but, before he knows it, the post has turned into a tree once more.

Big sugar estates, which erect miles of fences, keep a gang with machetes busy most of the time, to prevent their fence posts reverting to a forest.

Going to Town—with the Family

The day of days for Pedro is Sunday. Then he and all his family go to town. They dress up. Pedro wears another pair of cotton pants and they're usually clean. He also puts on a cotton shirt and, if not shoes, Dominican-made sandals of leather or reed.



President Trujillo, the Dominican Republic's Strong Man

Three times Chief Executive, he modernizes his country—paving roads, rebuilding cities, establishing schools, digging harbors, and improving agriculture—the while he cuts the public debt. Under Trujillo, wasting civil wars have ceased. In his honor, old Santo Domingo is now called Ciudad Trujillo (page 218). Friendly to the United States, his country was one of the first in Latin America to declare war on the Axis.

His wife miraculously produces a print dress of bright colors, shoes and stockings, and a flower for her hair. Some of the boys of ten or twelve wear pants and shirt, but the costume of the little ones is much like Gunga Din's, "nothin' much before, an' rather less than 'arf o' that be'ind."

Each little girl, however, will have one sartorial adornment. She may trot along beside her mother (who is seated sideways on the burro) as nude as the day she was born, but in her neatly combed and braided hair she will wear a bright-colored ribbon.

Pedro and family will go to town about the middle of the afternoon. All the other Pedros and Juans and Horacios and Ramóns and Ernestos and Alfredos from the near-by countryside will also go to town, taking their families with them.

Along the road as they meet or overtake each other and in the little green parks of "La Ciudad," beneath the soft pink blossoms of the álamo trees, or under the flaming-red clusters of the flamboyant tree, they will visit and laugh and talk and gossip till early dusk. They may crack a coconut together and drink its sweet milk.

They may even have a glass of beer at a little table of a sidewalk cafe—the men, never the women.

The children will beg for pennies to buy *dulces*—sweets made of figs, guava, coconut, etc.—and the mothers—fat, genial, friendly women with broad hips and shoulders—will gossip of the latest babies who have arrived or are expected. At early dusk the family procession will wend its way home, tired but happy.

Rafael, the Town Boy

Rafael, the town boy, has a life quite different from that of Pedro. His horizon is wide, his pleasures varied. If he's under thirty he has been seven years in school. He is a high school graduate. He may have gone to the University. He has a job, with the public works, the telephone company, the light company, one of the importing houses, or a Government office. In his home he has a radio and a shower bath.

Every week, in one pocket, he carries a "piece" of a lottery ticket. He loves the lottery and often goes to the drawing with hundreds of others on Sunday morning, to see who gets the weekly capital prize of $10,000 or $15,000 and the thousands of smaller prizes. Full tickets are $3 each, but all are divided into tenths, or "pieces," at 30 cents each.

Sometimes he wins two, three, five, or ten dollars. Every week some of his friends win and when he buys a ticket he does so with a feeling of virtue. He not only may become rich for life but, in buying even a piece of a ticket, he is a supporter of an enterprise from which his Government nets more than $200,000 a year from the concessionaire (page 199).

Office hours uniformly begin at 8 o'clock; so, to bathe, shave, dress, get breakfast, and reach work at 8, Rafael has to get up by six or a little after—almost as early as Pedro. But he doesn't mind. At 12 sharp all offices, stores, banks, and other business establishments shut up shop.

In Ciudad Trujillo, from 12 to 12:15, the streets teem with people, cars, carts, burros, and coaches, the latter resurrected from obscurity when gas began to get short. But from 12:30 to 2 you could shoot a rifle up or down most of the business streets with very slight danger of hitting anybody. The city becomes a deserted village.

Rafael goes home to lunch, and what a lunch! Heavy soup, chicken or pork, potatoes, beans, rice, plantain, melon, pineapple, tomato and heart of palm salad, pudding, and coffee. He finishes before one o'clock, removes his outer clothing, and goes to sleep. He is certain of at least an hour's siesta.

If he works for the Government, he can have two hours, for afternoon labor in Government offices is from 3:30 to 6. If he works for a business house, he's up with the quarter-to-two whistle, the wailing fire-department siren which blows 15 minutes before 2 to warn the siesta-takers that it's almost time to go to work again (Plate VII).

Furthermore, Rafael may break each half day's work session with a quarter or half hour of relaxation at a near-by cafe, where his beverage is coffee or coconut water.

If you happen to have business with anyone in Ciudad Trujillo and desire an informal, comfortable chat with him, drop in at his cafe about 10:30 in the morning or 4:30 in the afternoon and you'll be likely to find him, gossiping with friends over a demitasse, into which has been poured at least two or three teaspoonfuls of sugar. These twice-daily coffee sessions are a social institution.

That custom of the country of dodging the noonday heat brings up the question of climate. As a matter of fact, the summer temperature seldom goes over 90, between 11 A. M. and 4 P. M. But the point is, from May to November it is apt to go there every day. This period, especially May, June, and July, is also the "rainy season," when there may be half a dozen hard showers a day, with accompanying humidity.

Any physical exertion during the heat of the day makes perspiration break out in streams, which is the reason that Pedro and Rafael both try to lie low at this time.

Like other tropical islands, however, Hispaniola is blessed with practically continuous breezes from the sea. It is always comfortable on the shady side of the street or in any house or office that has north and south doors and windows.

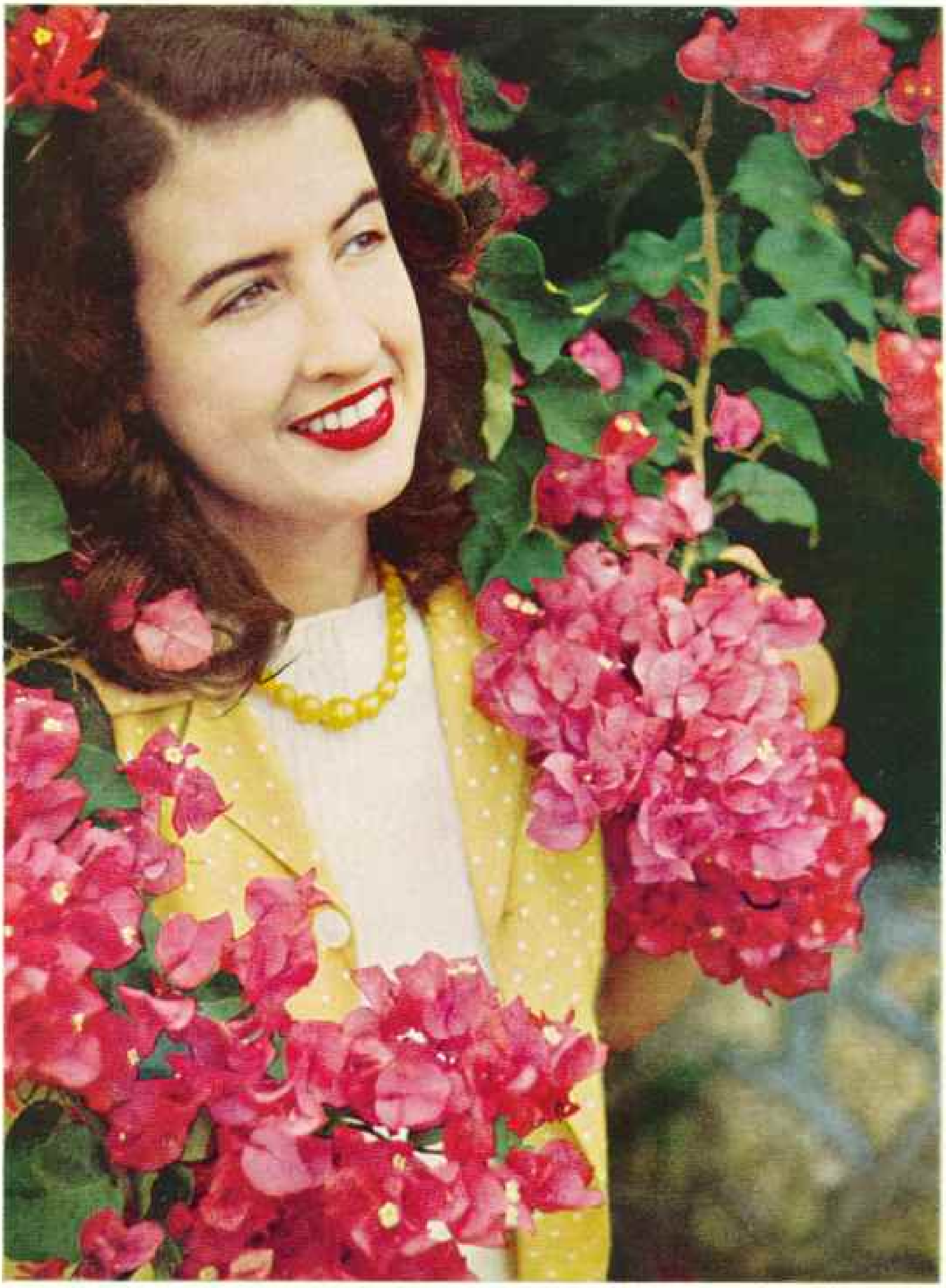
The temperature drops as the sun goes down and you sleep in comfort, often under a light blanket, almost every night. In the cool evenings most women need a light scarf if they are in a car or sitting outdoors on a balcony.

The good night's sleep, with the siesta heat after lunch, is the Dominican lifesaver. And from December 1 to May 1 the island has the kind of weather Florida advertises. In the winter of 1942–43 the temperature stood practically at 70 for five months.

The Republic and the War

Rafael usually gets in another period of relaxation after work in the evening. He quits about 6, but he probably does not have dinner until 8—another meal like his lunch.

His corner cafe, or a larger one with wide doors opening onto the street so that the evening breeze blows through, attracts him again.



 Kodachrome by B. Anthony Stewart

Lily Maid in a Bower of Purple Bougainvillea Typifies Dominican Beauty

Daughter of a Santiago businessman, she is a lovely representative of the old Spanish stock. Like many of her generation, she has been educated in the United States. Dominicans love flowers. The poorest earth-floor shack is not without its bouquet. And bougainvillea climbs the humblest wall.

Kodachrome by B. Anthony Stewart

Shrine of Santo Cerro (Holy Hill) Overlooks an Enchanting Tropic Garden Which Columbus Named La Vega Real (the Royal Plain)

Dedicated to the Virgin of Mercies, the chapel is built at the spot where the Discoverer's tiny army battled a horde of Indians in 1495. Capturing his wooden cross, the Indians tried in vain to burn it. In the flames, devout Dominicans believe, appeared a vision of the Virgin. Overawed, the savages were defeated.

Children Love Cashew's Big Juicy Stem Even More than the Nut

Kodachromes by B. Anthony Stewart

Your Chocolate Comes from Pods on the Cacao Tree's Trunk

 Reproduction by R. Anthony Stewart

Through Lily Pads the Dugouts Creep—Salt-water Fish Are Landlocked in Lake Rincón

 Kodachrome by B. Anthony Stewart

Rags for Herself, Silks for the Virgin—Almost Every Home Has Its Shrine

Kodachrome by B. Anthony Stewart

Debris of Centuries Cleared Away, the House of Diego Colón, Son of Columbus, Is Preserved Nearly as He Built It in 1510

In this fortress-mansion the Discoverer's grandchildren were born and his brother, Bartolomé, died. Found in Sevilla, Spain, the original architect's sketches were consulted in the restoration. Above San Diego's Gate in Ciudad Trujillo's old wall flies the Dominican flag. Beyond is a ship mast in Ozama River.

© National Geographic Society

"I'm Not Neutral," Crows a Raffish Cockpit Gladiator

Staked out between bouts, he gets exercise and sun bath. Back feathers are plucked and skin is hardened for armor-plating. On this bird Dominicans will lay bets by shout and gesture.

Kodachromes by B. Anthony Stewart

Ciudad Trujillo's Alarm Clock Awakens 75,000 from Siesta

Like Gabriel's horn on Resurrection Day, this wailing electric siren shatters the silence of a sleeping city daily at 1:45 p. m. It serves as a fire signal, too. The sentry is a city fireman.

Luxurious Hotel Jaragua, Finished in Wartime, Awaits Peace and Travelers

It is a four-story sample of Ciudad Trujillo's modernistic architecture. Two Dominican brothers, Guillermo and Alfredo González, designed it. The fair tennis players are on their way to its courts.

© National Geographic Society Kodachromes by B. Anthony Stewart

This Little Pig Went to *Pasadia*, the National Pork-barbecue Picnic

Six young people are sampling the roast. Carrying the pig on a pole, they have finished the parade that always precedes carving. Music and dancing, perhaps until 4 a. m., will follow.

He knows he will meet friends there, and Rafael, like most Dominicans, likes to talk.

Latterly, his chief topic has been the war. Rafael is violently pro-Ally, especially pro-American. He suffered agonies when the tide ran against the Allies and rose to heights of joy when it turned to Allied successes.

He is not content with mere lip service to the cause of the United Nations, of which his country has been a member from the first. Under the encouraging example of President Trujillo, who headed the list with a contribution of $10,000, the Pedros and Rafaels of the Dominican Republic have donated, as I write, $100,000 to the American Red Cross since December 7, 1941.

Hundreds of them have given 25 or 50 cents or a dollar a month, and the total, for the last year, has averaged $5,000 a month. The few American residents contribute freely, as do the Spaniards, Syrians, French, Puerto Ricans, and Chinese.

The British Red Cross receives from $2,000 to $2,500 per month from the same people. All of this, coming from a little country where most of the inhabitants are poor, where the population is small, and where the total Government budget is only $15,000,000 a year, gives emphatic answer to the question of the Dominicans' attitude toward the war.

Many Towns Are Spotless

One of Rafael's greatest prides is the cleanliness of the town in which he lives—and it makes no difference whether it's the immaculate capital city or one of the smaller cities, even down to a village of a few hundred inhabitants.

The cities and towns of the Republic are spotless. Even in the poorest sections the streets are cleaned every day or every night. The whitewings of the Dominican Republic wear khaki instead of white cotton, and they ply their trade constantly.

Other gangs of khaki-clad workers are forever trimming the palms which line most of the streets and swinging their machetes at grass or weeds along the edges of the sidewalks.

Dominican towns have many plazas, which are extensively used by the population. Evenings, Sundays, and holidays they are jammed with men, women, and children, indulging in the favorite Dominican pastime of conversation.

After that second big meal at 8 or 8:30, Rafael may go to an air-cooled movie, if he lives in one of the larger places. The pictures are American, in English with Spanish captions. The film may be two or three years old, but, if he hasn't seen it, what difference does that make?

Or he may drop in at his dancing club, the name typifying the friendly attitude of young Dominicans toward each other. One is called *Tu y Yo;* in English, "Thou and I."

True, the club has no walls, sides, or windows. It is merely a sizable dancing platform under a thatched roof with eaves extended to keep out rain. There is no orchestra, but there is a juke box and at one side a soft-drink vending machine.

Rafael Loves to Dance

Like all Dominicans, Rafael loves to dance and the juke box plays the strumming Spanish music which sets his toes tingling. A mama or two and several older married couples are always on hand; otherwise, nice Dominican girls could not be there. Monthly dances at the big social club run by the leading families last until daylight.

Rafael's greatest joy, however, is a *pasadia*, which means what it sounds like—"pass the day." And pass the day it is. The fiesta may be in a country home or it may be what Americans would call a picnic or barbecue, at a beach or a near-by resort in the hills.

Everybody goes about 11 o'clock, and at 2 the whole roasted pig, trussed to a 10-foot pole, is paraded to music, with everyone marching behind. It is carved by one of the experts always present. Huge slices are piled on a plate, together with *arroz con pollo* (rice with chicken), and eaten with glasses of foaming beer.

After the pig is consumed, the music starts up again and dancing goes on until early morning.

Rafael has many invitations to pasadias. They are always held on Saturdays, Sundays, or holidays. Of the latter there are fifteen or so every year, an average of more than one a month (Plate VIII).

The only thing that might possibly keep Rafael away from a pasadia would be a ball game, for he's as wild as a Brooklyn Dodger fan about baseball. Dominican boys play good baseball (about half of it in English), and Rafael is an ardent rooter.

The Marines went into the Dominican Republic in 1916, took possession, and ran the country for eight years. In contrast to the attitude of citizens of occupied countries in Europe and the Far East today, many Dominicans are now contributing to the war cause of the United Nations.

There will always be argument between some Americans and Dominicans whether the occupation was justified, but much of the

bitterness in that question has passed away. A world war was raging at the time. There were revolution and disorder in the island. American lives and property were threatened. Germany was seeking a foothold for secret operations in Latin America.

When the Marines Came

In that situation, our Government sent the Marines into the Dominican Republic, primarily to maintain law and order. The Marines did a job, as usual. Before the occupation was terminated, Dominicans discovered that the United States, despite some failures, was bringing certain material benefits.

Today Dominicans respect the United States, and feel friendly to our people. They go to the United States on the slightest provocation, or without any. They want the comforts, the conveniences, the luxuries enjoyed by the people of the States—and they are gradually getting them.

During the occupation they learned the meaning of a good water supply, a better postal service, adequate sewer systems, public education, sanitation, roads, bridges, harbors, paving, clean streets, agricultural development, public health.

President Rafael Leonidas Trujillo Molina was a lieutenant in a Dominican guard company when the Marines landed. The guard was converted into troops commanded by Marine officers, and the young lieutenant kept his eyes open.

He learned rapidly and during the last 13 years, since he has been in control of the State (eight years as President, four years as Generalissimo, and now again as President in his third term), he has applied and extended the policies initiated by the Marines between 1916 and 1925. Both he and his country benefited from close contact with American ideas (page 207).

On the Road to Self-sufficiency

The Dominican Republic is emerging into a modern, progressive country of comparative prosperity. In many ways, especially as to food, it is successfully promoting a self-sufficiency program.

In this respect, it is more fortunate than many of the other West Indies islands. Its population is only about 1,800,000, in an area of some 19,000 square miles, slightly larger than Vermont and New Hampshire together. It is not yet overpopulated to the same extent as some other Caribbean countries, Haiti and Puerto Rico, for instance, and much of the land is fertile.

Practically all vegetables can be produced abundantly and with ease. Tropical fruits abound. Much of the population is poor and lives in the country (more than 80 percent is rural), but nobody need be really hungry unless there is a crop failure. Rice, beans, plantain, chicken, and pork are available at reasonable prices for those who have some cash income, though some of these items are luxuries for the very poor.

Before rationing in her own country an American housewife would have worried a bit in the Dominican Republic about meat, especially about beef. There's plenty of it, but it is not the Kansas City sirloin kind. However, a new packing plant has recently been opened, and it won't be long now until the beef shows marked improvement. In the meantime, there is plenty of pork, ham, veal, chicken, turkey, duck, and squab. And there is fish—kingfish and red snapper—to satisfy the most particular palate. Lobster and shrimp are usually available.

Plenty of Food; Some for Export

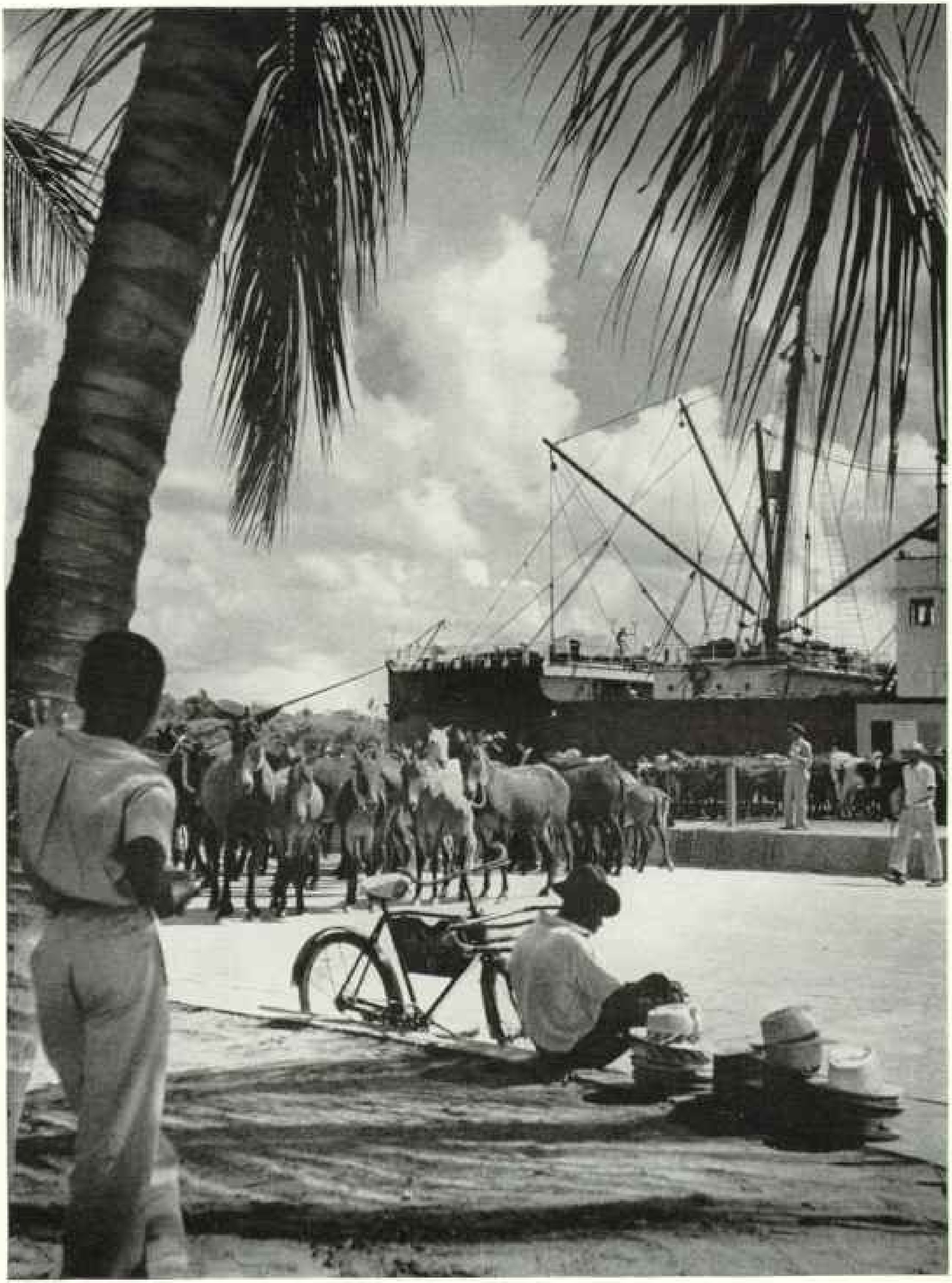
The Republic not only feeds itself; it now exports some foods. Some fifteen years ago growing of rice was encouraged by the Government because rice was a chief article of diet and had to be imported. Today Dominicans grow all the rice they eat and send a surplus to less fortunate countries in the vicinity. Salt is abundant and constitutes a big export (page 201). The cattle industry, which dates from Columbus's second voyage, is extensive. All the beef eaten on the island is raised there, and shiploads of beef on the hoof are exported to adjacent islands (page 219). Plantains and bananas are exported after the large domestic market has been supplied.

Of course, the money crop is sugar, and here again Hispaniola records another first. The first sugar cane brought to the Western Hemisphere came here with Columbus on his second voyage. The Dominican Republic now produces a little less than half a million tons a year.

In one warehouse on the south coast last summer the writer saw 75,000 bags of sugar—enough to sweeten a few million cups of coffee. Directly or indirectly, more than half of the Government's total revenue comes from sugar. Most of the crop usually goes to England and Eire (pages 204 and 222).

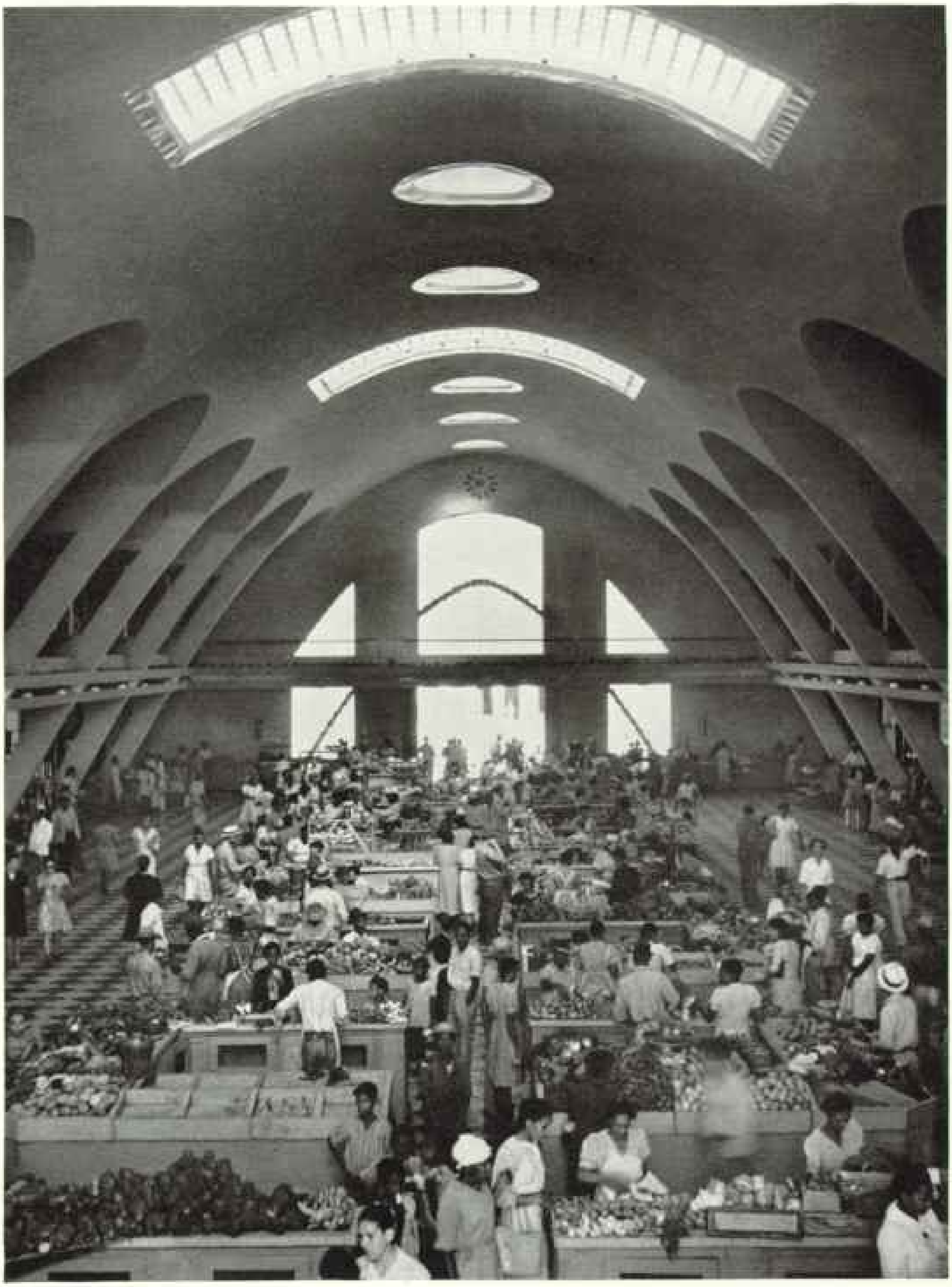
An Experimental Rubber Farm

Other money crops are cacao beans, coffee, molasses, peanuts, and tobacco. The chances are even that, when you eat a piece of candy, it is made from chocolate imported as cacao from the Dominican Republic (Plate III).



Passengers to Martinique, Mules and Beef Cattle Take a Last Look at Ciudad Trujillo

Blazing lights and safe-conduct passes were this vessel's protection against U-boats on weekly runs to Martinique when that island was under Vichy rule. The cattle are culls rounded up under the President's program for restocking the country with thoroughbreds. Beside his curbside counter a hat salesman drowses.



City Market Is a Good Example of Ciudad Trujillo's Modern Concrete Architecture

Skylights brighten El Mercado's stalls of fruits and vegetables. On the mezzanine back of the sloping columns, meat, fish, and staples are sold. In contrast to the women monopolizing stands in many tropical American markets, men share sales work here. Good sanitation is characteristic of the entire country (page 217).

And now the island has a small experimental rubber farm. It has a thousand trees and within a few years may be helping to provide the tires for your automobile.

Vegetables and fruit are most plentiful in the northern half of the Dominican Republic, while sugar grows more abundantly on the broad plains of the southern half. Visitors and many Dominicans regret that Columbus did not remain on the northern shore, where he established his second settlement, Isabela, on January 2, 1494, for that section is partially mountainous and is filled with broad, fertile valleys traversed by clear winding rivers.

Santo Domingo (now Ciudad Trujillo) is a beautiful city in a beautiful setting. At its feet the silver surf of the Caribbean breaks endlessly on its coral shores. At its back wooded and beflowered hills rise to foothills which finally become the mountains where Columbus sought for gold.

If the capital had been established on the northern coast, it would have had an even more beautiful setting and its accessibility to steamship lanes would long ago have put it almost in North America's front yard.

Nevertheless, one glorious heritage has come down to Dominicans of today from the sojourn of the explorer on the upper side of the island. It is the shrine of Santo Cerro (Holy Hill).

Santo Cerro stands in the center of a gorgeous vista. It commands a view of miles of country, which Columbus named "La Vega Real," the Royal Plain. It is similar to some of the beautiful vistas of the Connecticut River or Shenandoah Valleys, except that it is a greener green sprinkled with flaming tropical trees, plants, and shrubs.

On this hilltop, in 1495, Columbus and a little band of warriors were overwhelmed by Indians, who were about to wipe out the invaders to the last man.

On the crest of the hill the Spaniards had planted a wooden cross. This the Indians tried to set afire but the cross would not burn, and suddenly, in the flames, both Spaniards and Indians saw what appeared to be the figure of the Virgin.

The Indians fell down in fear and awe, Columbus rallied his men, and the tide of battle turned. The Indians were killed or driven off, and the Spaniards prostrated themselves in prayerful gratitude to the Lady of Mercies.

A beautiful chapel now stands over the spot where the cross (it may have been made of the island's famous lignum vitae) turned defeat into victory (Plate II).

Dominicans, like most other peoples, sometimes are moved to profanity. One may hear the name of the Lord taken in vain. But no Dominican would ever take in vain the name of the Virgin. If he did so, he would expect to be struck dead. He journeys miles on foot or burro to climb the hill and worship at the Santo Cerro shrine.

Most of the Republic's manufactured articles are, of necessity, imported—all textiles and everything made of metal, as well as dishes, refrigerators, ranges, electrical equipment of all kinds, glassware. In manufactures, however, as in agriculture, the Republic is making itself self-sufficient wherever possible.

Bags for its sugar constituted a big import, and last year lack of shipping caused apprehension. Therefore, President Trujillo promoted the creation of a plant to make bags of native and imported sisal. In another year or so the country hopes to produce its own bags.

It manufactures much of its leather goods, for hides from the cattle slaughtered for consumption are plentiful. Dominican-made saddles (on standard McClellan trees) are as good as any made anywhere. Work shoes and street shoes are turned out in half a dozen small shops in every city and wear well.

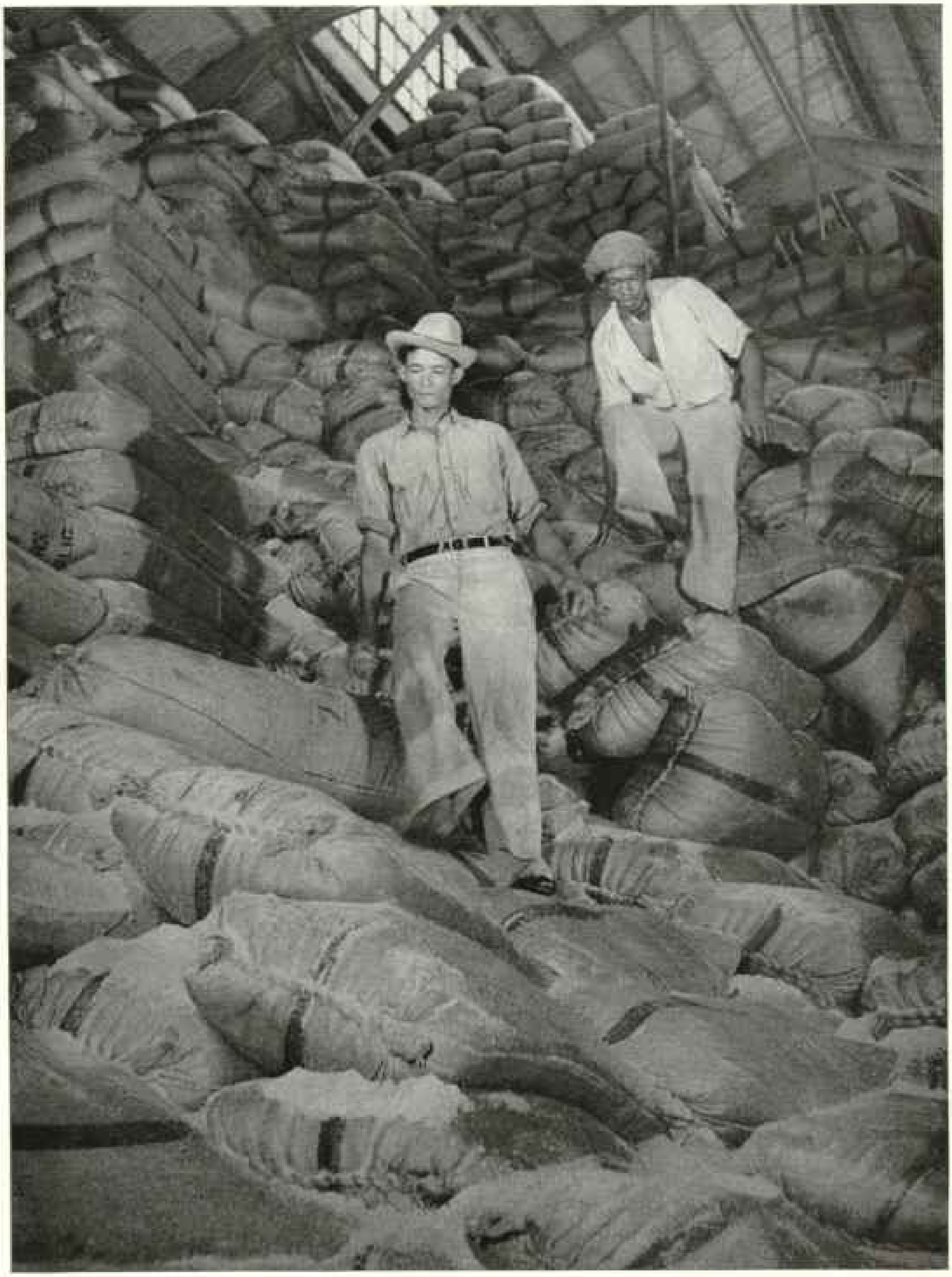
Homemade Furniture of Mahogany

In the shop windows of Dominican cities you never see a woman's ready-made dress on display. Instead, you see bolts and yards of dress materials, of fine quality and beauty. The modern women's dress shop is unknown. As a consequence, the trade of seamstress is followed by scores of women in the towns, and every home that can afford it has a sewing machine. And Dominican women and girls in the cities and towns are noted for their smartness of apparel.

In a country teeming with beautiful woods, very little furniture has to be imported. Practically every stick of furniture in every Dominican home and office is made in the country. Mahogany predominates, because it is so cheap. A visitor touring the country stopped to inspect an army barracks in the interior hills, miles from a city. Beds, tables, and chairs for the soldiers, even the kitchen tables, were all solid mahogany.

Lignum vitae and oak are plentiful and beautiful, and there is a great deal of satinwood. Furniture manufacture, chiefly by hand, is an important industry in every town, and when cargo ships are available quantities of mahogany are exported.

Speaking of ships, the entire Dominican merchant marine was sunk by submarines in the summer of 1942—all two of it. Small as



800 Miles from Sugar-rationed United States, a Warehouse Bulges with Sweetness

Last spring this Barahona depot contained a surplus that could not be exported because of the shipping shortage. U-boat defeats have eased the strain. Here the author saw 75,000 bags of raw sugar (page 218). The two workers reminded the photographer of Egyptian boys descending the Pyramids.

Giggles, Smiles, and Textbooks Announce School's Out in Santiago

Like other Dominican schoolgirls, they wear uniforms (page 224). "E N" on breast pockets stands for Escuelas Normales (Normal Schools). The patterned sidewalk is a decoration for the social club at right.

that merchant marine was, its loss was a blow to Dominican commerce, especially to its export business with other West Indies islands.

It was out of the question to replace the ships. Cargo vessels could not be had for love or gold, so the Dominican Government built sailing schooners. Two big three-masters were constructed of native timber, by day and night labor, on the shores of the harbor of Ciudad Trujillo and were launched early last summer. Others are being built as fast as native workmen (under a "down-East" Maine shipbuilder) can turn them out.

For the time being, they help solve the Dominican problem of interisland transport. They are so satisfactory that they may be continued even when cargo ships can be obtained.

In the past decade roads have been built, bridges erected, harbors improved. Ten years ago ships putting into Ciudad Trujillo had to anchor offshore and move passengers and cargo by lighter. Since 1938 the harbor has had 25 or 30 feet of water; it has been protected by a breakwater and furnished with concrete docks and modern warehouses.

Large areas of the country were formerly cut off from the port cities on both the northern and southern coasts during the rainy season, when the rivers were in flood. Structural steel bridges have been built at strategic points and main road arteries with feeders have been constructed.

Canals have been dug, and more are being dug, to encourage increase in rice production. Principal streets of all cities and most towns have been paved. Permanent water-supply systems have been created. Experts from the U. S. Department of Agriculture have been borrowed to explain modern agricultural methods.

Improvement in the social order has kept pace. Modern hospitals have been built and staffed. Experts in tropical diseases have been lent by the United States Public Health Service to work with Dominican scientists. Clinics for treatment of the poor have been opened all over the country.

Campaigns have been under way for several years against tuberculosis and cancer. A strong government department of health and sanitation has been built up. Effective work against malaria has been carried on. Substantial maternity aid has been extended throughout the country.

A Prescription for Tardiness

The Republic has had a compulsory education law since 1917, but until recent years it

could not provide sufficient school facilities. Today there are more than 1,700 rural schools, with an average attendance of 158,500 pupils. Town schools number some 230, with an average attendance of 54,900.

Every child between the ages of 7 and 14 must go to school. Parents are fined unless they can satisfactorily explain a child's absence. And no youngster is ever "tardy." Unless he is in school at 9 o'clock, he is not admitted but is sent home and marked absent. Children and parents alike take great pride in attendance records. Special normal school courses have been provided in the high schools.

In the cities and towns you seldom see a ragged or carelessly dressed school child, boy or girl. Each school has its distinctive uniform. It is usually thin khaki, one shade for the shirt and another for the skirt or trousers, sometimes varied by a black shirt. The different khaki shades make it possible for each school's uniform to be distinctive.

Swarms of these neatly clad boys and girls on the street when school lets out make a pleasing picture (page 223).

The school year runs from October to July. Latterly, English and Portuguese have been required, as well as Spanish.

In cities and towns old parks have been refurbished and new parks created. Blooming trees have been planted along the sidewalks until now, in most places, one walks beneath a bower of blossoms.

Avenida George Washington

In Ciudad Trujillo the old Spanish ruins have been restored and their grounds beautified. A magnificent boulevard has been constructed along the water front and has been lined with palms, flowering shrubs, and green parkways. This is the Avenida George Washington, and a bust of the Father of our Country stands at its western terminus. Along with their own revered patriots, Dominicans admire the first American President.

At the eastern end of the avenue, on the river bank, is the castle of Diego Colón, son of Christopher, erected in 1510 (Plate VI). Towards the western end, a mile and a half away, stands a beautiful, pinkish-white hotel, as modernistic as Norman Bel Geddes and the New York World's Fair (Plate VIII).

Ten years ago total Dominican revenues were between seven and eight million dollars a year. They are now only fifteen.

All the transformation described has been achieved from that limited income, except for a $2,000,000 loan from the Export-Import Bank of Washington, and every year the Dominican Government is now able to balance its budget.

In addition, during the same period, it has reduced the amount of its outstanding dollar bonds by three million, besides paying $800,000 to $900,000 a year in interest on those bonds.

The "Bones of Columbus"

Visitors to the Cathedral in Ciudad Trujillo are interested in the "bones of Columbus."

For years controversy has raged between Dominicans and Spaniards over the question, "Where are the bones of Columbus?" Two cities separated by an ocean claim to be his burial place (page 198).

Shortly before Columbus died in Spain in 1506 he asked for burial in his beloved Santo Domingo. However, the Cathedral that was to serve as the family sepulcher was not consecrated until 1541. Before many months it received from Spain the bodies of Columbus and his son Diego.

In 1795, when Hispaniola was ceded to France, an heir obtained permission to remove the First Admiral's bones. A crumbling casket, lacking inscription, was found, and the bones were moved with pomp to Habana. Upon Spain's evacuation of Cuba in 1898, the remains were transferred to Sevilla, Spain.

In 1877 workmen repairing the Cathedral in Santo Domingo uncovered the coffin of Columbus's grandson, Don Luis. Further investigation revealed another coffin. Amid utmost excitement it was opened before official witnesses, including the Spanish consul.

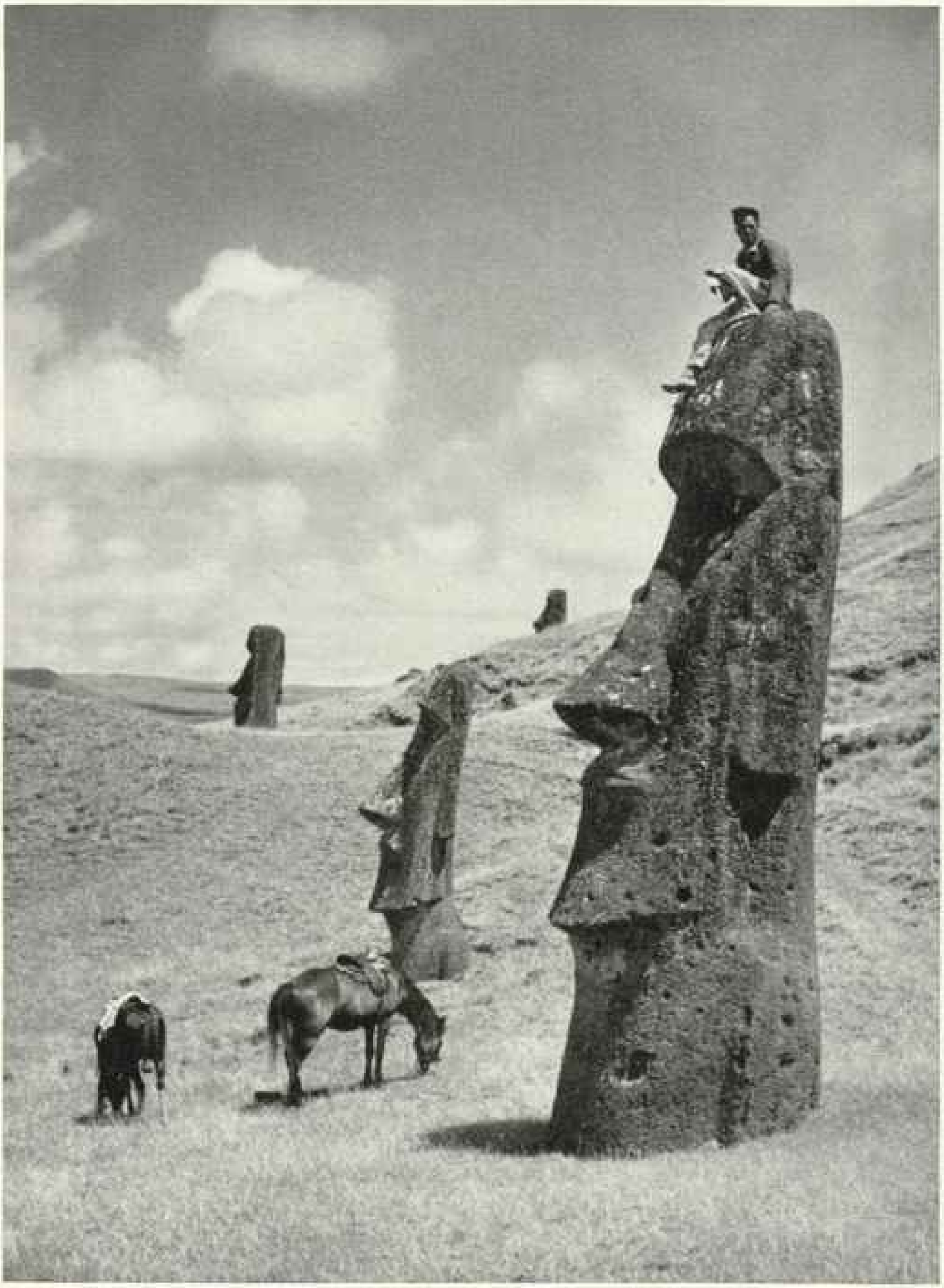
The cover was inscribed, "D. de la A. Per. Ate," interpreted as "Discoverer of America, First Admiral." Lifted, the lid bore, "Illtre y Esdo Varon Dn. Cristoval Colon," taken to mean "Illustrious and Famous Baron Don Christopher Columbus."

In the dust was a leaden bullet believed to have come from a healed wound. Also there were some loose screws and a plate inscribed "Cristoval Colon."

Spain branded the discovery a hoax, for it indicated the bones in its possession were Diego's. The consensus of impartial investigation has supported the Dominican claim.

On every important state occasion and on many days of religious significance, Dominicans kneel reverently before the crypt of their beloved Cristóbal Colón. They are certain they bow before the authentic remains.

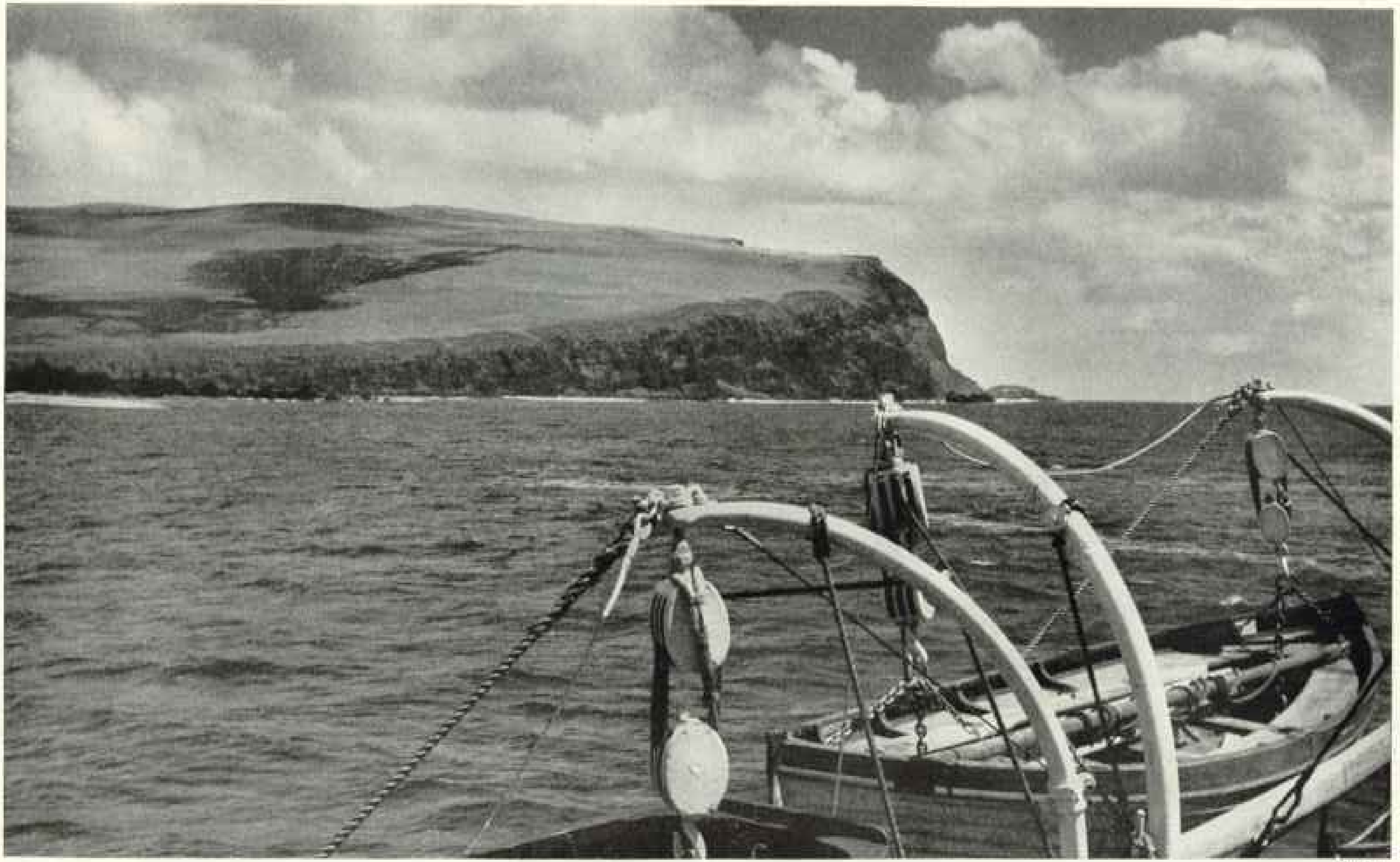
They know, too, that the spirit of the Great Discoverer is happy and at peace in the knowledge that his ashes rest in the "land that Columbus loved."



Martinl

Age-Worn Sentinels Scan the Sea from the Slopes of Easter Island

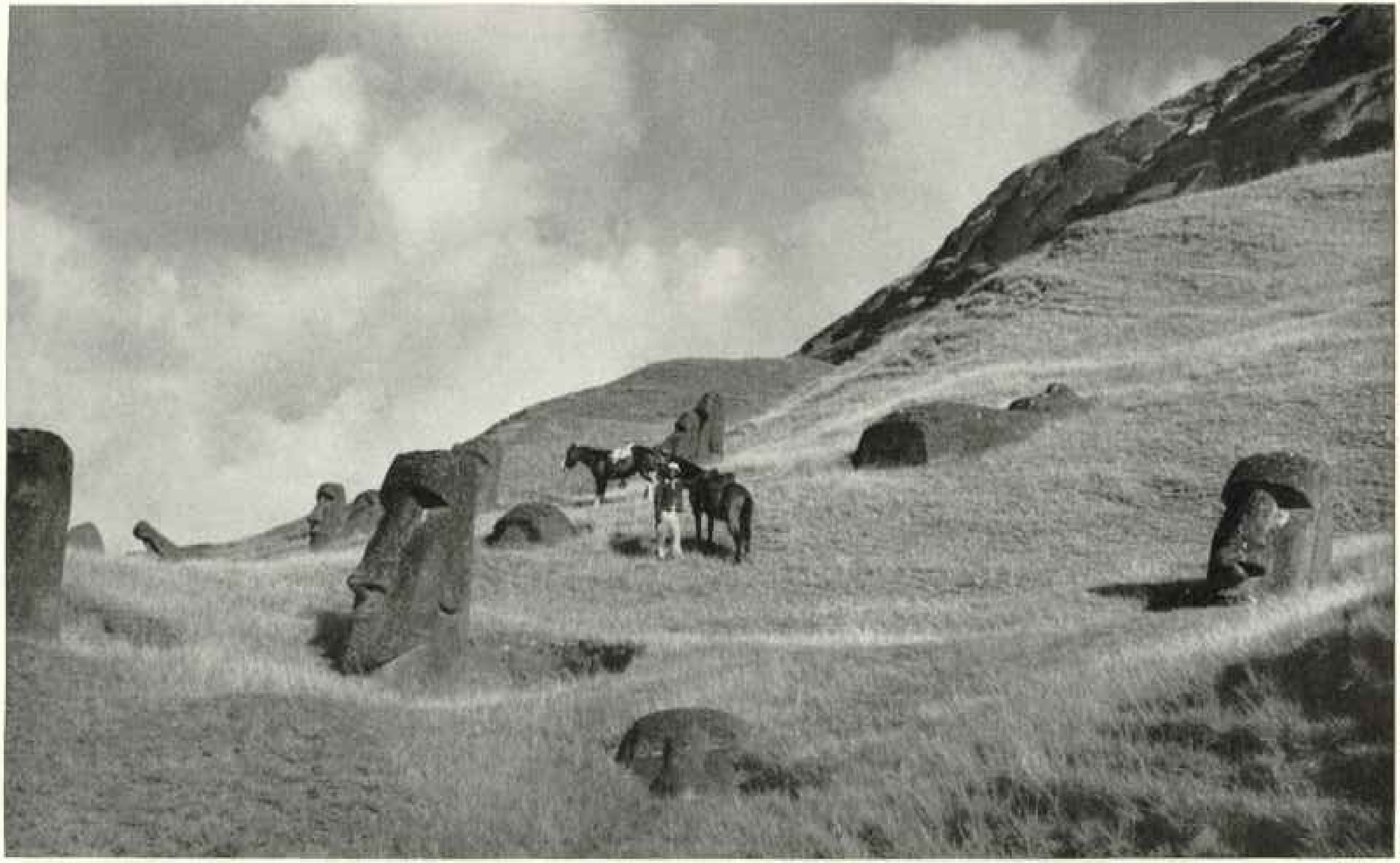
Mysterious statues carved of volcanic rock in a long-forgotten past awed 18th-century mariners who found this dot in the South Pacific, 2,200 miles west of Chile. The Dutch admiral Roggeveen landed here on Easter Day, 1722, and gave the name "Easter" to the island. Images dot the hillsides. Once they surmounted an almost unbroken line of burial platforms that fringed the coast. Islanders today do not know the significance of the statues.



Marden

Scarred by an Old Crater, a Plateau Blanketed with Lava Rises Sharply above the Surf

The steamer *Quoybaique*, bearing a new governor from Chile who must stay five years, moors near the extinct volcano of Rana Kao at the southwestern tip of Easter Island. On these cliffs a weird bird cult once lived, in the stone village of Orongo. Each year its chiefs risked their lives in a race through the treacherous surf to a high rock, Moto Iti, a half mile offshore, to find and bring back the first egg laid there by the sooty tern.



Scores of Ancient Monuments Still Stud the Slopes of a Prehistoric Quarry

Around an extinct volcano the ancient sculptors found their raw material. Each image represents a half-length figure, at the bottom of which the hands nearly meet in front of the body. The lobes of the ears resemble a fleshy rope. Most of the statues vary in height from three to 36 feet, although one prostrate figure is 66 feet long. Tall cylindrical hats of red tuff top many of the volcanic rock carvings.

Even Dogs Welcome the Shade of the Village Church at Noon

Only for an hour or two each day is the heat oppressive, for the trade winds blow almost constantly. Two hundred and fifty Polynesians survive from a population which once numbered several thousand.

Martinez

Sprightly Attire Appears on Hanga Roa Streets of a Sunday

On weekdays natives wear less pretentious clothing. Here they have assembled after church to say good-bye to the retiring governor, about to return to Chile.

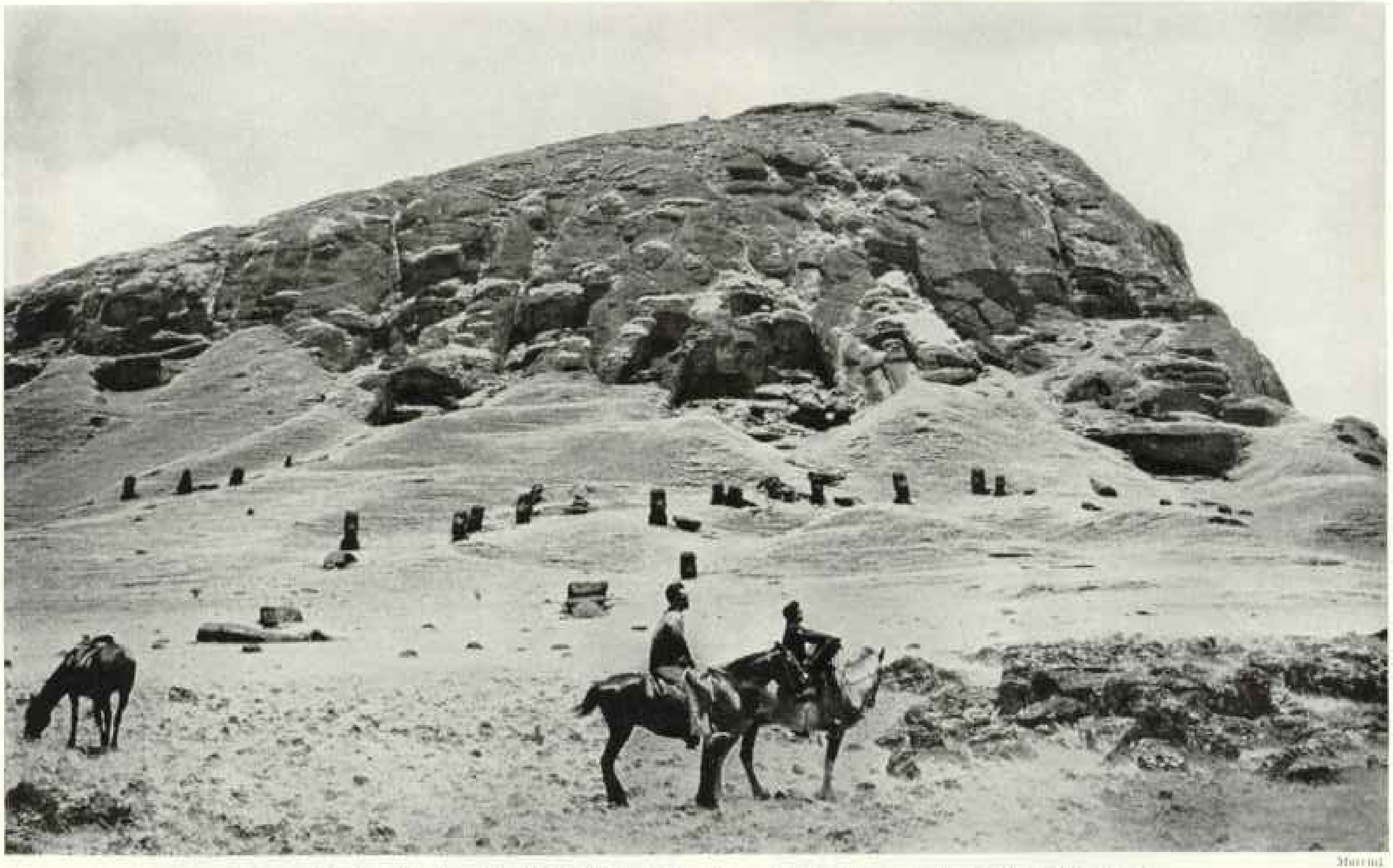
Pigs, Fattened under the Gaze of Stone Patriarchs, Go to Market

Checking up on the shipment, at right, is a white resident, administrator for a Chilean firm which leases the island from the Government. The porkers are bound for the South American coast.

Morton

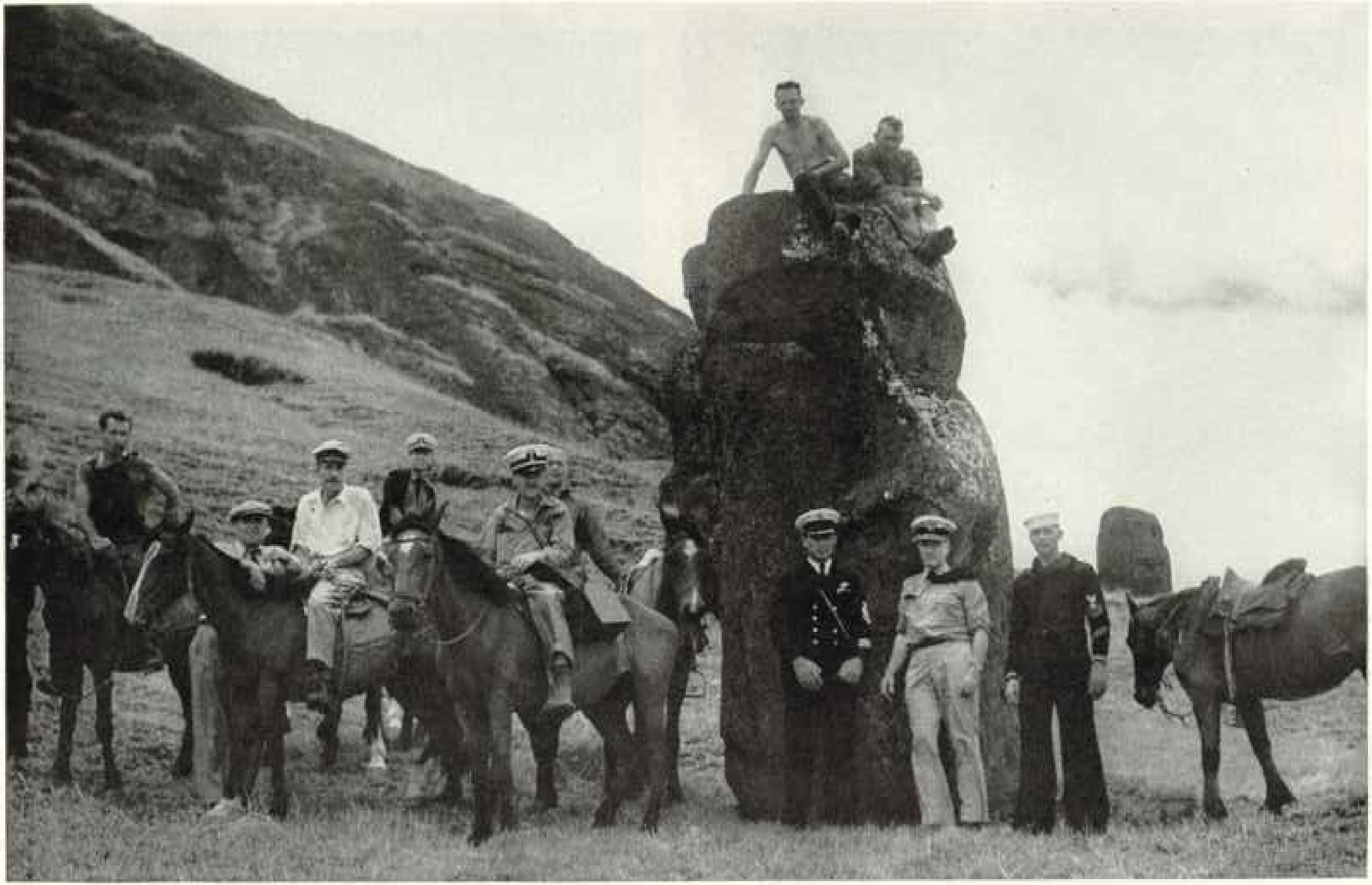
Stone Men Are Left Behind, But Sheep Go to Chile

Cattle also are raised on the island, horses are numerous, and there are many dogs. All available deck space is filled with animals, for in normal times a boat from Chile calls here only once a year.



Years Ago the Workers Suddenly Laid Aside Their Tools, Never to Take Them Up Again

Vertical and horizontal cuts on the upper part of the extinct volcano are plainly visible. An unfinished statue, still a part of the slope, rests in its niche at right center. Many images in all stages of completion lie about. The workers first cleared away a space about the rock to be shaped so that they could do their carving. When the entire figure was finished, the artisans would slice under it to free it from the cliff.



Members of the Second Byrd Antarctic Expedition Try Their Hand at Tropical Exploration en Route Southward

Admiral Richard E. Byrd (in khaki, at base of image) and his colleagues stopped off for two days at Easter Island in 1933 to inspect the ruins. They were impressed by the attire of one of their island guides, who sported a British admiral's cap, a Chilean naval officer's jacket, and a pair of pink silk pajama pants.

Two Giants, Staring at the Summer Sky, Keep Their Secrets Well

These monuments may have been intended for one of the stone burial platforms, which often were 15 feet high and 300 feet long, and contained from one to fifteen statues. The images, all mysteriously thrown down and broken years ago, stood in a single row, facing inland.

Marshall

"'Now Don't You Go till I Come,' He Said," But the Sculptor Never Came Back

Perhaps the prehistoric Little Boy Blue was unable to budge his giant toy. How the natives were able to move even smaller statues, some weighing fifty tons, is another unsolved island mystery.

On the Trail of King Solomon's Mines

The Bible, in Addition to Its Spiritual Values, Continues to Prove a Rich Geography and Guide to Exploration of the Holy Land

By Nelson Glueck

THE school children of Palestine use the Bible as a guidebook when they hike through the land. The close relationship between Holy Book and Holy Land, fostered by generations of pilgrims, is being confirmed anew by those who delve for facts in the very earth.

When General Allenby conquered Palestine in 1917-18, he relied mainly on two books for information concerning its topography, geography, strategic roads, important sources of water, and naturally strong sites. These books were the Bible and George Adam Smith's *Historical Geography of the Holy Land*. Upon them he based his tactics and the conduct of the deliverers.

Explorations Confirm Bible Geography

It is amazing how much of the Bible story is verified by finds made in archeological exploration or excavation. The Bible requires no "proof" for its validity, because it is primarily concerned with theology and only secondarily with history. But the spade is sometimes mightier than the pen in throwing light on facts long buried under the debris of centuries. Archeological finds continue to substantiate the details and the general background of Biblical accounts.

In August, 1943, I was flown from Jerusalem to Washington in three days, on the way back from my latest explorations in Bible Lands. Shortly before that I had stood by the ruins of Ezion-geber on the Gulf of 'Aqaba, looking toward Arabia (map, page 236). From it, some 3,000 years previously, had come the Queen of Sheba.

> And when the Queen of Sheba heard of the fame of Solomon concerning the name of the Lord, she came to prove him with very hard questions.
>
> She came to Jerusalem with a very great train, with camels that carried spices, very much gold, and precious stones (I Kings 10: 1, 2).*

The richly burdened caravan of the Queen of Sheba probably strung its slow-paced length through Ezion-geber, which the Bible tells us was situated "on the shore of the Red Sea, in the land of Edom" (I Kings 9: 26).

For almost 3,000 years, all positive evidence of the location of Ezion-geber had disappeared from the minds of men, as if it had been an Atlantis sunk in the sea. Ezion-geber was mentioned in Bible dictionaries. Its root meaning ("backbone of the man") was explained in the back pages of the family Bible. Its approximate position was shown on maps. But no modern scholar had precisely located this historic seaport.

In 1936, I swayed to the awkward but not unpleasant stride of my camel, seeking for positive identification of Solomon's seaport.

A long, wearying, fascinating camel trip through the Wadi 'Araba was nearing its end. Our Arab guides had been telling us that soon we should see the blue waters of the Red Sea. The stifling heat, the hard living conditions, the jolting of the heavily laden camels—all these, coupled with several bouts of malaria, had worn us down during almost two weeks' steady ride.

Then suddenly, as the camels ambled along, new life seemed to spring into the group of weary animals. They quickened their pace, lengthened their stride, and, before we realized what had happened, the ungainly beasts had broken into a run.

Mounting a rise, we saw what the camels had smelled. Before us were the waters of the Gulf of 'Aqaba, the eastern branch of the Sinai-split Red Sea.

Our weariness was gone, the mighty past again rode supreme, and like mad we raced toward the shore.

Site of Solomon's Ancient Port

Headlong we burst upon the site where lay our goal, the ancient mount called Tell el-Kheleifeh, halfway between the eastern and western sides of the Gulf of 'Aqaba.

A German explorer named Fritz Frank had visited it shortly before and collected some potsherds which he judged to be older than Roman. He realized only that it was an ancient site.

From its location on the shore of the Red Sea, from the correspondence of its situation with the Biblical description, it seemed probable to me that this might be the long-sought, long-lost site of Solomon's famous port city of Ezion-geber (page 240).

* Bible quotations are the author's own translations from the Hebrew. "My main reason for using my own translations," Dr. Glueck explains, "is that the word in the original which means 'copper' is generally mistranslated 'bronze' or 'brass,' which were not known in ancient times."

John B. Whiting

Luxury in the Desert—Coffee, Hot or Cold

While a sentry stands guard, members of the Desert Patrol unite around the long-lipped coffeepot. With a few dry dates or a bit of goat cheese the Arab can eke out an existence. But give him thick black coffee, one-third grounds, and he feels like a gourmet. Hardy and abstemious, the Arab has many fine qualities, greatest of which is his hospitality (page 254).

Striking the camel on the neck to make him kneel, I dismounted and threw the halter to one of the Arab guides to lead the beast to a near-by well. Then I hastily examined the site.

After even a cursory examination of the pottery fragments found on top of the mound, I was able to date them in the period extending from the tenth to the fifth centuries B. C. This was the age of David and Solomon; of Elijah, Isaiah, and Jeremiah; of the House of David from its founding until its two Great Exiles and the return of the Jews to Jerusalem.

There could be no question of the importance of this spot. "This is where we are going to dig," we decided. Three seasons of excavations justified our decision.

Having swiftly looked over the site, I stood lost in awe at the scene that unfolded. To the north lay the narrow desert rift through which we had come; to the south stretched the long reach of the Red Sea; to the east towered the mountains of Arabia Felix, storied land of cinnamon, frankincense, and myrrh; to the southwest rose the steep hills of Sinai, culminating in 8,652-foot Gebel Katherina and 7,497-foot Gebel Mûsa (Mount Sinai), traditional Mount of the Decalogue.

Looking toward the dark granite and brown sandstone ridges of Sinai, I could imagine the distant past unrolling itself before my eyes.

On days of storm in springtime I have seen enormous clouds of sand hurtling across from Sinai to Arabia. I have heard the thunder roar and have almost felt the ground shake beneath my feet. In such moments it seemed as if I could almost see Moses and his weary people emerging from the Wilderness on their way to the Promised Land.

Above them hovered the God of Sinai, who

American Schools of Oriental Research

Priceless Treasures Might Have No Value as Loot

Little above the level of grave robbers, early "archeologists" were treasure hunters. Today finds are judged not by their intrinsic worth but by their value in clearing up puzzles of the past. Archeologists at Ezion-geber here sort their pottery "Exhibit A's" into cheap, strong baskets.

in the midst of such thunder and lightning had spoken to Moses with the sound of a loud trumpet and to Elijah with the still, small voice that was stronger than wind, earthquake, or fire.

At such thrilling moments a glow of the mighty past lay upon the parched and barren land.

Bible the Archeologist's Guidebook

It is becoming more and more apparent that the Bible contains much more historically valid material than was supposed before the spade added its independent evidence to that of the written word.

The Bible writers had access to records which have long since disappeared. Written on parchment, papyrus, or other perishable materials, they were destroyed by fire, dampness, and other causes.

In numerous instances we find references to the "Book of the Kings of Judah and Israel" (II Chronicles 16: 11), or to the book of Jasher (Joshua 10: 13); or we read such statements as:

> And now the rest of the history of Solomon . . . is it not contained in the book of the Chronicles of Solomon? (I Kings 11: 41.)

In effect, the Biblical historians are saying: "And now, gentle reader, if you desire to know more about this particular king, please go to the archive rooms and read the original documents yourselves."

Alas, such perishable records have disappeared! But archeology digs up the rooms and resurrects inscriptions and other pertinent objects which have outlived their epoch but not their usefulness. Archeology helps complete the Biblical picture.

Let no one imagine that archeology in Bible Lands is modern. Nabonidus, the last king of Babylonia, oppressed the Jews, turned his Persian enemies aside toward the capture of King Croesus the golden, and finally lost his

Map Makers Search the Scriptures When They Chart the Holy Land

Place names from the Bible, with modern equivalents in parentheses, reveal the land of Solomon on the screen of present-day geography.

American Schools of Oriental Research

Arab Workmen Sift the Evidence on an Ancient Site at Ezion-geber

The deposits of centuries, scooped up on a pointed hoe, pass through a hand sieve. On top of the ancient wall are potsherds which will be classified and studied. Keeping check on the horizontal strata is essential to prevent confusing finds from an upper stratum with those from the stratum below it (p. 244).

city to Cyrus the Great in 538 B. C. But he was greatly interested in archeological research—of a primitive type, to be sure, from a modern scientific point of view.

He tells in an inscription, recently excavated, how he had dug down 18 ells into the soil and came upon the foundation stone of the Shamash Temple in Sippar, built by Naram-Sin, the son of Sargon.

"For 3,200 years previously," he writes, "no king before me had a sight of it."

King Solomon's Copper Mines

Because no copper or iron had previously been found in greater Palestine, which includes the Wadi 'Araba, the great rift between the Dead Sea and the Gulf of 'Aqaba, some scholars had thought that one very brief Bible reference to the presence of such minerals could not be true. Recent discoveries by the American Schools of Oriental Research in Jerusalem in the Wadi 'Araba definitely prove that the famous passage describing the Promised Land is correct when it says:

> And you shall inherit a land whose stones are iron, and out of whose hills you can dig copper (Deut. 8: 9).

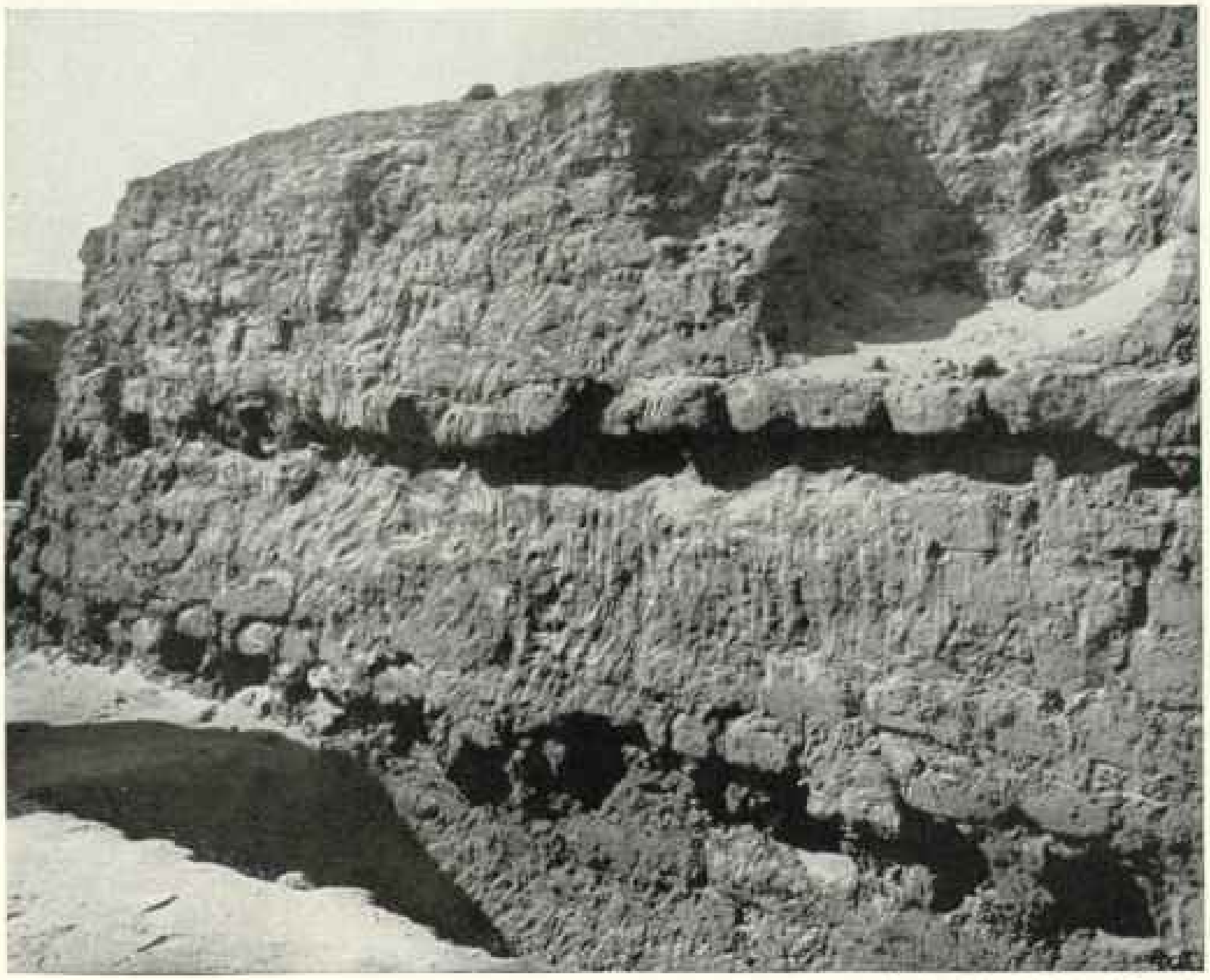
It is known now that along the entire length of the Wadi 'Araba there are deposits of copper and iron. These were intensively worked in ancient times, particularly during the time of King Solomon.

At numerous places throughout the Wadi 'Araba the archeological survey of the American School found ancient mining and smelting sites. They were all located close to some source of water. Many of them were found by visiting every water hole in the 'Araba, seeking for traces of ancient settlements. We found ruins of miners' huts and workers' encampments, small furnaces, and great heaps of slag, resulting from the initial roasting process.

The copper was mostly mined, crushed, and "roasted" on the spot. The fuel was probably charcoal, burned on the neighboring wooded hills of Edom. Numerous fragments of pottery were found among these ruins, which enabled them to be dated, particularly to the time of Solomon.

Slag and ore specimens on analysis have shown up to 58.7 percent iron and 10.3 percent copper. Roadways, water mains, labor supplies, and refineries would be needed if this ancient source of iron and copper were to serve modern commercial needs.

Some of the mining sites were found be-



American Schools of Oriental Research

Ancient Refiners Built Their Ezion-geber Copper Smelter in a Natural Wind Funnel

Lacking mechanical blowers, they faced their furnaces toward the prevailing northwest wind. Mud-dried bricks have outlived the centuries and show double rows of flue holes in the lee wall. Ezion-geber (Numbers 33: 35, 36) flourished in King Solomon's day (page 247).

cause of their names. One of them was called in Arabic "Khirbet en-Nahâs," which means the "Copper Ruin." On examination we discovered that the site merited its name. It was the largest copper-mining and smelting center we had yet found. Although it had been abandoned for some 2,500 years, evidences of its original character still clung to it.

Excavations have revealed not only that Solomon mined the minerals in the Wadi 'Araba, thus becoming one of the world's first copper kings, but also that he created at the southern end of the 'Araba an industrial establishment to turn his raw materials into manufactured articles.

This industrial plant, the like of which had been unknown before his own day, was not surpassed before comparatively recent times.

Excavating a City Built by Solomon

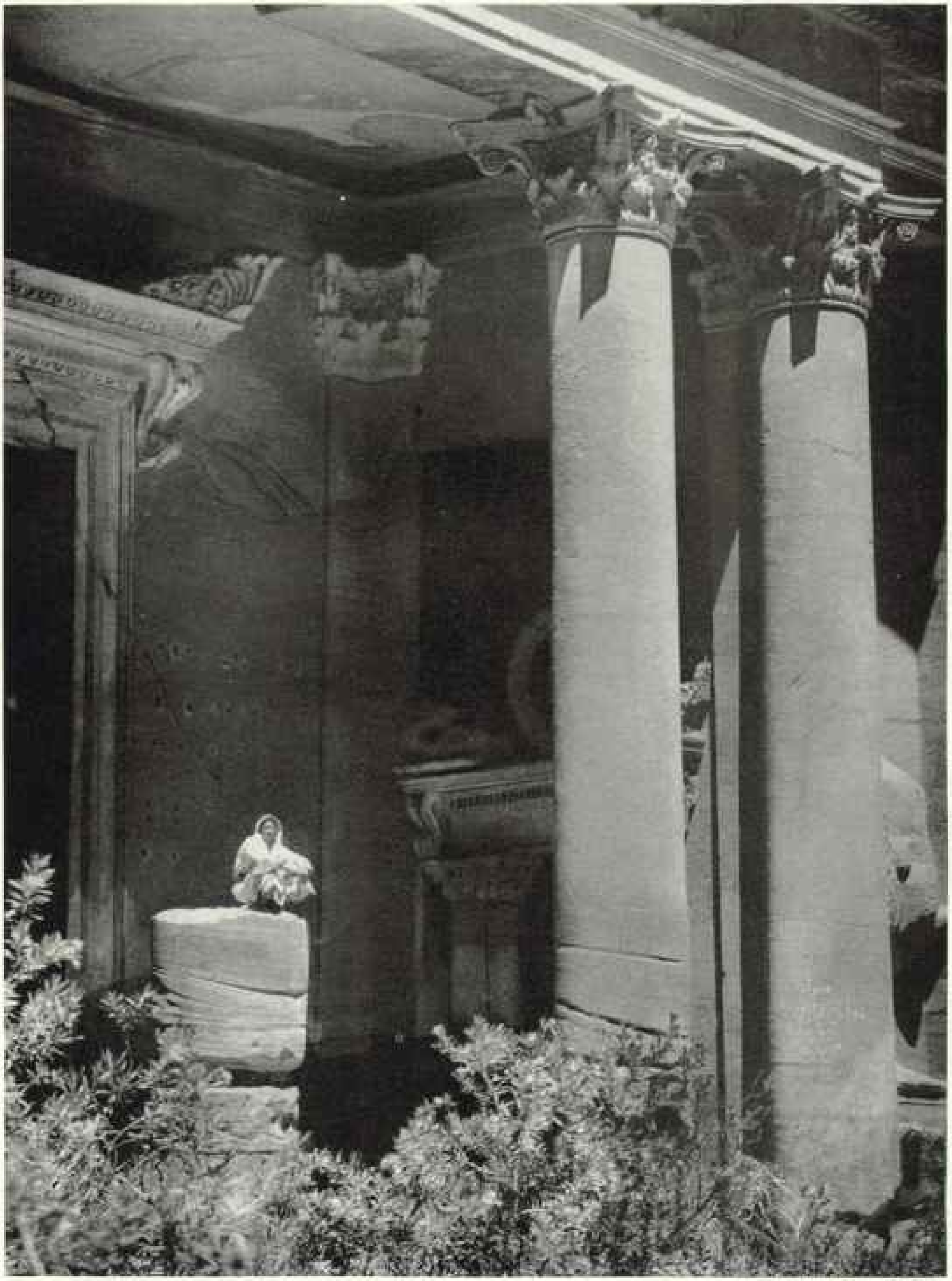
Following the clues furnished by the discovery of Solomon's copper and iron mines in the Wadi 'Araba, and taking carefully into account the pertinent Biblical materials, we discovered and excavated the long-lost seaport and fortress of Solomon's city on the Gulf of 'Aqaba, the eastern arm of the Red Sea.

The information of the Bible in I Kings (9: 26; 10: 11, 22) is rather explicit with regard to the location of Solomon's naval base, saying that it was situated on the shore of the Red Sea and in the land of Edom. Until recently, however, the exact site was not known.

Since some of the copper mines were found facing the very shore of the sea, we inferred that the present shoreline must be approximately the same as it was in Solomon's time.

The ancient mound of Tell el-Kheleifeh conceals the ruins of Solomon's industrial settlement beneath successive structures.

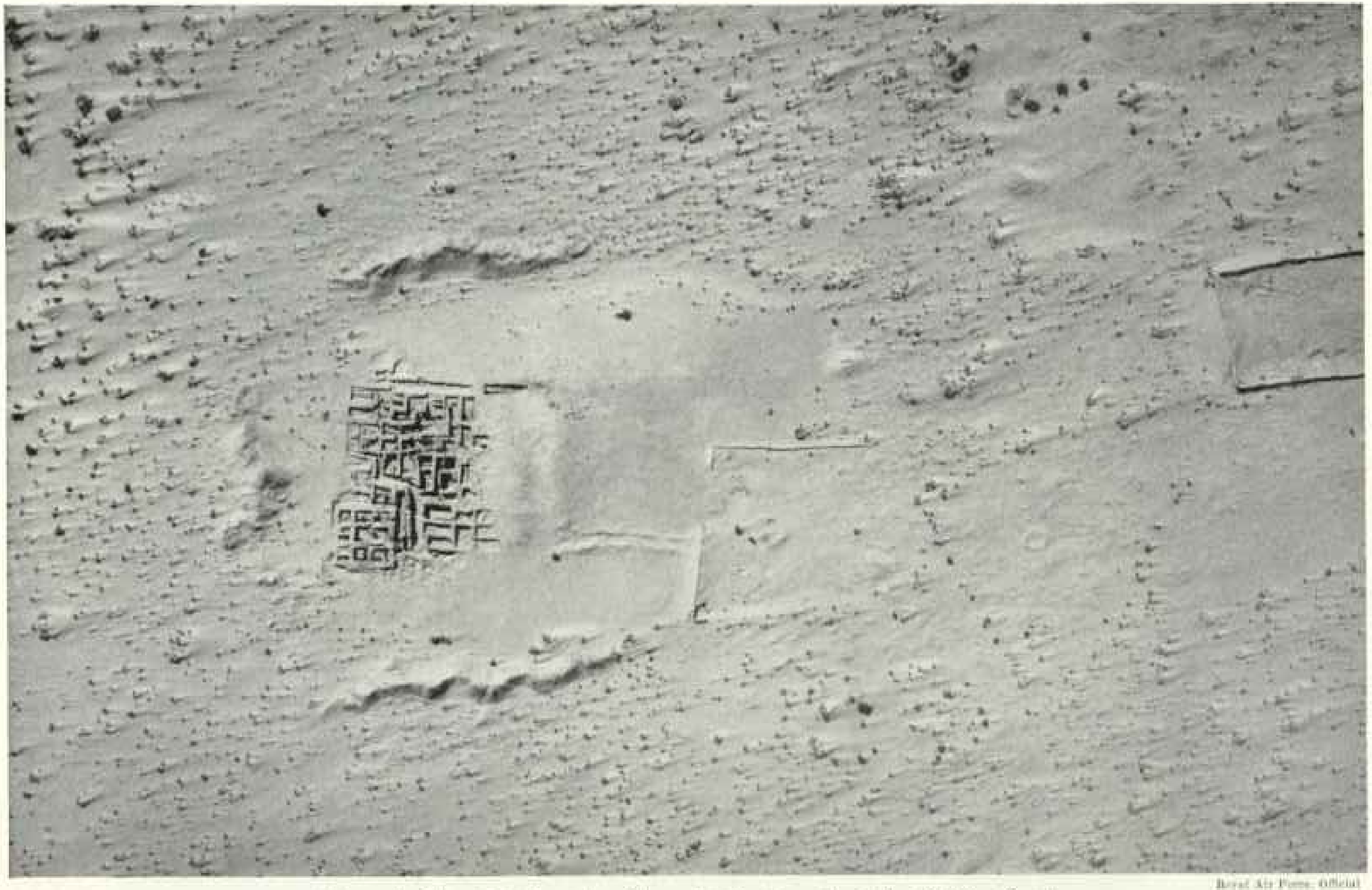
After extensive excavations, we have identified the earliest stratum with Solomon's seaport of Ezion-geber, whose architects built it directly in the path of blinding sandstorms.



© American Colony, Jerusalem

Like Richly Grained Wood Is the Rock from Which Petra's "Treasury" Was Hewn

After 1,800 years the capitals of these sandstone columns seem freshly carved. They were not put up, but cut out in position. Nabatæan engineers hewed their buildings out of solid rock. Near the watercourses oleander bushes add their red and green to the scene (page 248).



Royal Air Force, Official

Solomon's City of Ezion-geber Shows Its Skeleton Amid the Drifting Sands

From above, an aviator can see the direction of the prevailing northwest winds as plainly as if a wind sock swung over the ruins. Some archeological sites are reburied after their secrets have been studied. Here, on the Gulf of 'Aqaba, the wind would soon conceal Solomon's seaport as it did centuries ago (page 233).

G. Eric Matson

A Crusader Fort Once Protected the Desolate Isle of Pharaoh

Past this lonely spot in the Gulf of 'Aqaba, Phoenician-type ships delivered gold for Solomon at near-by Ezion-geber. Ivory, apes, and peacocks came from beyond the rising sun. Later, Roman legions camped near by. Crusaders from Europe were driven out by Saladin.

Palestine Archaeological Museum

On This Potsherd Is Scrawled a Wine Receipt 24 Centuries Old

The fragment was found at Ezion-geber, once Solomon's seaport on the Gulf of 'Aqaba. It also is known as an ostracon. In ancient Greece unpopular leaders were banished when the people wrote their names on such pottery fragments or shells. From this practice our word "ostracize" originated (p. 243).

Had it been located farther to the east, as were the later Nabataean and Roman settlements, it might, like modern 'Aqaba, have had protection from the winds and enjoyed unlimited quantities of sweet water.

The very first building we excavated at the northwest corner of the mound explained the seeming obtuseness of the city planners and also threw a new and brilliant light upon the age of Solomon, whose wisdom has become proverbial. It was a large building, made of sun-dried mud bricks, which had been made as hard as kiln-baked bricks by some terrific heat.

The walls of the rooms were pierced with two rows of flues, and the main walls were connected by a system of air channels into which the upper rows of flues opened. The portion of the brick walls between the two rows of flues had been turned green by sulphurous gases.

It soon became evident that this building was an elaborate smelter, where previously roasted ores were refined into ingots of pure metal. It is the most elaborate antique structure of its kind ever discovered.

The flue holes explain also the reason for choosing a town site subject to sandstorms and dependent upon a poor water supply. Steady winds, to which the sandstorms were incidental, blew through the flue holes and thus supplied a forced draft to keep the flames in the furnace rooms of the smelter going, without recourse to bellows (page 238).

A "Bessemer" Furnace 3,000 Years Ago

Thus, almost 3,000 years ago, Solomon's men employed what is essentially the principle of the Bessemer blast furnace, rediscovered less than a century ago. Ezion-geber was, therefore, not only a naval base and fortress guarding the crossroads to Arabia and Egypt but also an industrial center.

Solomon's ships sailed from Ezion-geber to near Ophir (I Kings 10: 11, 22), probably in Arabia, where gold is still being mined.

According to Numbers 21: 9, Moses made a copper serpent, which he placed on his staff. We know, too, that Moses married a Kenite wife. The Kenites were smiths, who probably told Moses and the Israelites of the location of the ore deposits in the Wadi 'Araba and taught them the metallurgical arts.

The Bible tells us that Tubal-Cain, whose name means "smith," was the first forger of copper and iron instruments (Genesis 4: 22).

American Schools of Oriental Research

Clues to Antiquity Unearthed at Ezion-geber, Where Caravan Trail Met the Sea

In a literal sense, the archeologist sifts his evidence. Such earthen pots, unbroken after thousands of years, are real finds. The jar at the right, to be displayed at the National Museum in Washington, D. C., contains rosin. Where was it collected? Was it used as a flavor for wine, to rosin the bow, or to protect a wall?

Solomon used copper on a lavish scale in his Temple in Jerusalem and imported especially skilled coppersmiths to do some of the most important work. We read in I Kings 7: 45:

> Now the pots, and shovels, and the basins, and all these vessels which Hiram made for King Solomon in the house of the Lord were of burnished copper.

Solomon traded copper and iron to Arabia in return for the spices, incense, and other precious objects obtainable there. It is probable that the Queen of Sheba came to Jerusalem not merely to bask in the brilliance of Solomon, but also to arrange trade treaties with him and to delimit spheres of interest.

One of our best finds was the royal signet ring of one of the kings of Judah. On it, engraved in retrograde, like an image in a mirror, is the inscription: "Belonging to Jotham."

Native Workmen Win Prizes for Finds

It was probably not a personal ring but the badge of office of the governor of the site, who ruled in Jotham's name. The first find of its kind, it eventually will be on display with the complete American share of the Ezion-geber discoveries in the U. S. National Museum of the Smithsonian Institution in Washington, D. C. (page 247).

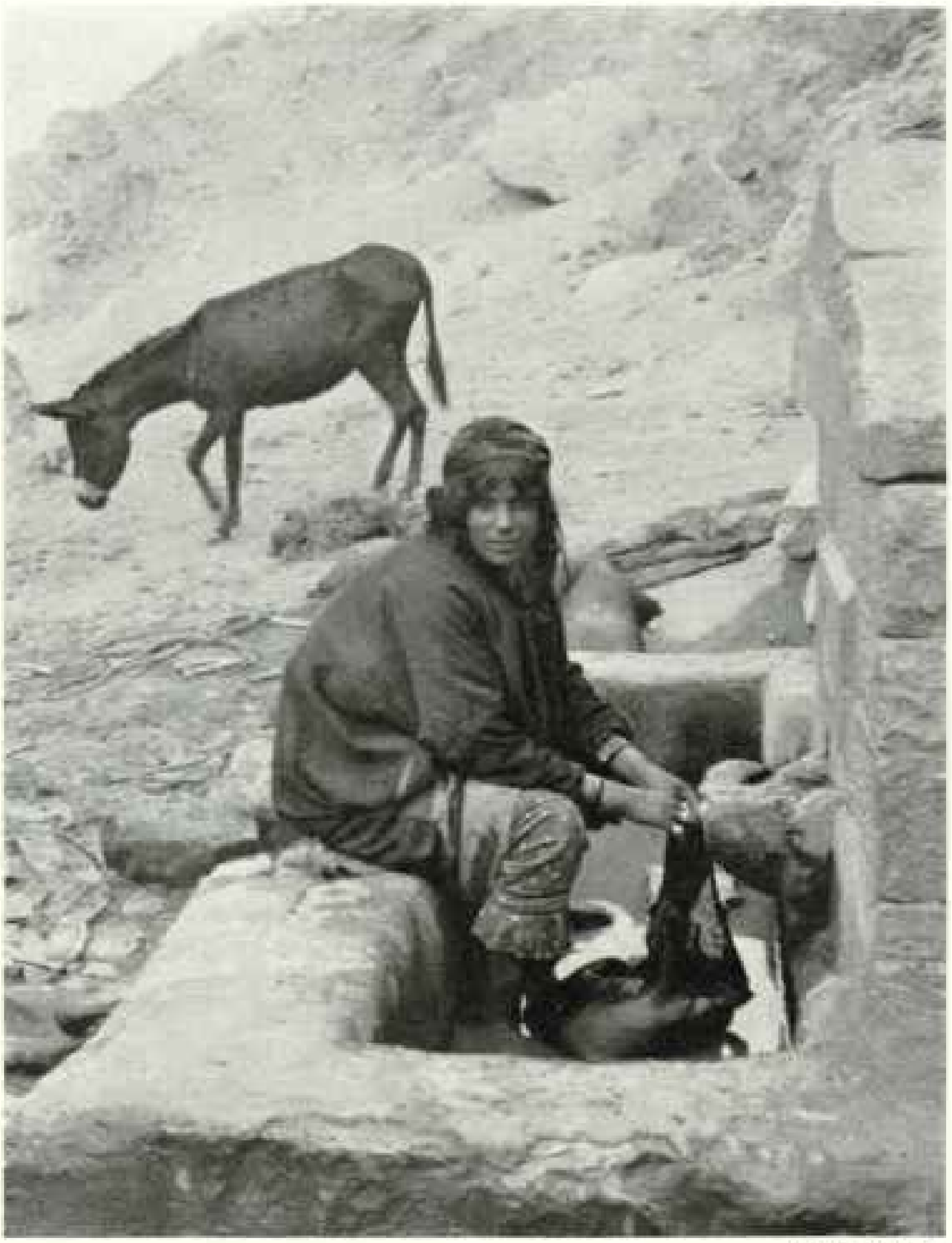
For every object found, the native workman who finds it is given a reward, the amount being graduated according to the value of the find. This bonus is given in addition to the daily wage.

Even the basket boys who carried excavated debris to the dumps searched carefully for objects which might have escaped the eyes of the older diggers. Between the two groups, very little remained undetected. In sections where finds are most likely, all the earth passes through a sieve, under watchful eyes.

The reason for rewards is twofold: first, to make the workmen and boys keep a sharp lookout for the smallest objects; and second, to make it worth their while to hand over the objects found. Otherwise, they might hide them in the voluminous folds of their garments and sell them to a dealer in antiques.

When the Jotham ring came up, it did not look like much, but the workman knew that he would get something for it. When he looked at me, I nodded affirmatively.

"How much do you think it is worth,



John D. Whiting

Water for Bedouin Tents Trickles into Her Goatskin Bags

The seminomad Arab woman in Turkey-red trousers will load the bloated skins on the donkey's back. When these grotesque containers are made, tanning fluid is poured into the skins and the openings tightly sewed up. As they lie in a row to tan in the sun, the skins look like dead animals, lying on their backs with their legs in the air.

Abbas?" I asked him. Hesitantly, he looked at me, and said, "Perhaps two or three piasters?" A piaster is worth about a nickel.

I gave him not three, but fifty. He looked at the money, then at me, and said, "But I don't want to take all your money from you."

Necklaces of crystal, carnelian and agate beads, an Egyptian cat amulet, and crude figurines appeared one by one from their hiding places as the soil was patiently shoveled up, brushed aside, or scratched with knife or finger.

Among designs which were found on pottery at Ezion-geber, and which had no further significance than that of being ornamental geometric patterns, were five-pronged stars of David, "Byzantine" crosses, and swastikas. Swastikas in the city of Solomon, King of the Jews!

One of the places where we sifted the evidence with special care was the only grave found in the excavations. Apparently a very important person had been buried there. His camel had been slain and buried with him. Provisions also had been put into the grave, as indicated by fish, bird, and animal bones, date seeds, and kernels of grain.

The grave had been robbed in ancient times, but two jars of provisions were fairly intact. The skeleton itself was largely decomposed, but most of the teeth were found.

Digging for Treasures Is Exacting Work

Excavation is painstakingly slow work. The abandoned mound, which sometimes contains as many as 10 or 20 settlements, each built upon the ruins of the preceding one, must first of all be carefully surveyed and mapped off into five- or ten-meter squares. Every object found is listed according to the square and the stratification of the spot in which it was found.

Numerous photographs must be taken of the work in progress, of installations and objects in place, and of the objects after they have been removed, so that other scholars may know the conditions as well as if they had themselves conducted the work.

The architect plans all the ruins. The draftsmen and artists draw all the objects to scale. A complete record is kept of every discovery, whether it be a patently valuable inscription or a plain little jar whose significance is not immediately apparent.

To reach the lower levels of an artificial city mound, the searchers must remove each upper level in turn. All that is left are the records kept by the archeologist, which must therefore be as exact as possible.

These artificial city hills were known to the ancients, as they are to the modern Arabs, as *tells*. Joshua 11: 13 speaks of "the cities that stood on their tells."

On even the outer surfaces of each "desolate tell" (Jeremiah 49: 2) are almost invariably to be found hundreds and sometimes thousands of fragments of pottery.

The ancient peoples were familiar with potsherds, which were sometimes used in lieu of more expensive writing materials.

A boy seized by Gideon wrote down for him on a piece of pottery a list of the chief men of Succoth (Judges 8: 14). Business receipts were inscribed on them. Job scratched his boils with a potsherd (Job 2: 8).

The Bible is replete with references to pottery. We read in Isaiah 30: 14:

> And its crash is like that of a potter's vessel, shattered beyond repair, so that there cannot be found among the fragments a sherd to bring fire from the hearth, or to draw water from the cistern.

Fingerprints Preserved for 3,000 Years!

Where handmade pottery occurs, it may be possible to distinguish the work of individual craftsmen who, in shaping the vessel, sometimes left their fingerprints on the wet clay. When the vessel was baked, the fingerprints were preserved.

The writer has thus held in his hands the fingerprints of potters whose bones have long ago become merged with the very clay from which they once fashioned their wares. G-men, unearthing such evidence, would be too late, by thousands of years.

Since pottery is practically indestructible, records written on potsherds have come down to us from remote times.

On recently found fragments are ink inscriptions which supplement the Book of Jeremiah. They describe events of the war between the Babylonians and Judeans with the same names of places and persons as those in the Book of Jeremiah.

They were written by one Hoshaiah—a good Biblical name (Jeremiah 42: 1; 43: 2; Nehemiah 12: 32), stationed near Lachish, to his commanding officer there.

He writes on one of these pottery fragments:

> Investigate, and my lord will know that we are watching for the signals of Lachish, according to all the indications which my lord hath given, for we cannot see Azekah.

This recalls Jeremiah 34: 7, which says:

> The army of the king of Babylon was fighting . . . against Lachish, and against Azekah, for these (Lachish and Azekah) alone remained of the cities of Judah as fortified cities.

In another letter partly illegible he mentions the name of ". . . iah the Prophet," which might be Jeremiah.

Inscribed sherds, *ostraca*, were used in ancient Athens to decide whether or not a man was to be expelled from the community.

If a victim's name was written on a sufficient number of ostraca, that individual was thereupon ostracized.

At the excavations of Ezion-geber, Aramaic ostraca were found which, when deciphered, turned out to be wine receipts (page 242). In addition, black-glazed Attic sherds of the fifth century B. C. were found, indicating international relations with the Greece of Herodotus and Thucydides.

In the same excavations were discovered fragments of a large jar, on which were the oldest South Arabic letters ever discovered *in situ*.

These letters are in the script of the Minaeans who controlled the Incense Route through Arabia and monopolized the trade in frankincense and myrrh.

Perhaps in such a jar the Queen of Sheba brought rare incense to King Solomon.

Bricks Better in Solomon's Day Than Now

The houses at Ezion-geber were made of sun-baked mud brick, with straw, bones, or shells used as a binder. We found an ancient brickyard in the excavations. It had been covered up and in a subsequent period a new town had been built over it. The modern mud-brick village of 'Aqaba near by is not nearly so well built as were its ancient predecessors. Modern bricks, made without any binder, soon crumble.

Our excavations of Solomon's settlement revealed the ruins of five others, built one above the other, between the tenth and the fifth centuries B. C. The ancient site was guarded by a massive double wall, with a great three-door southeast gateway facing the sea.

Solomon was a great builder. We are told in I Kings 9: 15-19, that he "built cities of store, and cities for his chariots, and cities for his horsemen." Among others, he rebuilt the famous city of Megiddo, whose stables were fitted with numerous stone hitching posts for Solomon's chariot horses.

The ancient importance of Solomon's Ezion-geber is equaled by the potential value of its present-day counterpart in the tiny mud-brick village of 'Aqaba.

Harold Gibbon

Their Game Board Is Wide, Their "Men" Without Number

Soldiers of the Arab Legion post at 'Aqaba play a sort of ticktacktoe, seven in a row, with hollows in the sand in lieu of a board, and black and white pebbles as men. From Kurdistan to Hadhramaut and from Gaza to the Tigris, other Arabs play similar games, for which the materials are ever at hand. Head shawl and camel's-hair cord afford protection against sun and dust.

'Aqaba is important because near it the boundary lines of Palestine, Trans-Jordan, Saudi Arabia, and Sinai—which nominally belongs to Egypt—converge on the Gulf, and 'Aqaba is the only village of any size at its head.

The force which controls 'Aqaba effectively controls the routes by sea and land leading to and from Arabia and Palestine and Trans-Jordan, and particularly to and from Egypt. In a minor way it is strategically comparable to Gibraltar or Singapore.

Ibn Saud, the powerful King of Arabia, has never given up his claim to 'Aqaba, and the British have considered it a point which they themselves must keep. Should the Suez Canal be closed, British boats could come up the eastern instead of the western arm of the Red Sea and unload their cargoes at 'Aqaba. These could then be taken overland by car to Palestine, or through Sinai to Egypt.

In the spring of 1940 a new fortress for the Arab Legion replaced the old post on the seashore where it was dominated from the hills. This made it possible for our expedition to occupy the comfortable old quarters.

The arrangement was fortunate for the members of our archeological staff. The mud-brick rooms, roofed over with palm-tree beams and branches which supported a thick layer of rolled and stamped clay, were comparatively cool and clean.

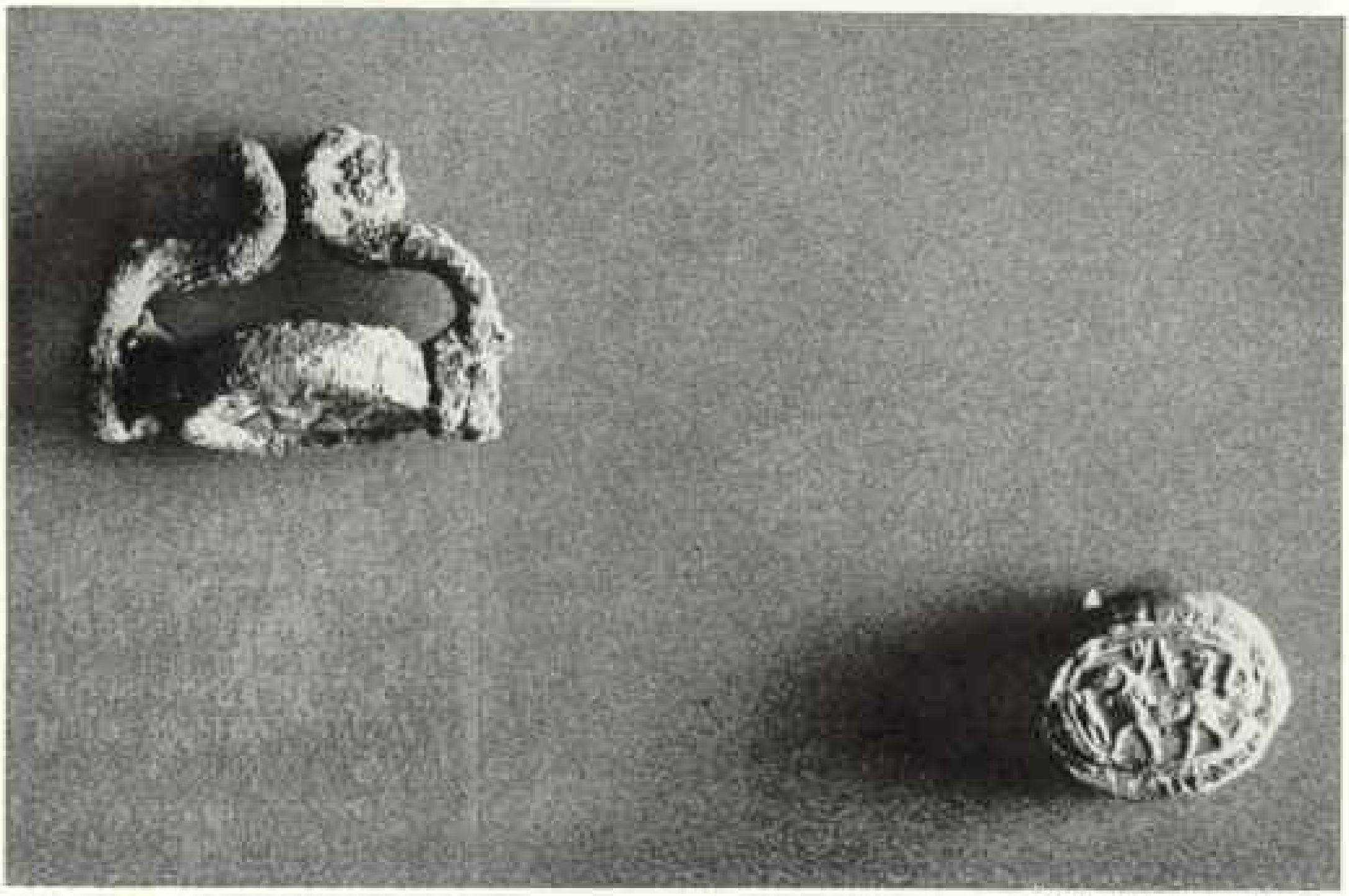
When we returned in the late afternoon from the blazing heat and glaring sun at the excavations, it was wonderful to relax in the shade of the open courtyard, sheltered from the rays of the setting sun.

Sharks a Menace to Bathers

The sea was so near that we had only to put on trunks and dash out for a swim near the shore. Sharks were a menace. For several days a big fellow kept coming in so close that we dared not venture into the water. The R.A.F. sent an armored car, whose crew was determined to get the shark by machine-gun fire. As long as the armored car was on hand, the shark did not appear.

When it returned, we threw out a large hook with a fish bait, attached to what we thought was a very strong line. The shark swallowed the bait, bit through the wire attaching the hook to the line, and got away. When the monster did not come back, we assumed that it had failed to digest the hook.

The entire Red Sea, including the Gulf of



Palestine Archaeological Museum

A Time-encrusted Signet of an Old Testament King Comes to the United States Capital

Ancient Hebrew letters above a long-legged ram show that this seal, at the National Museum in Washington, once belonged to Jotham, King of Judah. "Now the rest of the acts of Jotham, and all his wars, and his ways, lo, they are written in the book of the kings of Israel and Judah." (II Chronicles, 24: 7.) At right is an impression made by the ring on clay (page 243).

'Aqaba, is rich in luscious fish, which are not disturbed by any large-scale fishing. An Arab-Jewish company started to transport fish by truck to Jerusalem, but political disturbances stopped that.

'Aqaba's large grove of date palms makes the mud-brick village of about 300 inhabitants stand out from the stark grayness and blackness of the hills of Edom and Arabia. The water is excellent. I have seen the natives dig holes in the sand and, with cupped hands, drink of the sweet water welling up at the very edge of the sea.

On the Palestinian side of the gulf there is no drinking water. The Palestine police post at Mrashrash has to bring its water supply from 'Aqaba, which belongs to Trans-Jordan. The farther west one goes from 'Aqaba along the gulf, the more brackish and less drinkable the water becomes.

Explorers Welcomed as Sources of Gold and Gossip

Beyond the halfway mark, where the ancient site of Solomon's port city of Ezion-geber lay buried in the mound of Tell el-Kheleifeh, the water is so sulphurous as to be unfit for man or beast. Throughout this entire region, whoever controls the sources of sweet water controls the entire countryside.

The half-starved Arab villagers of 'Aqaba loved us, both because of the money we brought and because of the contacts we afforded them with the outside world.

Though the times of our visits could not be compared to the glorious days of yore, when a man was presented with a beautiful rifle, all the bullets he could carry, a fine riding camel, opportunity for loot, and occasion to demonstrate his heroic qualities, they were glad to have us at 'Aqaba.

But our copper and silver coins could not compare to the gold which, like the very manna from the heavens, T. E. Lawrence had thrown to them from airplanes. Alas for them, there was no Lawrence among us.

The English, however, have men who can carry on. There is the present British Resident of Trans-Jordan, Mr. A. S. Kirkbride, who rode with Lawrence, and whom Lawrence described in his *Seven Pillars of Wisdom* as "Kirkbride the summary." There is also that wisp of a man, Lt. Col. John Bagot Glubb, Commander of the Arab Legion. Like Mr. Kirkbride, he is completely at home among the Arabs. He, too, can read and write Arabic

Palestine Archaeological Museum

Such Gods Once Were Worshiped from Arabia to Italy

The Nabataean governor who imprisoned Paul in Damascus bowed before such pagan shrines as this in the temple at Khirbet et-Tannûr. On top are traces of burnt incense. On front panel is a relief of the Thunder God, Hadad, carved in the form of Zeus. On side is a relief of Tyche, goddess of victory. The legend is (Alexa)ndros Amron.

better than most of them, and like Lawrence can outride and outendure all but the toughest among them.

The Arabs of Trans-Jordan affectionately call him Abu Huneik, "the Father of the Little Chin," because of his chin, part of which was blown away in World War I. As the head of the Arab Legion, Glubb commands a rough, tough army, containing in its ranks not only Arabs but Greeks, Armenians, and Jews.

The Arabs of Trans-Jordan, under the leadership of the astute and loyal Emir Abdullah Ibn Hussein,* have remained faithful to Great Britain, which gave them and the rest of the Arab world the first taste of real freedom they have experienced in many centuries.

During the interval between the last World War and this one, archeology was able to advance with seven-league strides, throwing light not only on prehistoric and Old Testament periods, but also on the Hellenistic-Nabataean-Roman civilizations under which both the world of the synagogue and the newly founded church developed. The beautiful synagogue of Capernaum, where Jesus preached, is a building of classical lines and decoration. But who were the Nabataeans?

Archeology supplies the answer.

Rock-hewn Petra Was Nabataean Capital

Originally from Arabia, the Nabataeans developed an imposing agricultural civilization. Hellenistic and Semitic elements were combined by them in a remarkably successful way. They spoke Arabic and they wrote Aramaic and Greek. They produced a uniquely lovely type of pottery and a distinctive architecture.

Their capital city was Petra, "the Rose-red City of Rock," in southern Trans-Jordan, with its amazing rock-hewn temples and public structures † (page 239).

Their magnificent temples studded the length and breadth of the land. At one of them, Khirbet et-Tannûr in Trans-Jordan an entire pantheon of Nabataean deities of fertility was discovered by an expedition of the American Schools of Oriental Research under my direction.

Though basically Semitic, they looked like the Hellenistic-Roman gods commonly worshiped throughout the Near East, as well as in Greece and Rome. When Paul spoke about "temples made with hands," and idols of

* The Emir, born in 1882, is the second son of the late King Hussein of the Hejaz and elder brother of the late King Feisal of Iraq (died 1933).

† See "Petra, Ancient Caravan Stronghold," by John D. Whiting, National Geographic Magazine, February, 1935.

"gold or silver or stone, graven by art and man's device" (Acts 17: 24, 29), he must have been thinking of such temples and gods as well as those he saw during his travels abroad (page 248).

The Nabataeans were conquered by the Romans, who built magnificent cities, temples, fortresses, and roads throughout the land. Resplendent Roman cities existed not only in Italy but in Africa, Palestine, and Trans-Jordan. In southern Syria and Trans-Jordan are the ruins of the great cities of the Decapolis, originally the district of the Ten Cities.

Where Jesus Drove Evil Spirits into Swine

Gadara, in northern Trans-Jordan, familiar to us because of the "Gadarene swine" (Luke 8: 26-39; Matthew 8: 29-34), is a mass of monumental ruins today. Better preserved is its contemporary sister city of Gerasa in Trans-Jordan, which has been partly excavated by the American Schools of Oriental Research and Yale University.

Massive ruins of tremendous temples, theaters, and other public buildings still amaze the visitor with their beauty and with their suggestion of prosperity, ease, and popular amusement in the long ago. When I saw an Arab shepherd boy sitting in a theater which once seated thousands, the phrase, "So passes the glory of the world," leaped to my mind.

The beautiful theater of Roman Philadelphia in Trans-Jordan is still visible, although Circassian colonists from the Caucasus long used it as a quarry. The Trans-Jordan capital is now known as 'Amman, a partial reversion to its Biblical name of Rabbath Ammon.

Such cities and temples and theaters represented the might of Rome, against which the Jews rebelled. Did Jesus have this power in mind when he said: "Render unto Caesar the things which are Caesar's, but unto God the things which are God's" (Matthew 22: 21)?

Much of the past still remains a mystery, but archeology has helped greatly to reveal the world in which the Bible developed and Jeremiah and Jesus lived.* The refining fires at Ezion-geber long since ceased to glow to the forced draft of the winds that swept down from the north. But shall I ever forget how we sifted the evidence of the mighty past on the trail of King Solomon's mines?

How does the archeologist go about finding an ancient site?

Sometimes the original sources are quite specific, and in the century since the great American explorer, Edward Robinson, first followed Crusader and pilgrim to the Holy Land, the major sites have been studied, not only down to the ground, but down through it to the lowest level of human occupation.

Those who seek, at this late date, to reconstruct the ancient past also carefully examine the topography, and, above all, the water resources of the site.

In an anciently inhabited land, the surest sign of a historic spot is the presence of water. Thirst has not changed with the passing of the ages. The visitor to Nazareth is cheered by seeing at the well village women gaily dressed and with coin necklaces a-jingle under the drip of water from their head-held pots.

The spring is the only one in town and its very name, Ain Miryam, evokes a picture of a Nazarene mother and the child Jesus, coming here for the "water" which later figured in His parables as a symbol of everlasting life.

Fragments of pottery strewn over every ancient site can be dated by the competent student almost as if they were written records. But they must be found in their original stratum if their full meaning is to be known.

Above all, in Bible Lands the archeologist derives much information from the geographical and topographical references in the Bible.

In Arab lands, the archeologist, of course, gets in touch with the Bedouins, whose knowledge of ancient ruins, and everything else in their territory, is uncanny.

The Bedouins not only supply the Biblical background and color, but sometimes also help him locate actual sites.

The amazing Bedouins have maintained themselves virtually unchanged during all the turbulent history of the land. Even physically they are closely related to ancient types.

I have seen Bedouin encampments on Roman ruins in Palestine and Trans-Jordan. If history repeats itself, the tents they pitch today near modern frontier fortresses may stand tomorrow over crumbling gun emplacements, symbolizing one more struggle on this highway of conquest, where Egyptians and Babylonians, when the world was young, set the pattern for Richard the Lion Hearted and Saladin, Napoleon and Nelson, Allenby and Liman von Sanders, and those yet unknown

* For additional articles on Palestine and Trans-Jordan, see, in the National Geographic Magazine: "Change Comes to Bible Lands," December, 1938; "Changing Palestine," April, 1934; "Canoeing Down the River Jordan," December, 1940; "Pageant of Jerusalem," December, 1927; "Road of the Crusaders," December, 1933; "Flying Over Egypt, Sinai, and Palestine," September, 1926; "Skirting the Shores of Sunrise," December, 1926; "Visit to Three Arab Kingdoms" (Trans-Jordan, Iraq, and Hejaz), May, 1923; "Bedouin Life in Bible Lands," January, 1937.

'Aqaba's Muezzin, Calling to Prayer, Stands at the Hub of Three Religions

Mounting the rickety minaret of a humble mosque, and facing toward Mecca, 600 miles away, the Moslem crier has the Mount of the Mosaic Law (Mount Sinai) at his right hand, 100 miles distant. Behind him, 150 miles to the north, is the Christian Calvary at Jerusalem.

Harold Gliddon

Here Soldiers Safeguard the Future, Archeologists Delve Deeper into the Past between 'Amman and 'Aqaba

While defending modern Trans-Jordan, a motorized machine-gun unit stops to pull the archeological expedition's foundered car from a sand pit in the desert.

Carl Lotz

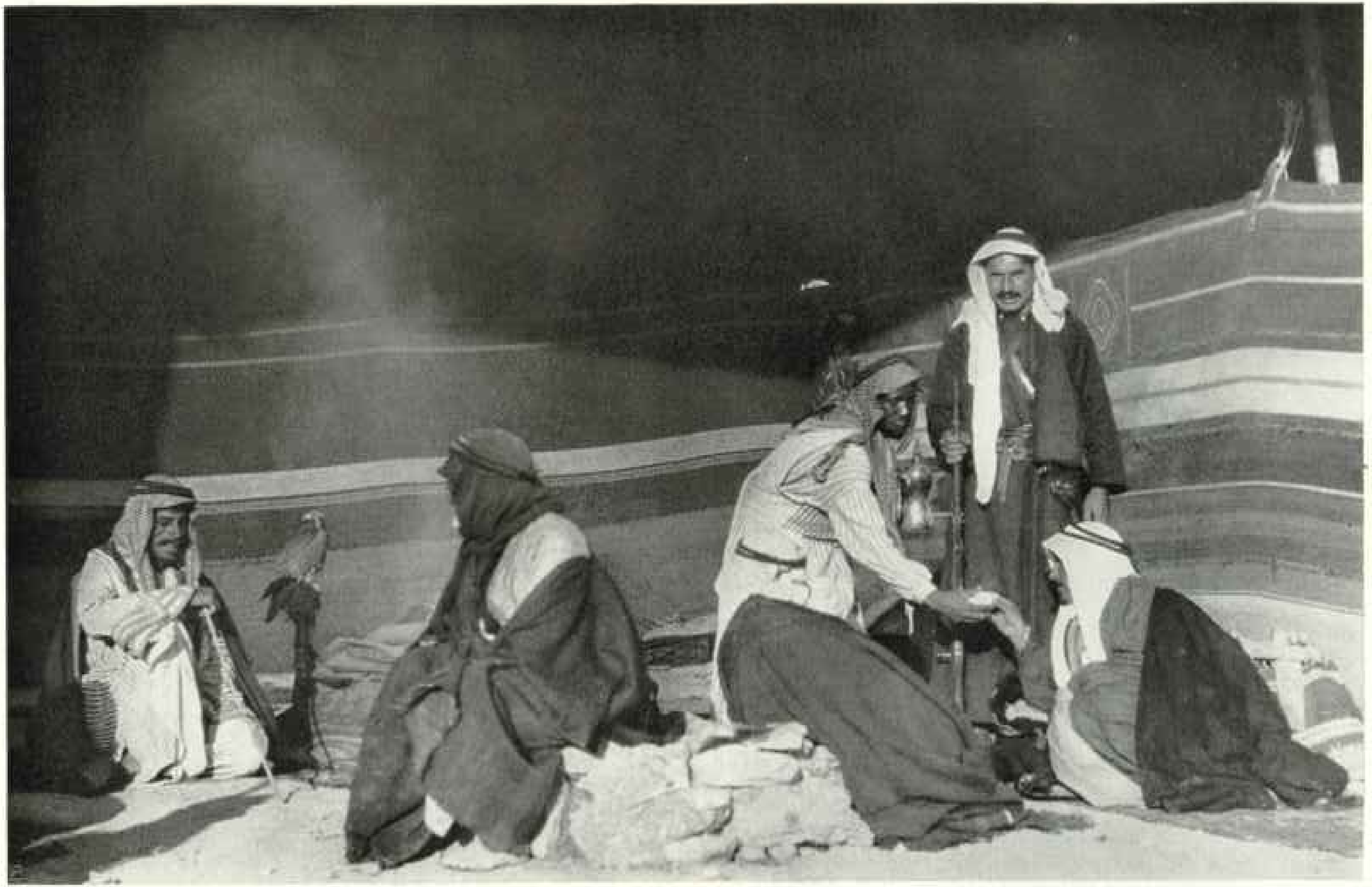
In Palestine, Where Arabs Shade Their Necks, Tel Aviv's Crowds Woo the Sun

An Atlantic City atmosphere prevails on this sandy beach north of Jaffa. Such recreation amazes the Moslems, to whom the direct rays of the sun are enemies.

Carl Lotz

Parasols on Camelback! Town-bred Moslems Seek Comfort when They Ride Ships of the Desert

Camel bells and other ornaments bedeck their mounts, gravely plodding along beside a railroad track in Palestine. The camel alone made the desert habitable for man for centuries before the arrival of steam travel and, finally, gasoline—greatest boon of all.



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With a Hawk to Tempt Him Afield and Coffee to Grace His Rest, the Arab Sheikh Is at Peace

Planes fly above his flocks. Ten-wheeled, air-conditioned cars made in Indianapolis roar past his camp. He himself has a Buick with blue beads on the radiator for a charm. But under his black tent, an atmosphere of Biblical leisure prevails.

Staff Photographer B. Robert Moore

"There Were Giants in the Earth in Those Days"

Long after these Old Testament words were written, the Romans built Baalbek's Temple of Jupiter, whose columns still stand (background) on an elevated terrace. The builders raised huge blocks like these, weighing about a thousand tons, 23 feet to their position in the massive wall which enclosed the terrace.

leaders who may here dispute the deathless trade routes of the East.

"The Weak Shall Inherit the Earth"

Of the Bedouins it may be said that it is the weak who shall inherit the fruits of the barren, desert earth. Only when they become settled on the land do they become subject to the forces of growth and decay from which, in their native nomad state, they are secure.

The poorest Bedouin is as gracious in his hospitality as Abraham was to the strangers he summoned to break bread with him.

> And (Abraham) lifted up his eyes, and behold three men were coming towards him. No sooner had he seen them than he ran to meet them from the tent door. Bowing himself to the ground, he said (to the leader):
>
> 'My Lord, if now I have found favor in your sight, pray do not pass by your servant. Let some water be fetched so that you may have your feet. Rest yourselves under the tree.
>
> 'I shall fetch a morsel of bread, and do you gather strength. After that you may continue your journey . . .'
>
> They replied, 'So be it in accordance with your words.'
>
> And Abraham ran to his herd, picked out a young and tender calf, and gave it to his servant, who hastened to dress it.
>
> Then (Abraham) took butter and milk, and the calf which had been dressed, and set it before them. He himself stood by them under the tree (serving them), while they ate (Genesis 18: 2-8).

A Bedouin will slaughter his last sheep to feed the stranger, and consider as an enemy anyone who will not sit in his guest tent.

Beneath the deadly sun, the Bedouin extends the tent of hospitality like a shield and shares it even with an enemy. But for hospitality the Bedouins might have died out, not so much from hunger as from thirst.

After freshly brewed coffee has been sipped, with many a "Wallah" of appreciation, the main meal is served. A huge platter is brought in, piled mountain-high with rice. On top are large chunks of goat meat or mutton.

The guests roll up their sleeves, squat around the dish, and fall to. The host stands by and serves. Proper decorum consists in grabbing a fistful of rice and making a ball of it. This is rammed down the throat, with a piece of meat tossed after it. One eats to satiety, belches appreciatively, talks loudly, and then sleeps—fitfully.

The Bedouins eat frugally when alone (p. 234). It is only when a guest appears or a marriage is celebrated, or on some other occasion, that the fatted sheep is slaughtered, as

Herold Ellsohn

The Author Calls a Motley Roll at Solomon's Seaport on the Gulf of 'Aqaba

Payday muster is exciting, for many a digger wins a bonus because he has saved some fact-finding fragment from the dust of centuries (page 243). Today, from Arabia to the Arctic Ocean, sunglasses protect men whose fathers shielded their eyes with a head shawl, or peered out through a narrow slit in a walrus-bone eye shield.

the Prodigal Son's father killed the fatted calf.

All movements are subject to suspicion, and the wise visitor is frank about his purpose.

The guest explains to the sheikh and to the assembled company just why he has come to the desert. He dwells upon the glorious past of the ancestors of the Arabs, professing his willingness, if sufficiently urged, to examine the ancient ruins that may be found in the district. He promises, through the abundance of his knowledge, to reveal the buried secrets of the past.

The listeners glow with interest, even when assured that no gold will be found. They like good stories, and are skillful at embroidering fragments of facts.

"Wallah!" (by God!), the sheikh exclaims, "I myself shall go with you tomorrow, and show you a site whose walls were built by the giants that once roamed this land."

The Guest Is Inviolate

Soon the guest is at home among the members of the tribe. Far and wide the news is spread by grapevine intelligence that the "European," accompanied by this or that Arab, is to be considered as a brother of the sheikh. Woe betide him who harms such a tribal guest!

The scientist may now explore the countryside in complete peace, alone and unharmed, but nevertheless under the far-flung protection of his kindly host. The only real danger I have ever been subjected to in Trans-Jordan is that of almost being killed—with kindness.

Wherever the lucky man roams, on foot, or by camel, donkey, horse, car, or plane, he is henceforth welcome. The price of safety in desert work is patience and courtesy and careful regard for local customs.

Ancient practices have been retained by modern Arabs. At one of my guest meals, the main dish consisted of a young kid boiled in the milk of its mother. But to the Jews, "Thou shalt not boil a kid in the milk of its mother" is a Biblical command (Exodus 23: 19).

A tablet unearthed at Ras Shamra in northern Syria explains that prohibition. The cuneiform inscription reveals that the proper offering to a certain pagan deity was a kid boiled in milk. To wean the people away from such pagan practices, the Mosaic Law prohibited this dish. But the Arabs today

serve it to honor their guest with what to them is a great delicacy.

If the Bedouin guide reveals an ancient site on which are pottery remains, the archeologist may be able to establish the date of those fragments by comparative studies with no more of an error than a century or two in a thousand years.

Some years ago my friend and teacher, William F. Albright, examined a site in southwestern Palestine called Tell Beit Mirsim, which he identified with the Biblical Kiriath-sepher, or Debir. From pottery fragments he found on the site, he dated it from about 2,000-600 B. C.; that is, from the period of Abraham to the taking of Jerusalem by Nebuchadnezzar.

Dr. Albright directed excavations at Tell Beit Mirsim for four successive seasons. On the basis of the great accumulation of materials then excavated, he came to the conclusion that his previous dating, based on surface remains alone, was not precise. No, it hadn't been occupied from about 2,000 to 600 B. C., but rather from 2,300 to 588 B. C.!

The Bible relates how the simple scouts of the nomad Israelites thought the Canaanite cities to be "strong and fortified to the heavens." The inhabitants of the land appeared to them to be "children of giants" (Numbers 13: 28; Deut. 1: 28; 9: 2). This is natural enough, since huge stone blocks, like those 63-foot megaliths of Baalbek, still mystify engineers (page 254).

Like the Dead Sea, deepest depression on earth, its surface lying 1,286 feet below sea level, much of the Wadi 'Araba also is below the level of the Gulf of 'Aqaba. In the Bible this is known simply as the 'Araba.

Flying Over the Dead Sea at Sea Level

The Trans-Jordan Government once graciously assigned a bomber plane to have me flown over this area. While we were flying about 1,300 feet above the Dead Sea in an attempt to locate the ruins of the ancient cities of Sodom and Gomorrah, the squadron leader who was flying the plane handed me a chit on which was written: "We are now flying at sea level."

I handed back the chit with a written request, "Let's fly below sea level." Down went the plane. We were soon cruising over the blue waters, high in the air but about 500 feet below sea level.

We could not see any remains of the cities of Sodom and Gomorrah, which, however, as may some day be demonstrated from archeological evidence, must have existed where and when the Bible locates them—near the south-east end of the Dead Sea, in the time of Abraham (Genesis 19).

The desert rift of the Wadi 'Araba furnishes a natural highway from the Red Sea to Palestine and Trans-Jordan. The Israelites during the Exodus followed it in part and camped at Punon (Numbers 33: 42).

Punon, now known as Feinân, still exists on the eastern side of the Wadi 'Araba. It was important in Bible times, as it still is for its water.

I shall not soon forget the day we arrived at Feinân on our camels, having ridden about a day and a half without coming to a spring. A rude Bedouin encampment was pitched by the stream which flows from the hills of Edom to bury itself in the desert sands.

Even before we made our camels kneel, a Bedouin woman came running out with a large skin of cool, coagulated milk, which the Arabs call *leben*.

The Wadi 'Araba is of great military importance to the British. Throughout this deep-sunk valley a sort of roadway has been cleared, so that an armored car can be driven from Jerusalem to 'Aqaba in ten hours.

There has been serious talk of building a railway from the Dead Sea to the Gulf of 'Aqaba, and another from 'Aqaba to Ma'an, where it would join with the pilgrim railway from Damascus to Medina. The potash and chemicals extracted from the Dead Sea could be sent by freight to 'Aqaba, and from there shipped to India or around Africa.

There Is Oil in Wadi 'Araba

The Wadi 'Araba is also important because of its own mineral and oil wealth. The Dead Sea has already become an important source of potash for the British Empire, and the Wadi 'Araba may develop as a major oil field in the petroleum-rich Middle East. That oil exists around and south of the Dead Sea has long been known.

In the spring of 1940, while we were conducting our excavations near 'Aqaba, American engineers, drilling at a series of sites along the length of the Wadi 'Araba, found quantities of oil. The outbreak of the war put a stop to all such activities, but the day may come when this region, as well as Iraq and Iran, will produce oil on a large scale.

Oil is already being produced in tremendous quantities along both sides of the Persian Gulf, and in Arabia. The islands of Bahrein, off the northeast end of the Persian Gulf, are little more than plugged faucets which need only to be opened to spout, and the great desert of Arabia is thought to be a sandy surface over a sea of oil.

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In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society–U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society cooperated with Dr. William Beebe in deep-sea explorations off Bermuda, during which a world record depth of 3,028 feet was attained.

The Society granted $25,000, and in addition $75,000 was given by individual members, to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

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"You have to *know* this friend . . . every spring and bolt of it . . . like you know the palm of your hand . . . and there *isn't long to learn* . . .

"And so they'll show you movies, soldier. They'll set up a Filmosound and let you see your Garand . . . and you'll learn how to clean it . . . how to hold it and carry it and aim it and shoot it . . . straight . . . and fast."

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"HOW hopelessly people fail, Mrs. Miniver thought, when they try to describe flying to someone who has never done it. They leave out all the really important things. They tell you that it saves time and (taking everything into account) money; they tell you that it makes the earth look like a map, cows like ants, and cars like beetles. But they don't tell you that it is staggering, tremendous; that it is not merely an experience but a rebirth; that it gives you for the first time in your life the freedom of a new dimension (for although we know that there are three of them, we are forced to move mainly in two: so that our sense of up-and-downness is necessarily dim and undeveloped compared with our acute perception of the to-and-fro). They don't tell you that when you are up there it is the aeroplane that seems to be the safe solid core of things, while the earth is a distant planet upon which unfamiliar beings move among unthinkable dangers. They don't tell you, either, that you will be torn all the time between an immense arrogance and an immense humility, so that you are at one moment God and at the next a nameless sparrow. Nor do they tell you what it feels like to thread your way among the noble and exciting architecture of the clouds; nor how—best of all—you may suddenly find a rainbow arched across the tip of your wing, as though you had caught it in passing and carried it along with you."

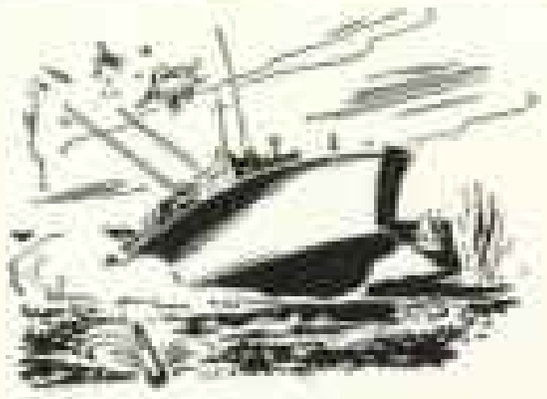
[From the book *Mrs. Miniver* by Jan Struther.]

The marvel of flight is ever a new experience to today's air travelers. To countless others it has yet to come—and come it shall. The Airlines of the nation are prepared to spend many millions of dollars and engage thousands of returning service men in extending air transportation to the threshold of every possible community . . . to bring the "freedom of a new dimension" to all.

Air Transport Association, 1515 Massachusetts Avenue, N. W., Washington 5, D. C.

THE AIRLINES OF THE UNITED STATES

LEADING THE WORLD IN AIR TRANSPORT



Fresh food on the high seas during long, heavy-action periods away from port is the result of compact, efficient refrigeration.

Self-Contained
½ h.p. Refrigerating Unit

Cool, clean air protects the life of the wounded in Army hospitals. Special aircraft refrigerators safeguard serums and plasma.

Aluminum
Aircraft Refrigerator

Peak welding efficiency is made possible by cooling of welding tips with water or brine held at the right temperature.

Spot Welder
Tip Cooling Unit

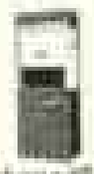
Tool life is increased and rejections are fewer when cutting oils used in high-speed machining are properly cooled.

Refrigerating Unit

The health of our armed forces is protected by dependable refrigeration in cantonments, huts, barracks, and on ships.

14 Cylinder
Refrigerating Compressor

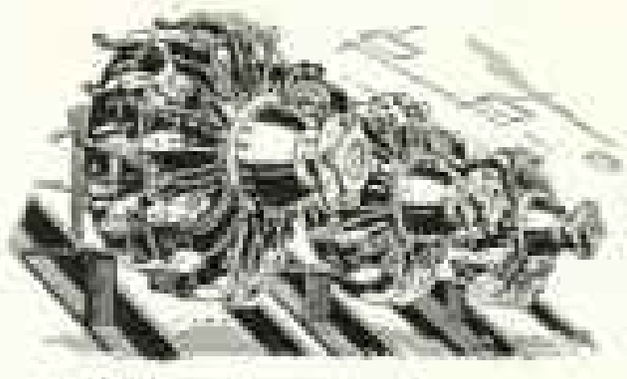
Super accuracy in gauge rooms is possible when the air is clean, dehumidified, and maintained at a constant temperature.



3 h.p. "Packaged"
Air Conditioner

Protection in the tropics against the ravages of humid atmosphere and vermin is necessary to preserve food and equipment.

Portable Panel
Refrigeration Unit



Identical performance of aircraft engines is assured by operation tests with carburetor air kept at the same temperature.

14 Cylinder
Air Conditioning Compressor

Clean, dry atmosphere is vital for machining sensitive metal surfaces where a spot of rust would ruin high-precision products.

3 h.p. "Packaged"
Air Conditioner

★ CHRYSLER AIRTEMP AT WAR ★

From tiny, fractional horsepower to big 75 horsepower units, Chrysler Airtemp Radial Compressors are performing a major war job on both the production and battle fronts.

The science of air control is built around the compressor. Chrysler Airtemp's *exclusive* Variable Capacity Radial Compressor provides a new efficiency and accuracy in indoor climate regulation. The radial cylinders cut in or out automatically, one at a time, to meet varying load requirements. This flexibility eliminates the peaks and valleys resulting from frequent starting and stopping of ordinary compressors . . . holds temperature and humidity at a constant level.

Years spent in building delicate mechanisms, have developed high-precision, versatile skills at Airtemp, now devoted to war production. Backed by Chrysler Corporation research and engineering, when peace comes, these skills will again create heating, cooling and refrigeration units for homes and commercial use that will set new, high standards of efficiency and performance.

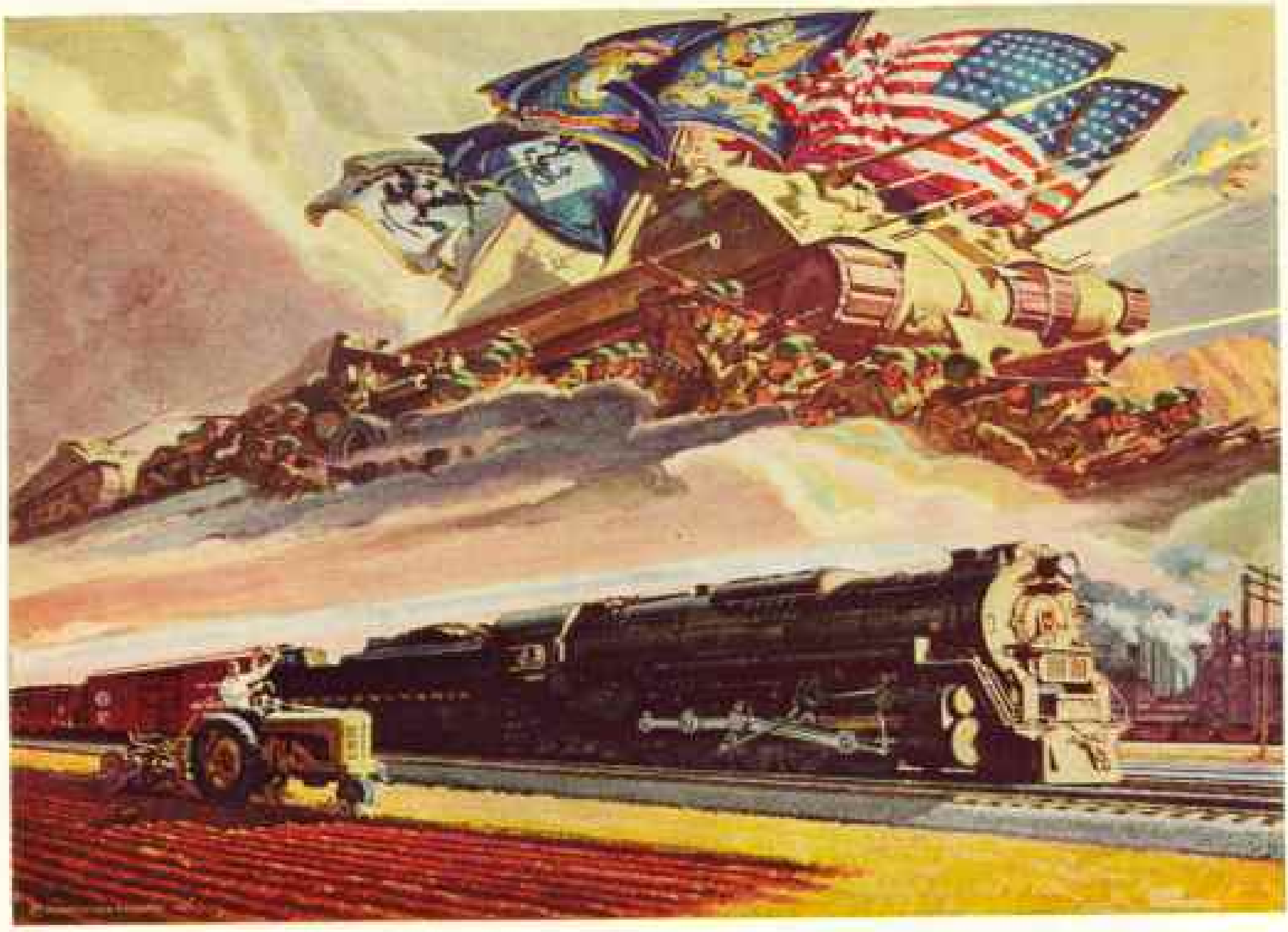
The lessons learned during peace in free competitive enterprise—freedom to produce and compete—today bring strength to a nation at war.

Chrysler Corporation

PLYMOUTH • DODGE • DE SOTO • CHRYSLER • AIRTEMP • AMPLEX

BACK THE ATTACK—BUY WAR BONDS

Tune in Major Bowes every Thursday, C B S, 9 P. M., E. W. T.



FORWARD

...all along the line!

AMERICA is on the offensive wherever the flag flies . . . for one purpose, and one purpose only—to bring this war to a victorious close as quickly as possible.

If this is to be the year, as everybody hopes, then the call is not only for *united* effort—but for that extra "something" from every American on the home front. Count on the 161,922 workers of the Pennsylvania Railroad to do their share!

Count on them to help keep rolling the greatest volume of freight and passenger traffic in the history of railroading . . . to push war shipments through with speed and efficiency . . . and to serve the traveling public in the spirit of courtesy and friendliness characteristic of the Pennsylvania Railroad at *all* times —in war or peace.

BUY UNITED STATES WAR BONDS AND STAMPS

Pennsylvania Railroad

Serving the Nation

★ *38,244 in the Armed Forces* ★ *84 have given their lives for their country*

"Tell Tojo for me . . . I'm the guy who proved we could make synthetic tires"

"I did it long before Pearl Harbor, too—in that B. F. Goodrich 80,000,000-mile road test"

"**Nope,**" said the Private on post number 4, "the tires I tested weren't the tires you're driving today. They were passenger car tires—and they had synthetic in 'em all right. They were the first such tires ever sold and put out on actual road test in America.

"B. F. Goodrich made 'em. Over half the natural rubber was replaced by their synthetic—Ameripol. I bought a set. So did hundreds of others. Together we rolled up 80,000,000 miles. I'm glad I made that test. Gives me a feeling of confidence when I see B. F. Goodrich synthetic tires coming through on these buggies!"

Today's B. F. Goodrich passenger car tires are made with Government synthetic—"GR-S." And more than 99% of the natural rubber has been replaced by it.

But the big thing gained in the 80,000,000-mile road test was "know-how." This three-year head start has already enabled us to produce a synthetic passenger car tire *almost* as good as a pre-war Silvertown . . . and it's the best synthetic tire you can buy today.

If you need tires, and can qualify, you may be able to buy a B. F. Goodrich synthetic Silvertown. But remember, please, the Army and Navy still need all the rubber they can get. Do everything you can to save your tires—and don't drive a single needless mile. The B. F. Goodrich Co., Akron, O.

Westinghouse and your private life . . .

One of our peacetime goals is to be as big a part of your life as possible. Before we went 100% into war production, there were Westinghouse products which would heat your water, cook your meals, preserve your food, light and clean your house, help keep you warm in winter and cool in summer, wash your clothes, help take you to work and bring you home. Each time you did any one of a hundred simple things such as snapping on the radio or going to a movie—we helped with that, too.

Westinghouse and your home town . . .

Another of our peacetime aims is to help make your town a better place to live in. Well-lighted streets, plenty of steady power for homes and stores and factories, better transportation—these are a few of the dozens of ways in which electricity and Westinghouse can help a city.

Westinghouse and your Country . . .

By combining thousands of skills that in the past have let us contribute to your comfort and your town's progress, we have been able to develop many new weapons that are making a major contribution to our country in war. We have increased our production of vital war materials month by month until thousands of Westinghouse products now are fighting in every battle and on every front. Westinghouse Electric & Manufacturing Co., Pittsburgh, Pennsylvania. Plants in 25 cities, offices everywhere.

You owe it to your Uncle Sam!

He needs manpower—every available person. A hearing deficiency may keep you out of the armed forces . . . but you can do your fighting on the home front . . . in war materiel plants. A good hearing aid enables you to go all out in the war effort. The movement is growing. In our plant today are workers wearing hearing aids and contributing as competently as if their hearing were normal.

You owe it to your friends!

They want to enjoy your company as much as you do theirs. Your hearing aid means as much to them as it does to you.

Are you really doing your part?

That question only *you* can answer. *Think!*

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

The New Zenith RADIONIC
HEARING AID
$40.00 READY TO WEAR

Complete—with Radionic Tubes—
Crystal Microphone and Batteries
. . . *Liberal Guarantee*

●

Zenith has built the best that modern knowledge and *radionic* engineering make possible into this $40.00 hearing aid. It has no other models . . . *one* model . . . *one* price . . . *one* quality.

Report on a Revolution

Zenith recently started a revolution —to reduce the *cost of hearing*. After years of research and preparation, the Zenith Radionic Hearing Aid is now offered to the public.

The price—$40—(about one-quarter that of other good vacuum tube instruments). Complete—ready to wear—with miniature radio tubes, crystal microphone and batteries—liberally guaranteed.

Inquiries from everywhere have flooded the mails—telephone calls —telegrams.

A sales volume—unheard-of in this field—is gaining daily momentum—and is a demand created by self-evident merit of the instrument itself. Today our problem becomes one of production and distribution —to as quickly as possible make the Zenith Radionic Hearing Aid available in all localities.

We are doing our best to furnish additional manpower for Uncle Sam's production forces. And—in the doing—we are experiencing that rare satisfaction born of directly contributing to the welfare of individuals.

THE ZENITH HEARING AID WILL BE AVAILABLE THROUGH REPUTABLE OPTICAL ESTABLISHMENTS FRANCHISED BY ZENITH. (NO HOME CALLS OR SOLICITATIONS.)

Write us for address of outlet nearest to you.

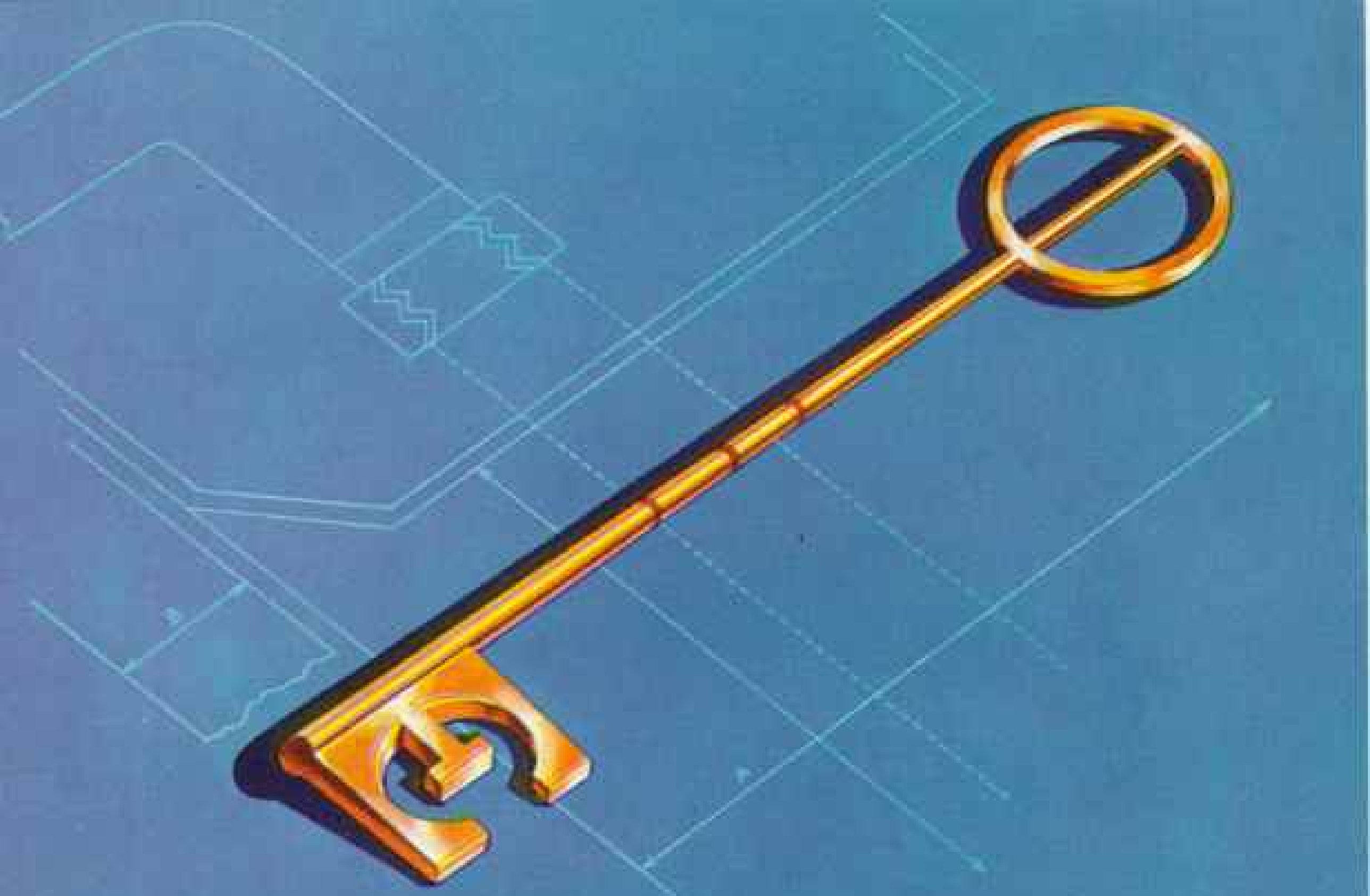
☆ ☆ ☆ ☆

There are cases in which deficient hearing is caused by a progressive disease and any hearing aid may do harm by giving a false sense of security. Therefore, we recommend that you consult your otologist or ear doctor to make sure that your hearing deficiency is the type that can be benefited by the use of a hearing aid.

TO PHYSICIANS:
A detailed scientific description will be sent upon request. Further technical details will appear in medical journals.

Write for Free Descriptive Booklet
ADDRESS DEPT. NG-2, HEARING AID DIVISION
ZENITH RADIO CORPORATION
CHICAGO 39, ILLINOIS

ZENITH "LONG DISTANCE" RADIO
RADIONIC PRODUCTS EXCLUSIVELY—
WORLD'S LEADING MANUFACTURER



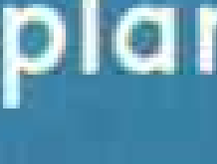
Why Copper is the key metal in so many postwar plans

THE WAR PERIOD has stimulated broad experiment with many different materials and production techniques. Substitutes made through necessity for critical war-needed copper have had wide testing.

But copper and copper alloys have been proved essential over and over again both in old fields and many new ones. A recent check of more than 700 leading manufacturers, whose peacetime production ranges from fountain pens to airplanes, shows that brass, bronze, nickel silver and other copper alloys will continue to play a basic part in the products they are designing for postwar America.

There are many reasons, but the important one, both to industry and the public, is the proved *dependability* of copper. For copper and its alloys have this multiple advantage over all other commercial metals: They best combine the properties of toughness and workability, excellent electrical and thermal conductivity, high resistance to corrosion and freedom from rust.

Plus still another advantage that ranks high with production men: Anaconda Copper Alloys are noted for *uniformity*—with all that it means to fast, efficient production, lower overall costs, greater value to the user of the finished product.



When the red metal gets the green light

Today, war needs get first call on copper. But industry and the public, designers and engineers, those making products and those providing public services, are counting on the return of copper with victory. Anaconda Copper, Brass, Bronze, Nickel Silver—and many special copper base alloys—will be ready to serve postwar America.

The American Brass Company operating 13 U. S. A. and Canadian plants, has produced record tonnages of copper and brass for war purposes. All U. S. plants earned the right to fly the Army-Navy "E" pennant. While not eligible for the "E" award, the company's Canadian plants have also established outstanding records for wartime production.

HELP BRING VICTORY SOONER BY BUYING WAR BONDS

ANACONDA

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., *New Toronto, Ontario*

Anaconda Copper & Brass

A SURPRISING THING about sound is that when the human voice is electrically amplified, the amplification sometimes causes harsh overtones that make it difficult to understand.

One of the jobs of Dictaphone research is to assure that any voice will be clear and intelligible when a secretary "plays it back" for transcription.

HOW TO REMODEL A WHISPER

Dictaphone engineers don't aim to reproduce sound with absolute fidelity. You might call them *sound sculptors.* They trim away a resonance here . . . step up a tone there . . . until every syllable can be *understood* by the secretary who listens and types.

It is fortunate that such knowledge and skill were ready and could be put to practical uses by the Government and industry to meet the urgent demands of war . . . fortunate for busy men whose time and energies count for so much in the victory drive..

From the Dictaphone Research Laboratories at Bridgeport, Conn., have come many other improvements in electrical recording for use in war-industries and by the armed forces. The experience gained in the production of this war equipment will be available to extend the usefulness of the Dictaphone method after the war is won.

Dictaphone Corporation, 420 Lexington Ave., New York 17, N. Y.

DICTAPHONE

DICTATING AND RECORDING EQUIPMENT

DICTAPHONES AVAILABLE! Dictaphone equipment is available to firms whose work is essential to the war effort.

"SURE, THERE'LL BE A PARADE..."

I know what I'm up against.

I know what the odds are.

I know what they mean by "lost at sea."

But *I'm* going to make it . . . nothing can stop me!

Sure, when this war's over there'll be crowds and cheers and ticker tape and confetti. Sure, there'll be handshakes and pats on the back and good wishes. Sure, but what's bringing me back is bigger than that . . .

I want what I've been fighting for . . . a fighting chance!

• • •

Maybe some folks would say I was crazy, if they could hear me talking out loud this way . . .

Maybe they'd laugh and say, "Listen, buddy, get wise . . . the trouble with guys like you is—you keep trying to do it the hard way . . ."

Well . . .

It wasn't easy learning how to swim, but I did . . . and now I won't drown. It wasn't easy to stick it out when the going got tough, but I did . . . and now *nobody* can make me quit. It wasn't easy finding out how to steer a course by the stars and the sun, but I did . . . and now, even from out here, I'm going to find my way home!

The girl I'm going to marry wasn't easy to win . . . because she's the finest girl in the world.

The job I'm coming back to wasn't easy to get . . . because it was the swellest job any guy ever had.

The future *I'm* after is so big nobody's ever going to hand it to me on a silver platter!

That's why I want a fighting chance . . . a chance to move *up* . . . an opportunity to go ahead. That's why I want to plan a future of my own in a land and a world where every man is free to make the most of his ability . . . where there'll be plenty of work days and plenty of pay days . . . with no limits on how high you can rise . . . how far you can go.

That's the America I left behind me.

That's the America I'm fighting for.

That's the America I want when I get back.

• • •

Here at Nash-Kelvinator we're building Pratt & Whitney engines for the Navy's Vought Corsairs and Grumman Hellcats . . . Hamilton Standard propellers for United Nations bombers . . . generators, fuselages, parts for ships, jeeps, tanks and trucks . . . readying production lines for Sikorsky helicopters. All of us devoted 100% to winning this war . . . to speeding the peace when our men will come back to their jobs and homes and even better futures than they had before . . . to the day when together we'll build an even finer Kelvinator, an even greater Nash!

The Army-Navy "E" awarded to Nash-Kelvinator Corp., Propeller Division.

NASH-KELVINATOR CORPORATION

Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

Let's Get It Over With Quick!
Buy More War Bonds Now!

NASH AUTOMOBILES

KELVINATOR REFRIGERATORS • ELECTRIC RANGES

GM Diesels will be on hand to show that they can do an even bigger job in America's trucks. Simple in mechanical construction; sturdily and precisely built; economical in operation and upkeep, GM Diesels will prove as indispensible in peace as they are proving vital in war.

WHEN THERE'S WORK TO BE DONE —IN WAR OR PEACE

You will find GM Diesels hard at work in every theater of the war. They power massive tanks moving into battle—heavy trucks in endless supply lines, tractors to clear landing fields, landing and assault boats, big submarines and fast subchasers in home and in foreign waters.

In every respect, these GM Diesel Engines are living up to all that was predicted for them—and more. In many instances they are doing an even greater variety of jobs than they were designed for. They are standing up under conditions that couldn't possibly have been foreseen.

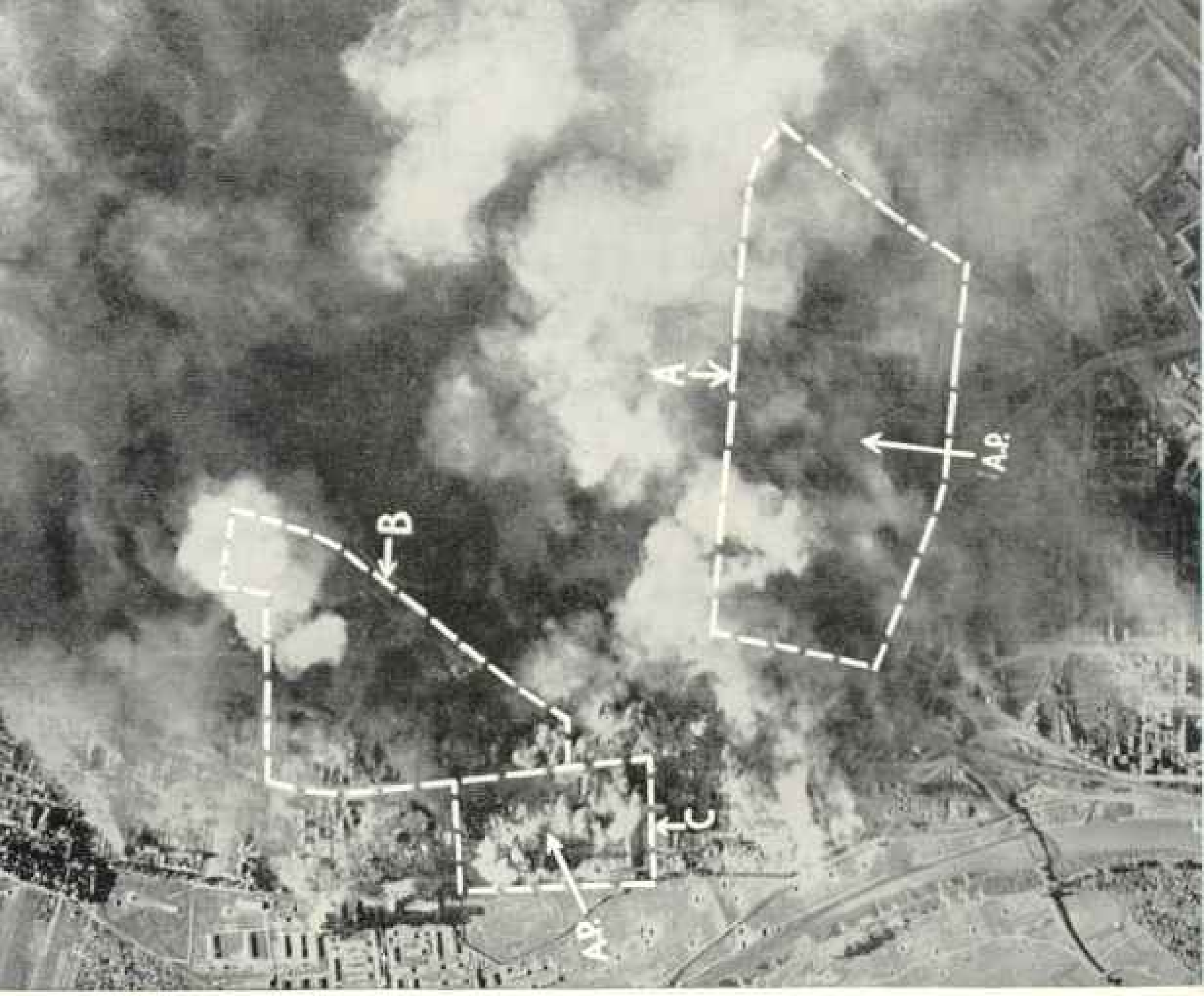
When the war is over, GM Diesels will be ready to serve the peace as they are serving in war. With this difference: expanded production facilities, together with improvements and refinements in design and construction, will make them even more available for use—more capable of reliable, low-cost performance.

GM
GENERAL MOTORS
DIESEL POWER

ENGINES . . 15 to 250 H.P. . . **DETROIT DIESEL ENGINE DIVISION,** Detroit, Mich.

ENGINES . . 150 to 2000 H.P. . . CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

LOCOMOTIVES . . . . . ELECTRO-MOTIVE DIVISION, La Grange, Ill.



Official U. S. Army Air Forces photograph of the second Schweinfurt raid. Dotted rules and letters indicate heavily bombed target areas.

Schweinfurt Story

Both sides knew it was a major engagement — that second bombing mission against Schweinfurt. It was a battle between large armies, for a crucial objective. The Nazis massed 60% of their total fighter strength in a vain effort to prevent the Boeing Flying Fortresses from getting through.

In a period of a few hours the Forts invaded German-held Europe to a depth of 500 miles, sacked and crippled one of her most vital industries. They did it in daylight and they did it with precision.

This is the task for which the Boeing Flying Fortress was designed: *precision destruction by daylight, in areas where the going is toughest.*

It is not an easy task. The Germans tried it in the Battle of Britain, and gave it up as too costly when 185 of their own planes were shot down in a single day.

The Fortress is engineered to perform superbly at altitudes of more than 7½ miles; it bristles with effective firepower; and it can absorb terrific punishment and still keep flying.

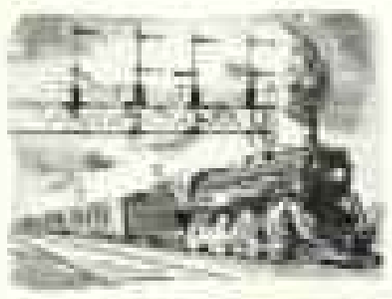
Fortresses are lost, of course . . . sometimes many of them on a single mission. But a recent check shows that over a 12-month period, an average of more than 95% of them have returned from each attack. Their stout-hearted and superbly trained crews have never yet been turned back from their objectives by enemy opposition!

To produce a plane like the Fortress requires unusual qualities of research, design, engineering and manufacture. You can expect these same qualities in the peacetime tomorrow, knowing that any product "Built by Boeing" is bound to be good.

DESIGNERS AND BUILDERS OF THE FLYING FORTRESS • THE NEW BOEING B-29 • STRATOLINER • TRANSOCEAN CLIPPERS **BOEING**

"Who was it said, Democracy is inefficient"?

Everybody knows who—and it was one of the worst of his wrong guesses—as many things are proving.



One proof is the record of the American railroads.

In the year just ended, they handled a volume of traffic which dwarfs anything in the history of transportation.

And this job was done—not under the arrogant compulsion of dictatorship, but by voluntary cooperation in the finest American tradition.

There was first of all, the cooperation of railroad men and railroad companies with one another.

There was the surpassing cooperation of shippers and receivers of freight, who did their indispensable part in keeping freight cars on the move.

There was the helpful cooperation of government agencies with railroad management.

And there was, on top of all this, the cooperation of the Army and Navy—the greatest shippers in the world.

Without all these, the record would never have been possible.

And finally, there was the friendly and patient cooperation of the traveling public—which accepted the inconveniences, and sometimes the hardships, of wartime travel, with typical American good humor and good sense.

So far have we come together along the road to victory. The road ahead calls for still more effort, still closer cooperation, in getting the utmost transportation service out of our railroad plant.

And when the victory is won—as surely it shall be—it will have been won by free men, working together under the rules free men established for themselves—the thing we are fighting to preserve.

★ BUY MORE WAR BONDS ★

ASSOCIATION OF
AMERICAN RAILROADS
ALL UNITED FOR VICTORY

On hot desert roads

Test cars proved General's mileage

. . . with American-Made Rubber

● Over the tire-defying roads of the Mojave Desert went test cars . . . through noonday heat and the cold of desert nights . . . to learn for you the kind of *mileage* and *safety* you could expect from the new General Tire . . . with *American-Made* rubber.

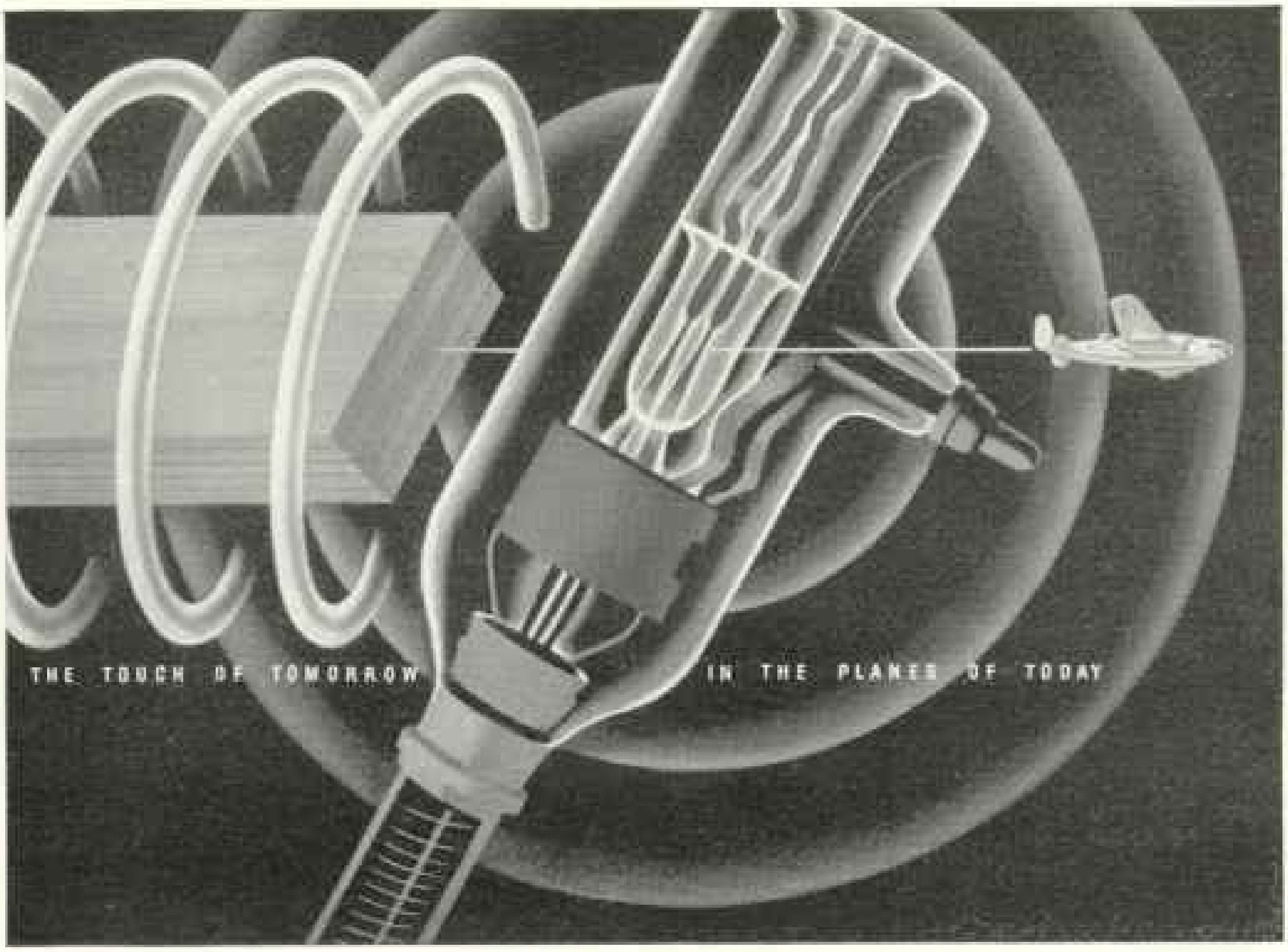
The results are in. This General delivers the kind of *performance* that has made General, for 25 years, the leader in *Top-Quality*. Yes, if you are eligible to buy, you get *the most* from American-Made rubber . . . in today's General with its quick-stopping, slow-wearing Silent-Grip tread . . . and the same extra strong, blowout-resisting cords, as always.

Remember, however . . . tires are still very precious and will be for a long time to come. You *must* save those you have. For every tire need: Kraft System recapping, repairing or new tires, see your General Tire Dealer. *He is a tire expert.*

THE GENERAL TIRE & RUBBER COMPANY • AKRON, OHIO

". . . Now remember, Butch, it's a GENERAL!"

BUY MORE WAR BONDS



New Magic from the Mysterious Electron

Through X-ray, the unfathomable electron has saved millions of lives. Through radio, it has extended man's hearing to every corner of the world. Through television, it permits him to see beyond all previous limits of sight.

And now Fairchild's Duramold engineers have harnessed the electron to a new and urgent task—the manufacture of aircraft components.

The usual plywood techniques for joining thin layers of wood could not be applied in making highly stressed, thick sections. New methods were needed—*in a hurry*.

Duramold engineers found the solution in electronic energy, employing radio high frequency with apparatus similar to that used by radio stations in sending out short wave broadcasts.

Heat generation by radio frequency, coupled with special adhesives, now turns out better, stronger aircraft parts. And the production cycle has been clipped from hours to minutes. The use of electronics is becoming a new and important technique in Duramold's process for assembling molded wood structures.

Thanks to the ingenuity of Fairchild engineers, with their flair for getting the "touch of tomorrow in the planes of today," a new technique has been successfully applied toward the common goal of turning out stronger planes—and doing it faster.

BUY U. S. WAR BONDS AND STAMPS

FAIRCHILD ENGINE AND AIRPLANE CORPORATION

30 ROCKEFELLER PLAZA, NEW YORK

Ranger Aircraft Engines Division, Farmingdale, L.I. • Fairchild Aircraft Division, Hagerstown, Md. . . . Burlington, N.C. • Duramold Division, New York, N.Y.

From ROCK *to* RUBBER

One of our country's large rubber plantations has its roots in limestone quarries. From this plentiful rock we produce carbide, then acetylene which is the basis of a widely used synthetic rubber.

Acetylene is one of the many chemicals available through the Airco family of companies for an infinite variety of uses, from cutting metal to preserving food. Today these chemicals are hastening victory—tomorrow a better world.

★ BUY UNITED STATES WAR BONDS ★

AIR REDUCTION SALES COMPANY
MAGNOLIA AIRCO GAS PRODUCTS CO.
NATIONAL CARBIDE CORPORATION
PURE CARBONIC INCORPORATED
THE OHIO CHEMICAL AND MFG. CO.
WILSON WELDER & METALS CO., INC.

AIRCO

AIR REDUCTION

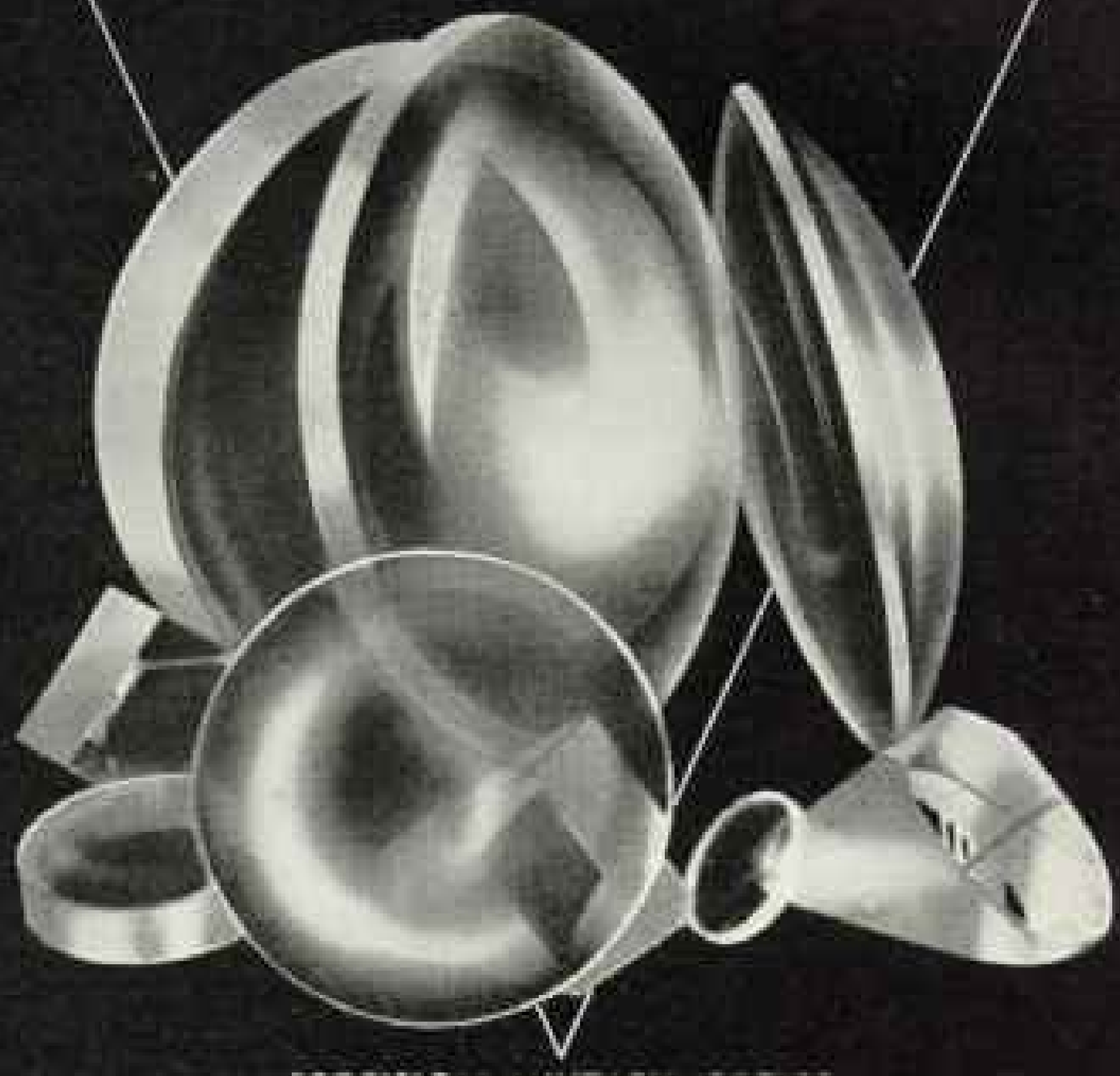
60 EAST 42nd STREET • NEW YORK 17, N. Y.

OXYGEN, ACETYLENE AND OTHER ATMOSPHERIC GASES • GAS WELDING AND CUTTING APPARATUS • CALCIUM CARBIDE
ARC WELDING MACHINES AND SUPPLIES • CARBON DIOXIDE • "DRY ICE" • ANAESTHETIC AND THERAPEUTIC GASES AND APPARATUS

Jewels of Today

ARGUS EYES FOR VICTORY

AWARDED TO PLANT 2
OPTICAL DIVISION



PRECISION MILITARY OPTICS
By

argus

INTERNATIONAL INDUSTRIES, INC.

ANN ARBOR MICHIGAN

FINE AMERICAN CAMERAS

•

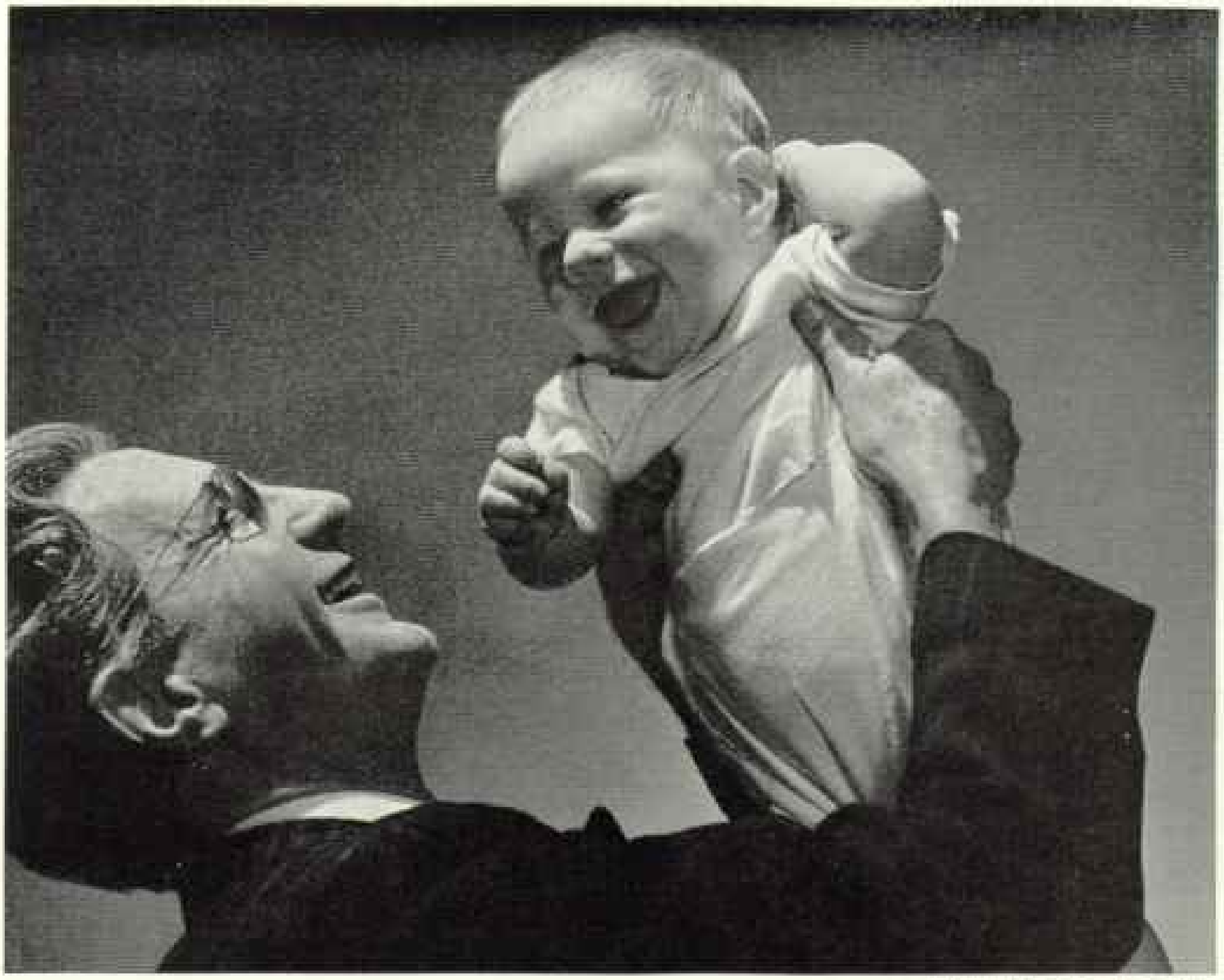
PRECISION OPTICAL INSTRUMENTS

•

AVIATION RADIO EQUIPMENT

•

BUY WAR BONDS



How long will they live?

They're both enjoying life—one in his very first year—the other in his first year as *Granddad*. And their chances of enjoying life a *long* time are better than ever before!

Only 28 years ago, one baby out of every ten died before its first birthday. Today, the rate is less than one in twenty. And over the same period, the average span of human life has lengthened from about 55 to 64 years.

This precious gift of life has come largely through your family doctor, as a result of research by the profession of which he is a part. By their skill and devotion, medical men have saved the lives of millions of Americans who, in turn, are saving America today.

Remember this debt to your doctor—and the tremendous pressure under which he works now. He's carrying the practice of colleagues called to war. He's crowded for time, hungry for rest. And his first duty is to those who need him *most*.

Be as considerate as you can. A telephone call may save a personal visit. If you call early in the day, he can better plan his schedule. Try to let him sleep at night. *And follow the instructions he gives you!*

In a modest way, we are partners with the medical profession. Some measure of America's advance in health is due to better food. National Dairy Laboratories have helped improve products made of milk — nature's most nearly perfect food. Right now they are developing new products that promise still better nutrition and longer life.

Dedicated to the wider use and better understanding of dairy products as human food . . . as a base for the development of new products and materials . . . as a source of health and enduring progress on the farms and in the towns and cities of America.

NATIONAL DAIRY
PRODUCTS CORPORATION
AND AFFILIATED COMPANIES

"Buy U. S. War Bonds—They Identify You"

Modern "MOHAWKS" on the Warpath

New Dual-Purpose Locomotives Speed War Traffic on the Water Level Route

THERE'S a roar from her stubby stack as "Mohawk 3112" rolls west with a string of troop-filled Pullmans. There's an answering roar from her twin locomotive, eastbound with a train of war freight.

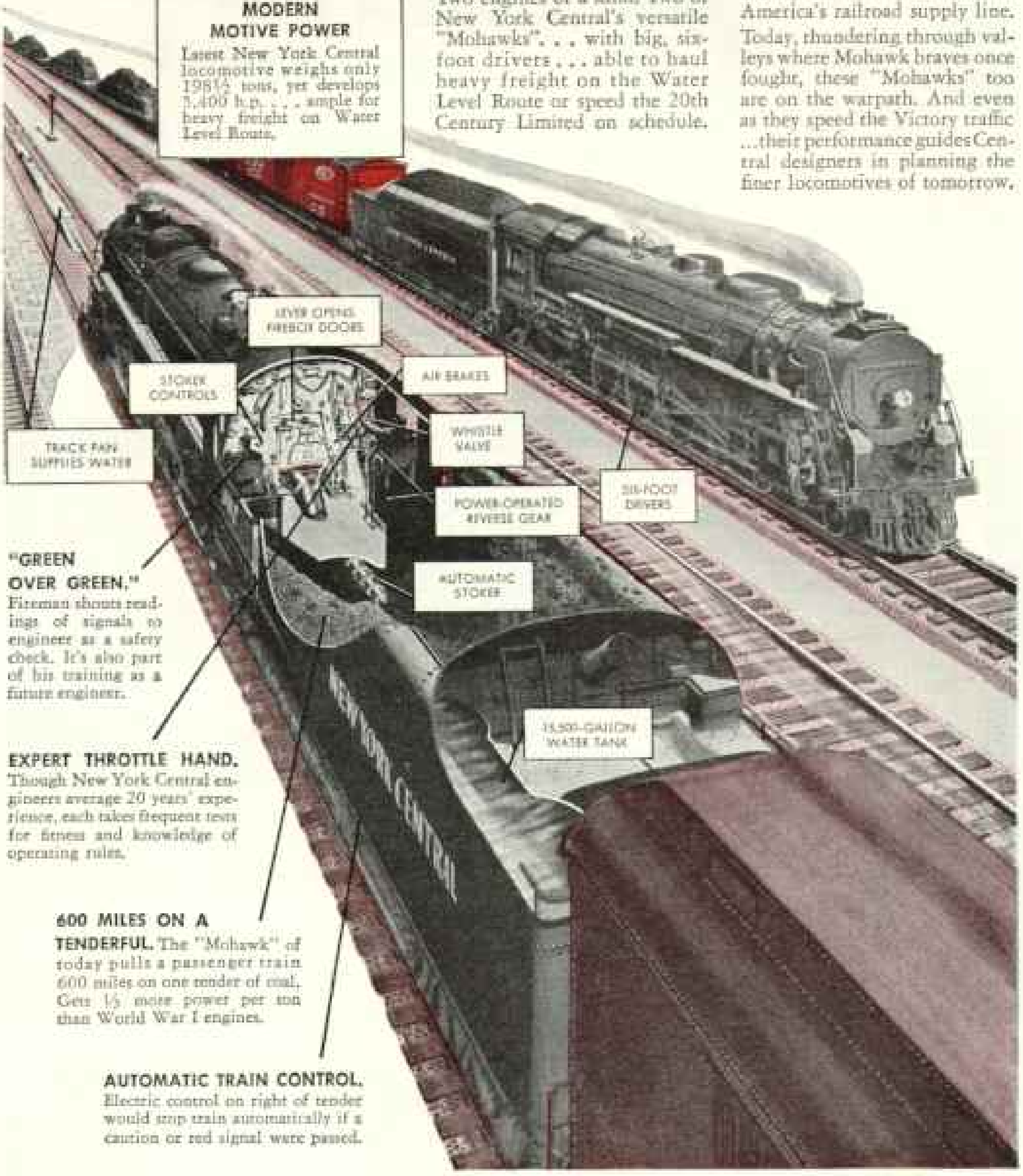
Two engines of a kind. Two of New York Central's versatile "Mohawks"... with big, six-foot drivers... able to haul heavy freight on the Water Level Route or speed the 20th Century Limited on schedule.

Made possible by this almost gradeless route, "Mohawks" are newest among Central's fleet of steam, electric and Diesel locomotives. And their adaptability to freight or passenger service means much to wartime efficiency on this vital link in America's railroad supply line.

Today, thundering through valleys where Mohawk braves once fought, these "Mohawks" too are on the warpath. And even as they speed the Victory traffic ...their performance guides Central designers in planning the finer locomotives of tomorrow.

MODERN MOTIVE POWER

Latest New York Central locomotive weighs only 198½ tons, yet develops 5,400 h.p. . . . ample for heavy freight on Water Level Route.



"GREEN OVER GREEN," Fireman shouts readings of signals to engineer as a safety check. It's also part of his training as a future engineer.

EXPERT THROTTLE HAND. Though New York Central engineers average 20 years' experience, each takes frequent tests for fitness and knowledge of operating rules.

600 MILES ON A TENDERFUL. The "Mohawk" of today pulls a passenger train 600 miles on one tender of coal. Gets ⅓ more power per ton than World War I engines.

AUTOMATIC TRAIN CONTROL. Electric control on right of tender would stop train automatically if a caution or red signal were passed.

New York Central

One of America's Railroads All United for Victory

NEW YORK CENTRAL SYSTEM

LET YOUR DOLLARS FIGHT INFANTILE PARALYSIS

FALSE TEETH WEARERS RISK DOUBLE DANGER BY BRUSHING with makeshift cleaners

Brushing your plates with tooth pastes, tooth powders or soap, may scratch the denture material which is *60 times softer than natural teeth.* These scratches cause stains, film, and food particles to *collect faster and cling tighter* . . . can result in unpleasant breath. You may not know it, but others *do!* Besides, brushing with makeshift cleaners often wears down the fitting ridges designed to hold your plate in place. With worn-down ridges, of course, your plate loosens.

PLAY SAFE...SOAK YOUR PLATES IN POLIDENT

A safe, modern way to keep dental plates, partial plates and removable bridges clean is to soak them in Polident every day. No brushing, no danger, yet the daily Polident bath works into the corners and crevices no amount of brushing seems to reach; leaves denture sparkling clean.

DO THIS EVERY DAY

Place denture in Polident solution for 15 minutes, or longer if convenient. Rinse—and it's ready to use.

No brushing

"Now I go places . . . do things . . . enjoy life"

Millions call Polident a blessing. No fear of unpleasant breath due to unclean dentures—no risk of wearing down and loosening the plate due to brushing. Today—get Polident at any drug, department or variety store. 3 oz. size—30¢; 7 oz. size—60¢.

FREE! Booklet on Denture Care. Write Hudson Products, Inc., Dept. M-24, 8 High St., Jersey City 6, N.J.

The Safe, Modern Way to Clean Plates and Bridges

POLIDENT

FOOD fights for FREEDOM
produce and conserve—
share and play square!

The doctor talks to Mrs. Roberts about Rheumatic Fever

THE DOCTOR says Jimmy has rheumatic fever. The boy's anxious mother wants to know all about this illness . . . the most serious disease of childhood years.

Mrs. R.: Is rheumatic fever catching, doctor?

Doctor: Not like measles or chicken-pox, but it seems to run in families. Children between the ages of 5 and 15 are its chief victims.

The great danger lies in the damage it can do to the heart. Fortunately nowadays the majority of children who receive good medical care are leading normal, useful lives.

Mrs. R.: But I didn't notice any unusual symptoms!

Doctor: That's just the danger! Early rheumatic fever symptoms are sometimes very slight—a sore throat, a slight fever, nosebleed, poor appetite . . . perhaps rapid heart action and fleeting pains in muscles and joints. Any of these may or may not mean early rheumatic fever.

Mrs. R.: How long will Jimmy have to stay in bed?

Doctor: As long as the disease is active. It may be a few weeks, but some cases last for a year or more. The only way to lessen the possibility of damage to Jimmy's heart is *complete rest in bed* until all symptoms and signs disappear.

Mrs. R.: How active can he be when he is able to get up?

Doctor: Children can usually resume normal activity gradually. Of course, I will want to examine Jimmy at regular intervals, even though he appears well.

Mrs. R.: Is he likely to have another attack?

Doctor: It's very possible. In fact, this attack shows Jimmy is susceptible to the disease. You can help prevent recurrence by keeping his general health at a high level. He will need to eat well, dress warmly, and get lots of sleep. And since sore throats, colds, and other respiratory infections frequently precede an attack, you must take *extra* precautions against them. *Protect him from others who have colds!* If he gets a cold, put him to bed immediately . . . and let me know.

Doctors hope that it will not be long before there are surer ways to prevent recurrences. Medical experiments are now being made with small, regular doses of certain drugs for this purpose. These drugs seem to show great promise, but should be used only under the direction of a physician.

For additional information, send for Metropolitan's free booklet, 24-N, entitled, "About Rheumatic Fever."

Heading five miles high on engines that Studebaker craftsmen built

THE whole world knows the war record of the mighty Boeing Flying Fortress. Its tremendous flying power is supplied by supercharged Cyclone engines, large numbers of which are built by the famous master craftsmen of the Studebaker plants.

Many of these men are fathers of younger Studebaker craftsmen now in uniform. In peacetime, these fathers and sons applied their skill to the manufacture of Studebaker Champion, Commander and President motor cars, as well as Studebaker trucks, for civilian use.

Today, the Studebaker working force is engaged in all-out military production. They will keep at that task until victory permits them to devote their skill to building the marvelously advanced new Studebakers of the better days to come.

BUY U.S. WAR BONDS

Awarded to Aviation Division of The Studebaker Corporation

Studebaker war trucks are serving the wide world over—Studebaker is one of the world's largest builders of big, multiple-drive military trucks. That equipment, plus Flying Fortress engines and other war matériel, is enabling Studebaker to play a useful part in our country's vast war production program.

Studebaker BUILDS CYCLONE ENGINES FOR THE BOEING *Flying Fortress*

Have a Coca-Cola = As you were

. . . a way to relax on a battleship

Wherever a U. S. battleship may be, the American way of life goes along . . . in sports, humor, customs and refreshment. So, naturally, Coca-Cola is there, too, met with frequently at the ship's soda fountain. *Have a "Coke"* is a phrase as common aboard a battlewagon as it is ashore. It's a signal that spells out *We're pals.* From Atlanta to the Seven Seas, Coca-Cola stands for *the pause that refreshes*—has become the symbol of happy comradeship.

* * *

Since 1886 Coca-Cola has spread around the world. Its refreshing goodness is welcomed by people around the globe. Despite the fact that many bottling plants are cut off in enemy-occupied lands, Coca-Cola is still being bottled in over 35 allied and neutral nations. So our fighting men can still enjoy it many places overseas.

It's natural for popular names to acquire friendly abbreviations. That's why you hear Coca-Cola called "Coke".

A Soldier's GIRL . . . and his MOTHER

. . . another occasion for

Reproductions of Kodacolor snapshots, reduced in size

Full-Color Snapshots

THEY'RE always in his thoughts: his wife or sweetheart; his mother. Think what it will mean to him to get *full-color snapshots* of them together.

With the revolutionary new Kodacolor Film, anyone—in good sunlight—can take these beautiful color snapshots with an ordinary Kodak or Brownie. From the negatives, the Kodak Company makes Kodacolor Prints—full-color snapshot prints on paper.

Since Kodacolor Film is precious today—save it for important occasions. All Kodacolor Film is processed at Kodak's laboratories. Ask your Kodak dealer for details . . . Eastman Kodak Company, Rochester, N. Y.

THE MARCH OF COLOR

IN 1928 Kodak brought out a film for making home movies in full color.

IN 1935 Kodak introduced full-color Kodachrome Film—making color movies available to every home.

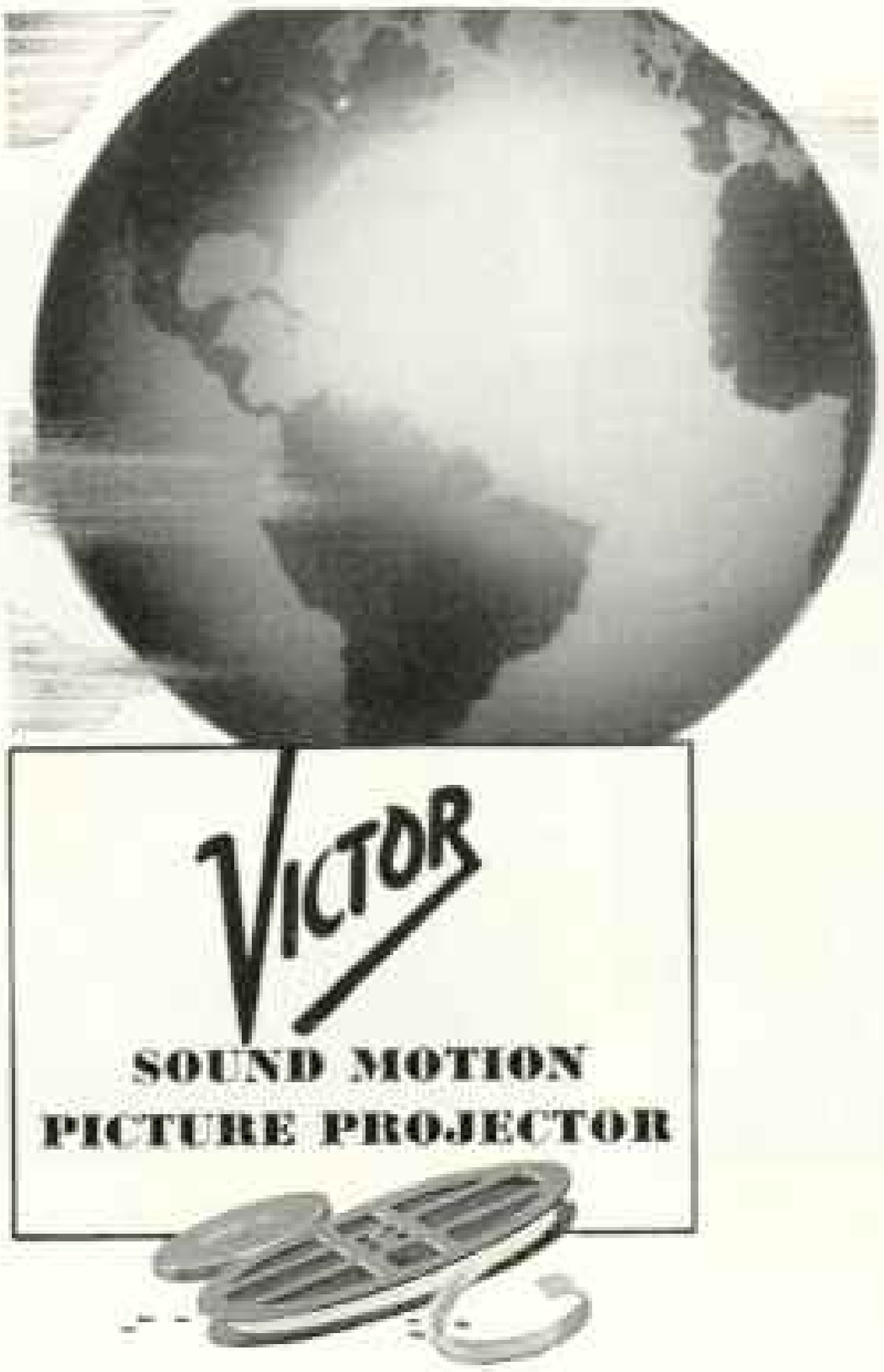
IN 1936 Kodachrome "still pictures," shot with a Kodak Bantam or 35-mm. camera, became the joy of tens of thousands.

IN 1938 Kodachrome sheet film led to full-color photographs in magazine and newspaper illustrations.

IN 1941 Kodak introduced Minicolor Prints from miniature Kodachrome Film transparencies—the first direct full-color photographic prints.

IN 1942—Kodacolor Film fulfilled the dream of generations—color snapshots, full-color prints made from color negatives in an ordinary roll-film camera.

Kodak Research has made Color Photography a part of everyone's life

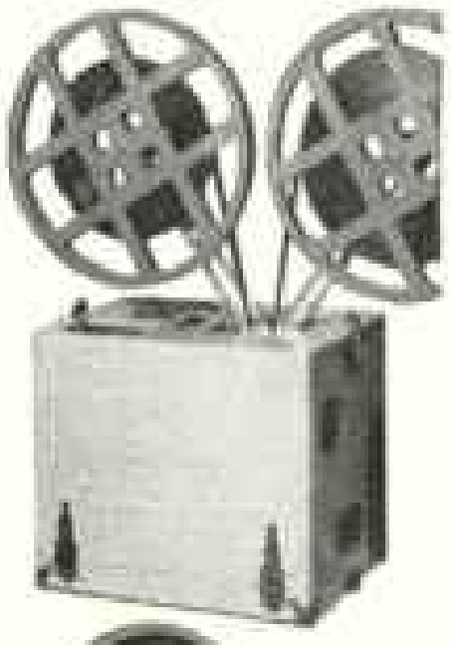


VICTOR

SOUND MOTION PICTURE PROJECTOR

..Unfolding New Worlds

Vocational Films . . . Instructional Films . . . Military Films . . . Government Films . . . Films of every description in an unprecedented array, and covering an unbelievable scope and magnitude of subjects . . . Films that are revolutionizing the training of millions of men, women and children—will all be available for every educational and business purpose.



It took a War to do it

The pressure of Total War — the immediate urgency of accelerating the training of millions in war jobs has proved beyond all doubt the tremendous advantage in using the 16mm motion picture medium of instruction. It has helped to bring about our Military Victories today — it will affect and benefit every educational institution, business and home in postwar years.

Then too, you can benefit by Victor's pioneering and leadership in supplying the World's Finest Sound Motion Picture Projector.

Buy War Bonds Now
Assure Earlier Victory

Victor 16

Sight Sound Sequence
THE WORLD'S GREATEST TRAINING FORCE

VICTOR ANIMATOGRAPH CORP.

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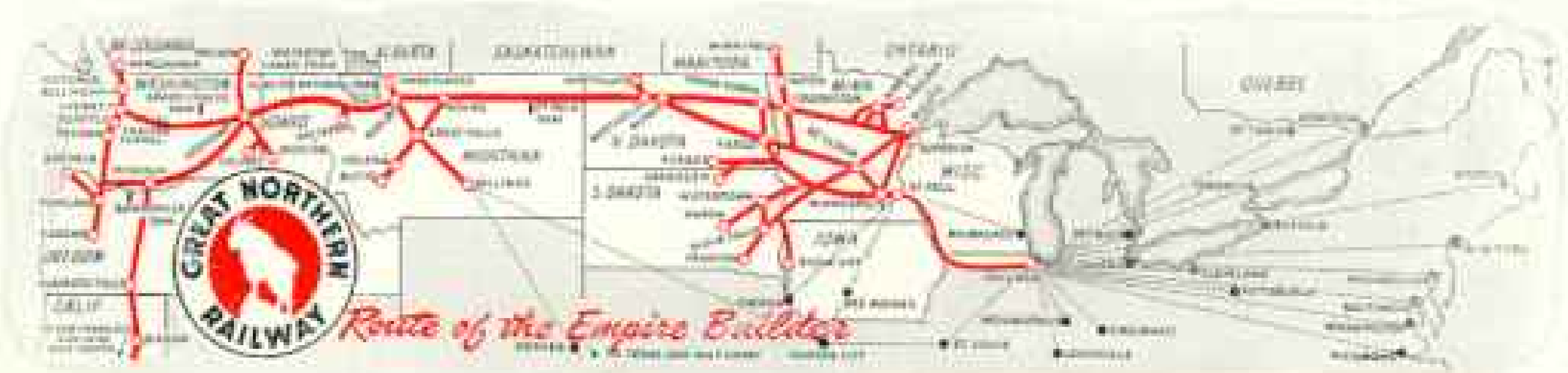
GREAT NORTHERN RAILWAY

BETWEEN GREAT LAKES AND PACIFIC



SKILLED "GROUND CREWS" HELP MAKE GREAT NORTHERN SERVICE DEPENDABLE

Five Men on Ground to Every Member of Train and Engine Crew

Railways have "ground crews," too—thousands of men (and women, these days) who perform the vitally-essential tasks which keep trains rolling.

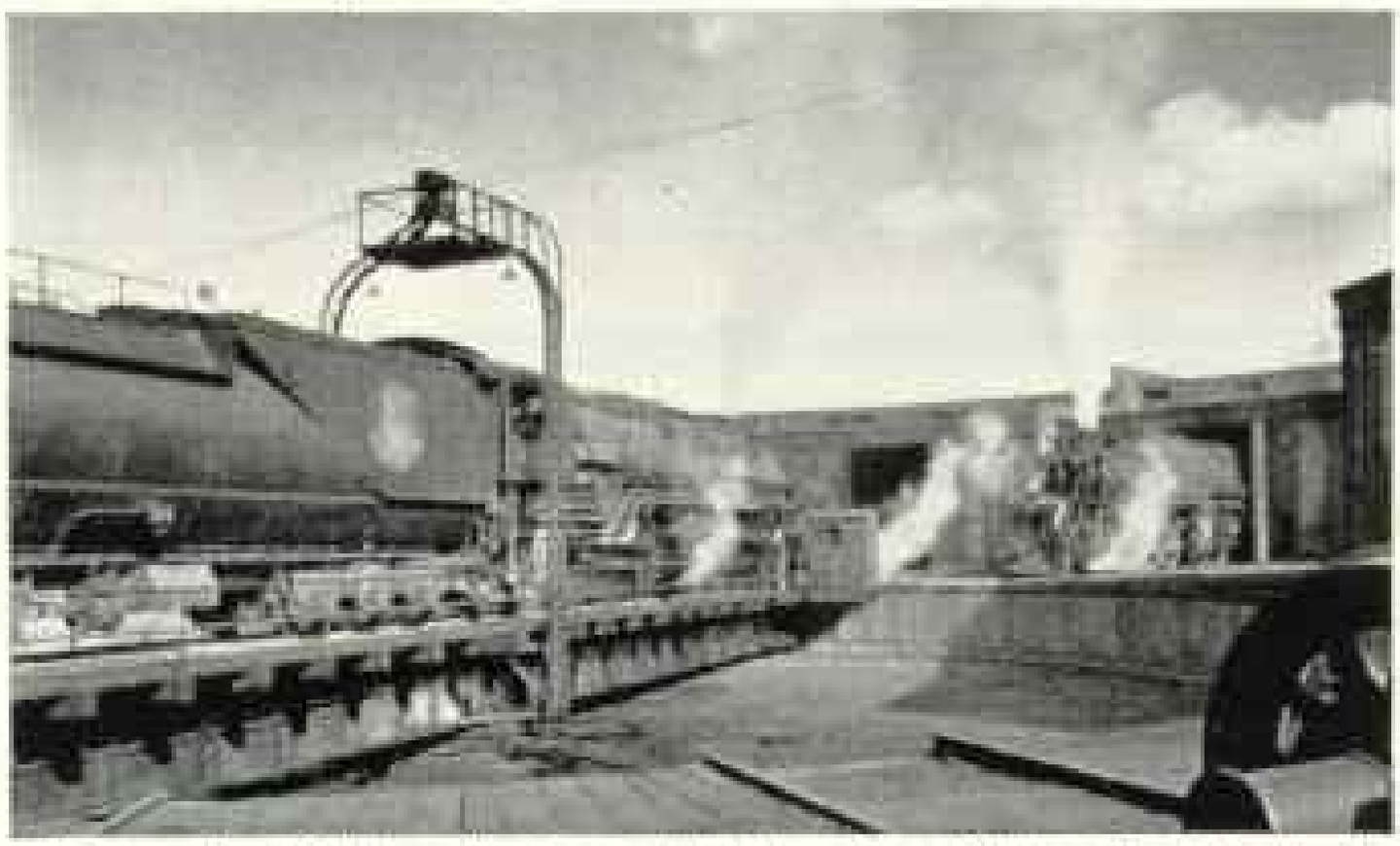
Movement of a 5,000-ton Great Northern freight train over a 400-mile division requires co-ordinated action by yardmen, car inspectors and servicemen, engine handlers, train dispatchers, water and fuel servicers, clerks, telegraphers, telephone operators and signalmen—**a 90-man "ground crew."**

Although not actually involved in train operation, there also are the maintenance-of-way crews who keep in shape Great Northern's tracks, signal systems, bridges, and other structures.

And, we're not forgetting the shopmen, who also are working around the clock repairing and rebuilding locomotives, freight cars, and other equipment.

Skilled "ground crews" are among the many things which make Great Northern great—*and a dependable transportation system.*

Boss of train movements is the dispatcher. This "ground crewman" is the nerve center of train operation.



Groomed by skilled mechanics, and all steamed up for the pulling job ahead, a big Great Northern locomotive leaves the roundhouse with a hostler at the throttle.

This "ground crewman" is oiling the bearing on which a car wheel rolls. Oil-soaked waste lubricates the bearing.

Installing new track. The machine drills holes thru the steel so that rail ends can be bolted solidly together.

A switchman throws a switch for an oncoming yard engine with cars for assembly into a train.

Huge power plants for B-24 Liberator bombers, moving toward completion on the Rohr production line.

5000 STEPS TO BERLIN

Starting with sleek Pratt & Whitney Motors, Rohr Production Fighters perform 5000 separate manufacturing, assembling and servicing operations in building up these motor nacelles, complete even to camouflage!

Each operation is a step on the road to Berlin, done with a precision that contributes to the on-time, over-target arrival of devastating bomb loads.

Men and women at Rohr add hourly to Allied aerial might. They're on the job around the clock, meeting the challenge of greater production . . . saving American lives by shortening the time to "unconditional surrender".

More War Bonds—
your steps to security.

ROHR
AIRCRAFT
CORPORATION

HELPING TO WRITE THE STORY OF TOMORROW

CHULA VISTA, CALIFORNIA

*DUES: Annual membership in United States, $3.50; Canada, $4.50; abroad, $4.50; life membership, $100. Remittances should be payable to National Geographic Society. Those from outside of continental United States and Canada should be made by New York draft or International money order.

RECOMMENDATION FOR MEMBERSHIP

IN THE

NATIONAL GEOGRAPHIC SOCIETY

** The Membership Dues, Which Are for the Calendar Year, Include Subscription to the National Geographic Magazine*

PLEASE FILL IN BLANK BELOW, DETACH, AND MAIL TO THE SECRETARY

_____ *1944*

To the Secretary, National Geographic Society,
Sixteenth and M Streets Northwest, Washington 6, D. C.:

I nominate _____

Occupation _____
(This information is important for the records)

Address _____

_____ *for membership in The Society.*

_____

_____
Name and Address of Nominating Member

3-44

Do you know that you may be literally throwing away as much as 10% of your valuable gasoline, if you're not using Macmillan RING-FREE Motor Oil in your car? Hundreds of motorists have proved that point! In 1094 Certified Road Tests with owner driven cars, the average gasoline saving was 1.3 miles per gallon after crankcase oil had been changed to Macmillan RING-FREE. Gasoline savings as high as 10% were not uncommon.

That's because RING-FREE reduces friction *fast* —delivers to the rear wheels more of the horsepower ordinarily used up in overcoming the internal friction of the motor itself. In other words, RING-FREE lubricates better!

In addition to this, RING-FREE actually removes carbon *while you drive.* Start today getting the multiple benefits of Macmillan RING-FREE Motor Oil — more gasoline mileage guaranteed* — carbon removal — less motor wear.

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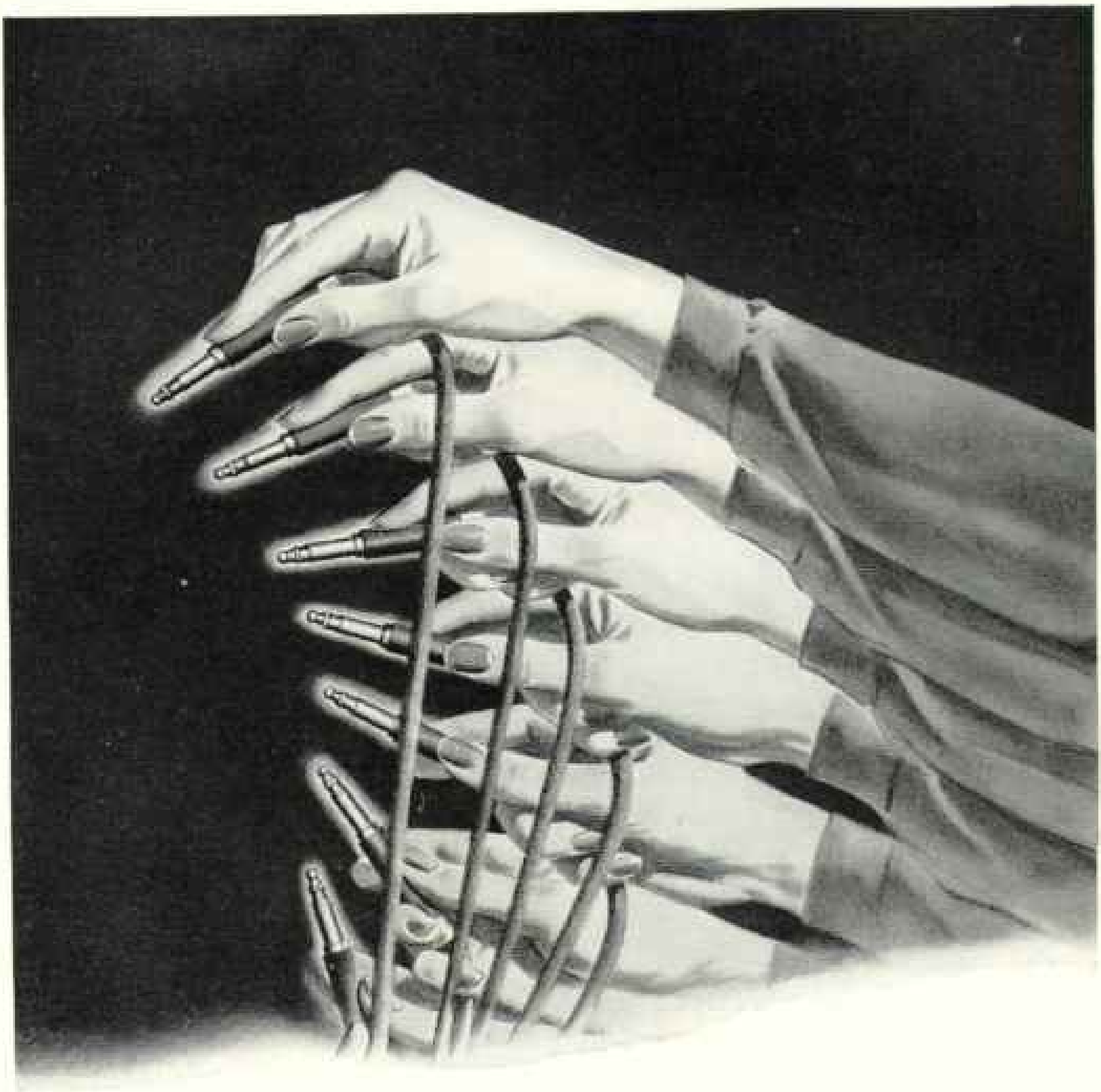
* **GUARANTEE**

Ring-Free Motor Oil is guaranteed to make your motor run smoother, give more miles per gallon of gasoline, reduce wear and repair; because it removes carbon, cleans the motor and reduces friction fast by thorough lubrication. Try a fill and if you are not satisfied that Ring-Free is doing these things, your money will be refunded by your dealer immediately.

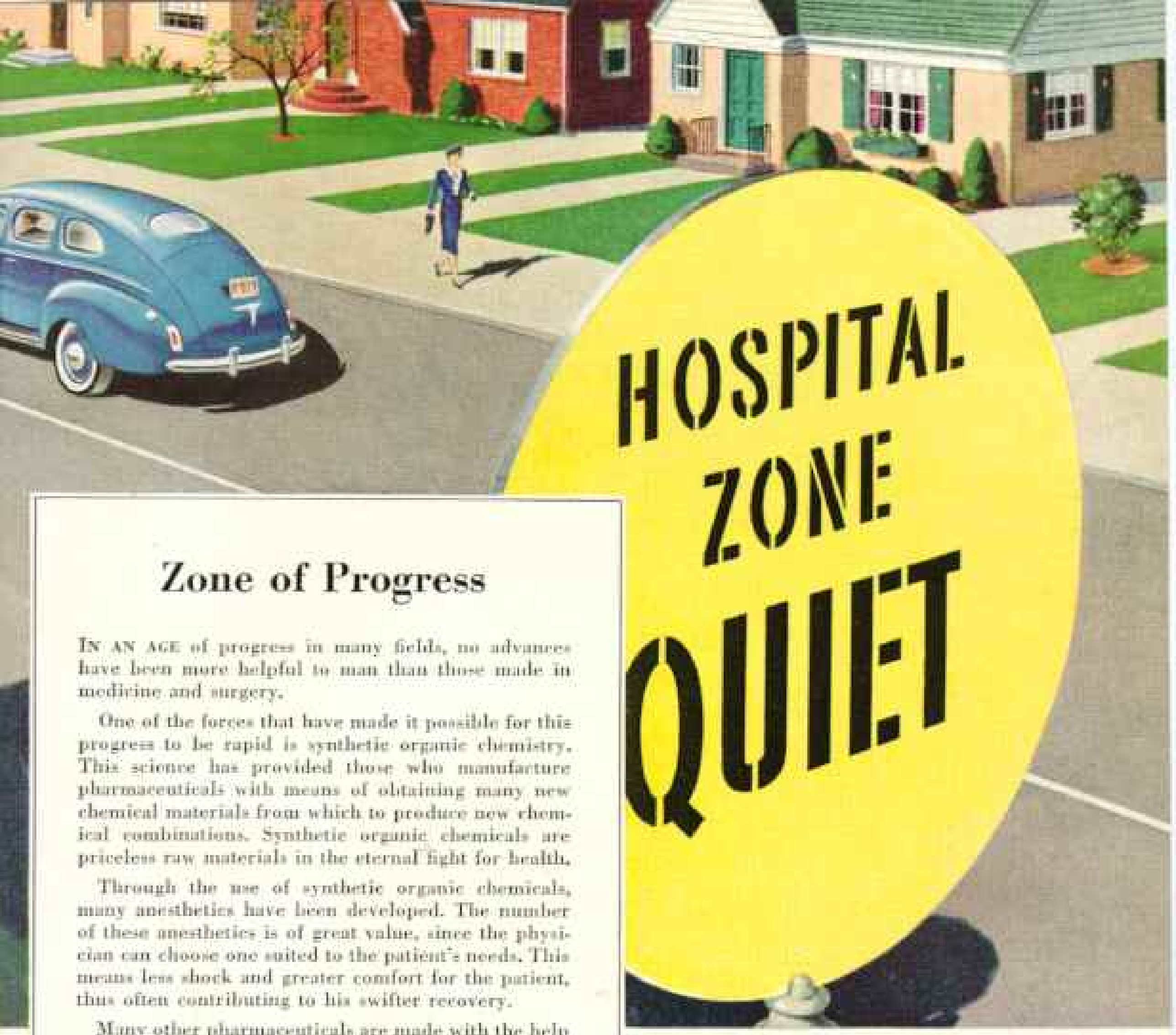


The Hurry Calls of War

War needs Long Distance more and more every day — *and night!* More calls are in a hurry than ever before.

When you must talk over crowded circuits, the Long Distance operator will say — "Please limit your call to 5 minutes." That's to help everybody get better service.

BELL TELEPHONE SYSTEM



Zone of Progress

IN AN AGE of progress in many fields, no advances have been more helpful to man than those made in medicine and surgery.

One of the forces that have made it possible for this progress to be rapid is synthetic organic chemistry. This science has provided those who manufacture pharmaceuticals with means of obtaining many new chemical materials from which to produce new chemical combinations. Synthetic organic chemicals are priceless raw materials in the eternal fight for health.

Through the use of synthetic organic chemicals, many anesthetics have been developed. The number of these anesthetics is of great value, since the physician can choose one suited to the patient's needs. This means less shock and greater comfort for the patient, thus often contributing to his swifter recovery.

Many other pharmaceuticals are made with the help of synthetic organic chemicals. Anti-malarial substances, synthetic adrenalin, man-made vitamins, antipyretics (to cut down fever), many kinds of sedatives, vehicles in which drugs are administered, and solvents used in extracting drugs from natural sources are some of the medicinal aids made possible by these chemicals.

CARBIDE AND CARBON CHEMICALS CORPORATION, the Unit of UCC which pioneered in the field of synthetic organic chemistry, has made more than 160 synthetic organic chemicals available in commercial quantities. Many of these chemicals are important in various ways in the pharmaceutical industry.

Pharmaceutical manufacturers, and research and technical men in chemical and allied industries, are invited to send for a copy of the 100-page booklet E-2, "Synthetic Organic Chemicals," which technically describes the properties and some of the uses of these chemicals in pharmaceutical and other fields.

BUY UNITED STATES WAR BONDS AND STAMPS

SAVINGS FOR YOU! Synthetic chemicals in tank-car quantities serve as solvents and raw materials throughout industry to make more and better things at less cost for you.

COLD-PROOF! Coolant for liquid-cooled aircraft engines and base for anti-freeze in military cars and trucks is ethylene glycol, an important synthetic chemical.

MAGIC PLASTICS! Wonderful plastics that look like glass, stretch like rubber, and which are proof against water, sunlight, oils, and many chemicals are made from SYNTHETIC synthetic resins.

MAN-MADE! All types of synthetic rubber require synthetic organic chemicals for their manufacture. Here's hope for tires for you in the future.

UNION CARBIDE AND CARBON CORPORATION

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