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Special Map Supplement of Mexico, Central
America, and the West Indies

SIXTEEN PAGES OF ILLUSTRATIONS IN FULL COLOR

A Half Mile Down

With 29 Illustrations

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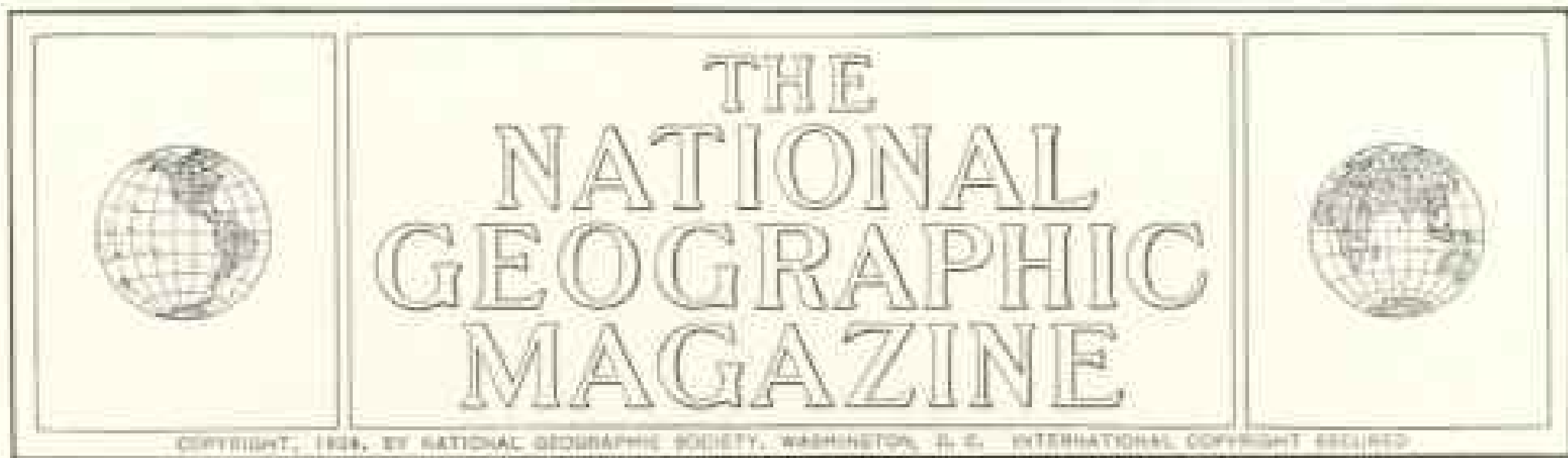
With 36 Illustrations and Map

BERNARD BEVAN

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A HALF MILE DOWN

Strange Creatures, Beautiful and Grotesque as
Figments of Fancy, Reveal Themselves
at Windows of the Bathysphere

BY WILLIAM BEEBE

The deep-sea investigations of Dr. William Beebe, oceanographic naturalist, during the season of 1934, financed and sponsored by the members of the National Geographic Society, are described by the leader of the expedition, who this year successfully established a new depth record of 3,028 feet in Bermuda waters.

THE Bathysphere lived throughout the spring, summer, and autumn of 1933 quietly in the Hall of Science of A Century of Progress Exposition at Chicago. In this time half a million people thrust their heads within the narrow doorway and murmured, "Thank Heaven, we don't have to go under water in this!"

Being only an inanimate mass of quartz and steel, she would remain the static creator of vicarious thrills until the Hall of Science passed away unless some activity more potent than slow corrosion and rust was brought to bear.

THE CALL TO ACTION COMES

The summons came at the end of her year, when her paint was still undimmed, her quartz eyes steadily watching; it came to me in a letter saying that the National Geographic Society would be glad to sponsor a new dive.

Four years ago Mr. Otis Barton and I had reached and returned from a depth of a quarter of a mile,* and later we had made a still deeper dive. However, knowing that

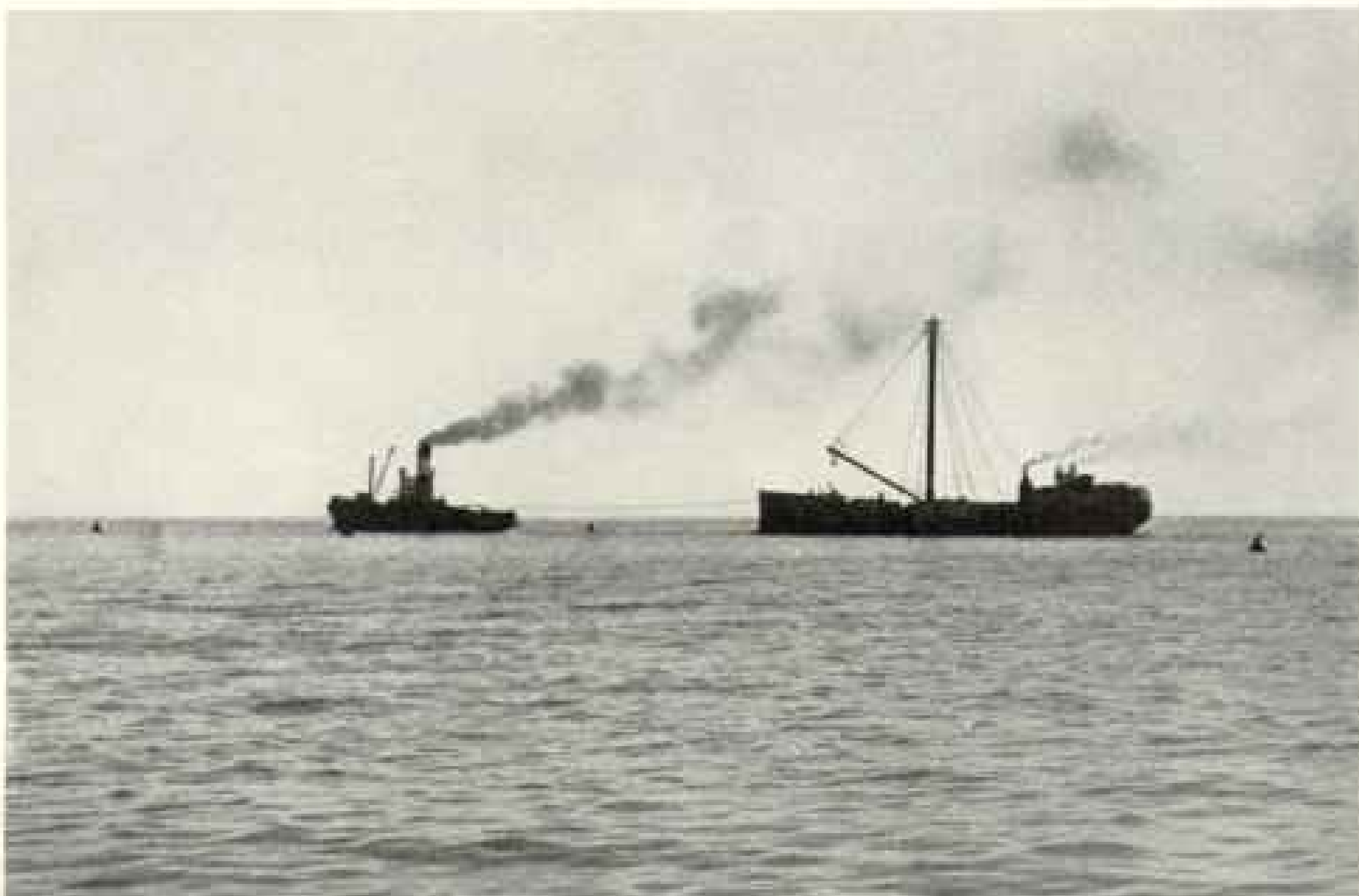
* See "A Round Trip to Davy Jones's Locker," by William Beebe, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1931.

my interest in the work lay only in scientific observations, the National Geographic Society made no stipulation of a record.

Friendly arrangements were speedily effected between the National Geographic and New York Zoölogical Societies, and early in March the new expedition was well under way, the twentieth of my Department of Tropical Research and the sixth year of oceanographic work off Bermuda.

The large blue sphere was roused from her long reverie one day and hoisted upon a freight car. The next time I saw her she was squatting disconsolately amid an enormous jumble of intricate machinery, whirling belts, and flying sparks in a factory at Roselle, New Jersey. She had returned to the place of her birth for a thorough overhauling.

As the Bathysphere rested on her present bed of steel filings she seemed as staunch and sturdy as ever. I would willingly have scrambled inside and trusted her to carry me down and back safely to any depth I chose; but the doctors of mechanics, gathered in consultation, were more skeptical and they began to assemble what in human hospitals would be stethoscopes and sphygmometers.



DAWN SILHOUETTES THE EXPEDITION'S "FLEET"

The tug *Powerful* tows the barge *Ready* through the narrow, winding entrance of St. Georges Harbor to the open sea for the unmanned test dive on August 7. The top of the Bathysphere shows on the forecastle of the barge, beneath the end of the boom. Coral formations and huge purple sea fans can be seen through the clear shallow water along the buoy-marked channel.



Photographs from Dr. William Beebe

THEY WITNESSED MAN'S DEEPEST OCEAN PLUNGE

The entire personnel, including the crew of the *Ready*, forgathered after the 3,028-foot dive August 15, six miles off Bermuda. The official staff, standing at the upper left, are (left to right): John Tee-Van, Jocelyn Crane, E. John Long, Gloria Hollister, William Ramsey, and Dr. William Beebe. Seated at extreme left is Otis Barton, Dr. Beebe's diving companion.

I peered in through the center window and it seemed as clear as ever, and then I was startled to see several radiating lines as from a fracture. I rubbed the glass, and a small spider ran over my hand, as at my touch the strands of cobweb disappeared. I left the experts to their intricate examination, and as I motored back to the city I laughed at the fright which the spider had given me and remembered that one of its relatives, the water spider,* could put to shame all of man's submarine efforts, whether with diving bells or Bathyspheres.

When I again visited the Bathysphere the physicians of inanimate things had made out a very bad case. The quartz eyes on close examination had shown a strange cloudiness, and minute fractures were visible to all eyes but mine.

No one but I would trust them again; therefore a test force was brought to bear—physical pressure—and the poor old lenses, which had so bravely withstood mighty loads of black water, cracked at comparatively low strains, about 900 pounds to the inch. Mr. Gerard Swope, of the General Electric Company, heard of this and generously ordered new windows of the finest possible material. The copper setting of the door and its central wing bolt of brass were found to be crystallized and had to be replaced.

When high officials of the Air Reduction Company viewed our old oxygen tanks and

* See "Afield with the Spiders," by Henry E. Ewing, in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1933.



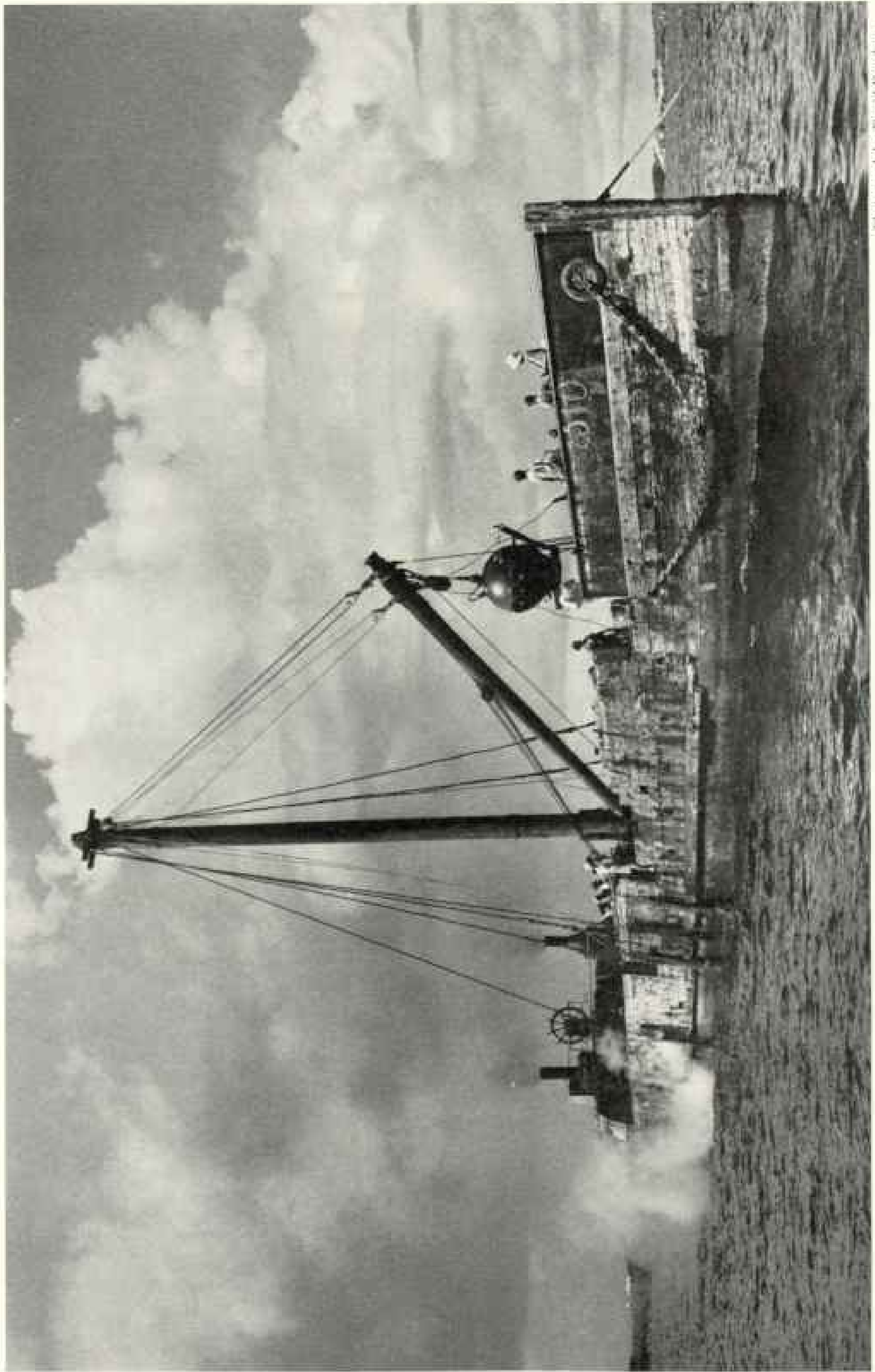
Photograph by John Tee-Van

COLUMBUSES OF THE LOWER DEPTHS

Dr. William Beebe (right) and Otis Barton are back on deck after their world's record dive of 3,028 feet. The United States and the National Geographic Society flags, carried down on man's deepest plunge, are attached to the cable, as they were during the descent.

chemical trays and saw our palm-leaf fans for circulating air, they said such things were more or less contemporary with the Stone Age. They forthwith devised a most effective arrangement—four superimposed trays with a diminutive electric blower which changed and purified all the air in the sphere every minute and a half.

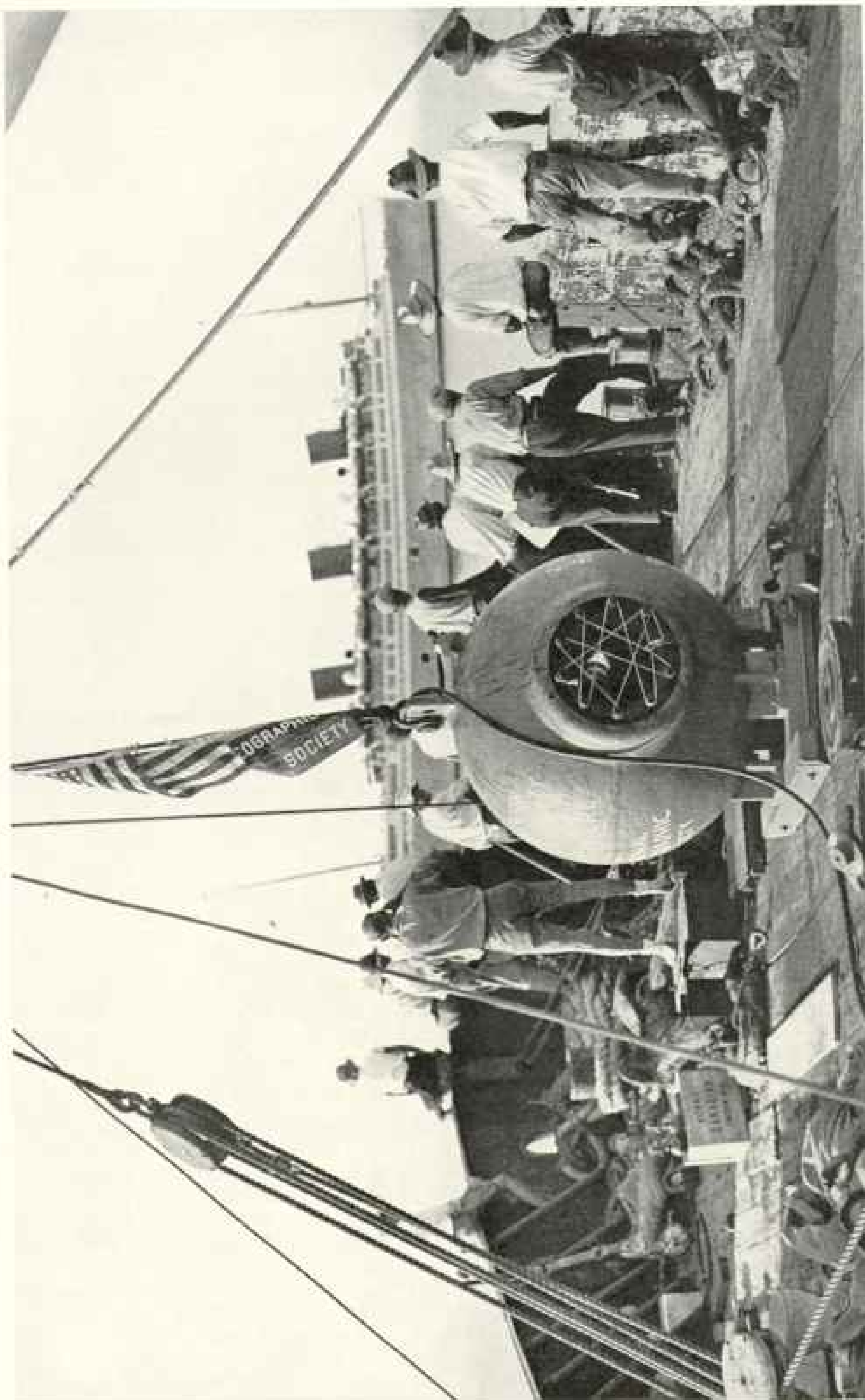
The old oxygen tanks were scrapped and new ones made to order and fitted with the latest thing in valves. Our former allowance of two liters of oxygen a minute was cut down to one, as quite sufficient. The visible gauge in the valve was a glass bubble which danced up and down in a tube,



THE MOTHER SHIP "READY" WAS ONCE A BRITISH MAN-OF-WAR

Following the deep-sea descent of August 11, when 2,510 feet was reached (note the chalked figures on the bow), a contour dive was made a mile off Nonsuch Island in 100 feet of water. Here the Bathysphere, with its rudder fins attached, is dangling in the air just before it was swung over the side (see page 668).

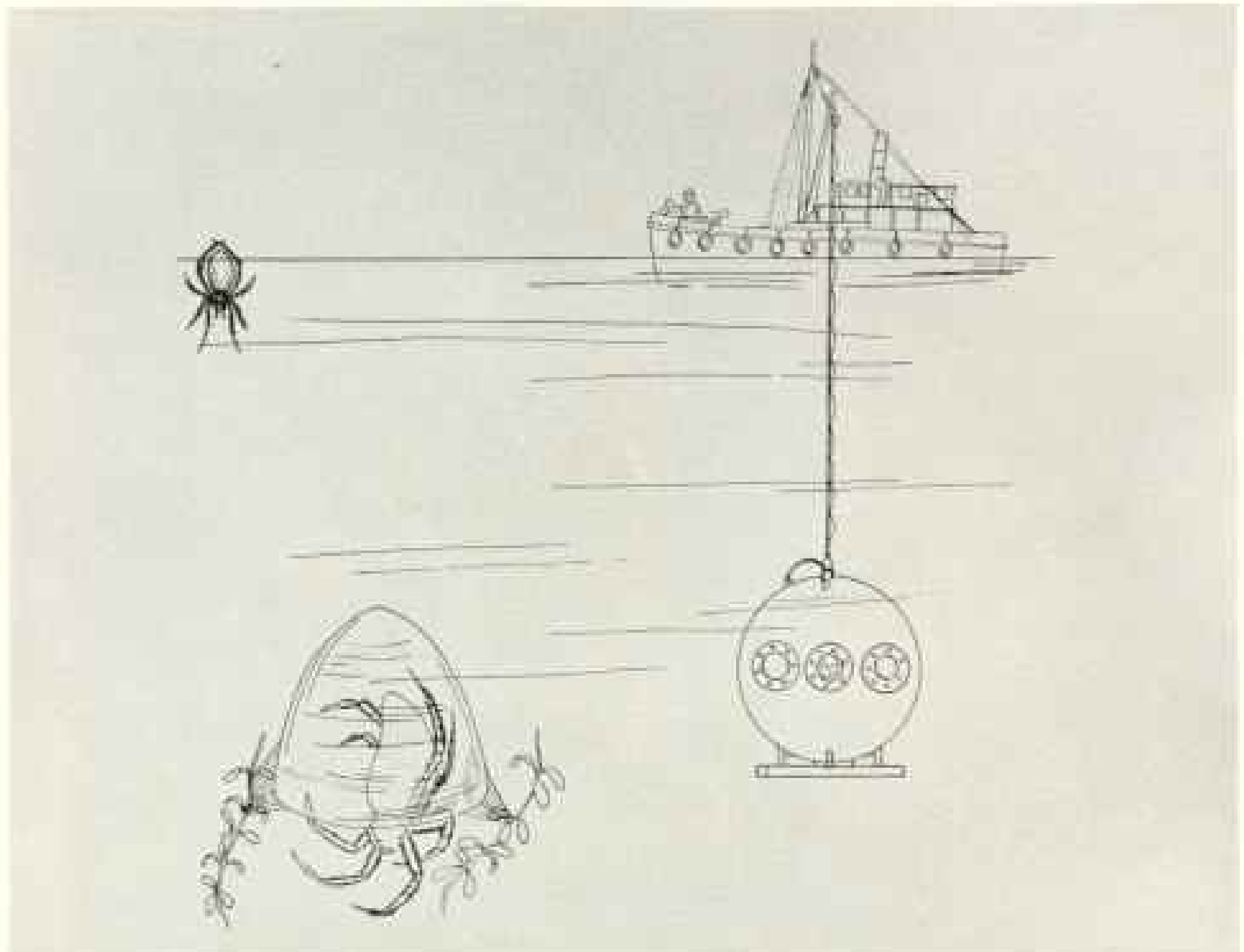
Photograph by David Keidson



Photograph by John Yee-Van

THE "MONARCH OF BERMUDA" SALUTES A NEW WORLD'S RECORD

Returning to St. George after the 3,028-foot dive on August 15, the *Ready* passed the giant Furness liner outward bound for New York. The hoarse siren of the mighty passenger ship joined the din of harbor craft celebrating the expedition's achievement.



Drawing by John Tee-Van

NATURE PROVIDED THE WORLD'S EARLIEST "BATHYSPIHERE"

Millions of years before man-made undersea devices were thought of, the water spider filled a sac with air and lived, ate, courted, and sheltered eggs in its under-water home. At the surface the artist shows one of these tiny creatures (not drawn to scale) capturing a bubble, which will be carried down and added to the store of air beneath the silken sheet fastened to aquatic plants.

balanced on a slender column of outpouring oxygen, and adjustable to exactly the right height and the fraction of a liter.

Even the earphones were replaced. The Bell Telephone Laboratories said that if I would let them have my old ones for their museum they would furnish sets of the latest models. Only a noncommercial naturalist about to undertake some new adventure or phase of exploration can ever realize the friendliness of hosts of people, and supposedly cold business corporations, who, perceiving an opportunity of adding to the factors of safety, go to all lengths of trouble and expense.

Finally the ten thousand and one details of an expedition such as this were initiated or completed and we were ready to depart for Bermuda. I cabled to Panama, inviting Otis Barton to join me if he wished, and he accepted, expressing a desire to concentrate on photography.

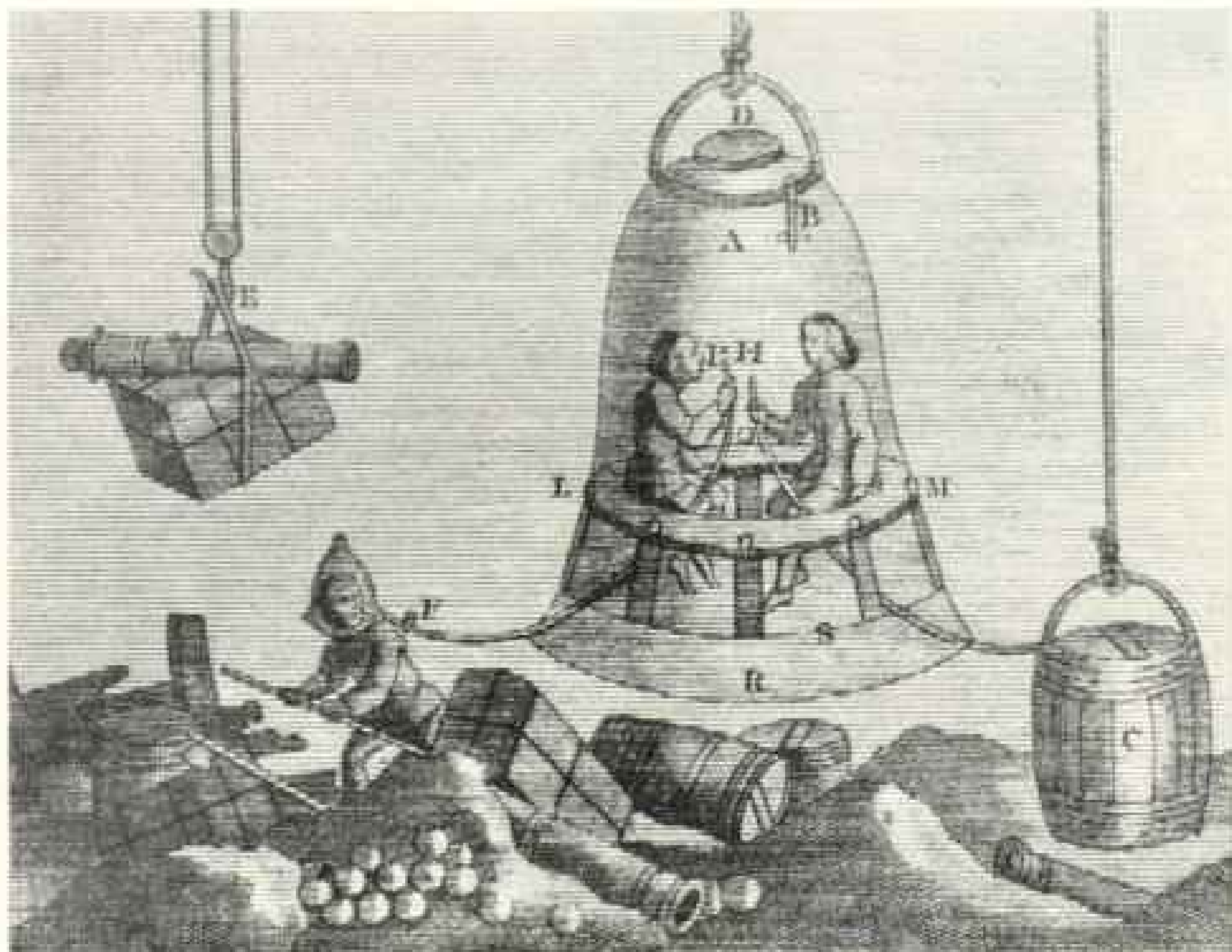
Together with Capt. H. J. Butler, Mr.

Barton first developed the idea of a deep-sea sphere and financed the initial cost. In the autumn of 1930 Mr. Barton presented the Bathysphere to the New York Zoological Society, and it is now playing an important part in the study of Bermuda shore and deep-sea fish, researches upon which my staff and I have been engaged for the last six years.

BACK TO THE MOTHER SHIP "READY"

The Bathysphere arrived in Bermuda on July 5, and I visited her while she was deep down in the lowest hold of the *Monarch of Bermuda*, half hidden by cargo. Later in the same day she was hoisted into the blazing sunlight and lowered gently onto her old mother ship, the *Ready*.

Early on the first clear morning I took my associate, John Tee-Van, and my two assistants, Bass and Ramsey, down to the farthest end of St. Georges Harbor, where, in the midst of a welter of ancient ships,



Photograph from Dr. William Berbe

THIS EARLY DIVING BELL ACTUALLY WORKED

Fresh air was sent from the surface by alternating barrels, each of which was connected with the device by a leather hose. A single diver could work out on the open sea bottom by wearing a skin helmet, similarly tethered. Halley, the 18th-century physicist and astronomer, used such an arrangement in 9 to 10 fathoms of water for periods of an hour and a half.

we found the *Ready*. Near by lies a Peruvian gunboat, once bought by some Americans for a round-the-world cruise, which died a natural death in these waters.

Here, too, is the tug *Gladisfen*, newly painted, which for five years has faithfully drawn deep-sea nets—1,500 of them—through the waters of our eight-mile circle off Nonsuch Island. Our old friend, the *Tairun*, was another familiar sight, a three-masted schooner slowly rusting away on an even keel, to whose side the *Ready* was lashed (see map, page 670).

Our poor old Bathysphere appeared rather like some ancient Galápagos tortoise, or the shell of a sea turtle, scarred and dull, barnacled and stained. Her dark-blue color was sadly marred and scratched by her long journey, and her great eyes were closed with wooden lids.

With an impromptu block and tackle we got off the heavy door and took out all the new gear. I pried off the thick wooden eye

plugs, and the new quartz lenses gleamed with the sheer transparency of mighty Koh-i-noor diamonds. New steel frames, much stronger than those which had been used before, held the three-inch-thick masses of quartz as firmly as if they had been part of the very steel.

An entire month was consumed in assembling, refitting, and testing all the intricate machinery, from the seven-ton winch, which was as nearly perfect as when I first used it on the *Arcturus*, almost ten years ago, to the delicate Friez temperature and humidity recorder.

Most of the instruments in the Bathysphere were intended to increase ease and clarity of vision through the quartz windows, but I was extremely anxious to utilize the facilities of these deep-sea dives in every possible direction, from the point of view of physics as well as that of zoölogy. Two difficulties presented themselves: first, the relatively small space left to us after the



Photograph by John Ten-Van

A FEW MORE TURNS, AND THE BOLT WAS RIPPED FROM HIS HANDS

During a test dive in 1932 one of the quartz windows leaked, and an implosion filled the Bathysphere with water at terrific pressure. The sphere was hoisted so rapidly that the imprisoned water could not escape. As the wing bolt (above) was unscrewed, air and water whistled through the cracks with a strange, high, singing sound. What happened a moment later is shown in the illustration on the opposite page.

disposition of our instruments and ourselves, and, second, the comparatively short time we should be able to remain at the greatest depths.

SPECTROGRAPH TOO LARGE FOR THE DOOR

Dr. George L. Clarke found that the only satisfactory spectrograph available was too large to go in through the 14-inch door. Concerning the recording of cosmic rays, Dr. R. A. Millikan wrote: "The rate of discharge is so exceedingly slow at great depths that we shall not be able to get any readings at all in the time during which you can stay down."

Throughout this month we shuttled back and forth among our three focal points—living quarters at the Bermuda Biological Station; the complete laboratory of the New York Zoölogical Society at New Non-such, the home of our library, instruments, and collections, where all of our preparations and researches are carried on; and finally our fleet—the *Skink*, *Gladisjen*, and

Ready, 15 minutes away in St. Georges Harbor, the direct link between ourselves and our oceanographic investigations.

On the sixth of August, when we were ready to put to sea, our grand captain, Jimmie Sylvester, announced that he wanted a rehearsal for the whole crew, while we were still tied up to the ancient three-master close to shore. We all for-gathered, set the instruments to work, put every man at his station; and Mr. Barton and I climbed into the Bathysphere.

The heavy door was lifted and swung home with its old familiar clang. There followed the ear-splitting crash of hammer on wrench as one mighty nut after another was twisted home (see page 673). Soon after, a warning came through the telephone and we were lifted and swung back and forth over the deck. It has always struck me as rather amusing that as a preliminary to descent we must always rise about 20 feet toward the stratosphere!

Within a minute or two I was surprised



Photograph from Dr. William Beebe

EXPLOSION FOLLOWED IMPLOSION

After clearing the deck in front of the sphere, Dr. Beebe jumped to one side of the hissing wing bolt and gave it a final twist. Like a shell from a cannon, it shot across the deck and crashed into the steel winch 30 feet away. The trajectory was almost flat, and the whole ship was drenched with the spray and water which, suddenly released, roared from the interior of the Bathysphere. Any one who had been in the way would have been decapitated (see text below).

to see the humidity dial shoot across the record card, and I realized that our new apparatus was working with swiftness and accuracy. The chief reason for this abrupt approach to saturation point was Mr. Barton, who was sitting, soaked to his skin, on his side of the Bathysphere. My canoe had tipped over alongside, and he had valiantly dived overboard to right her and salvage the paddles.

FOUR FEET DOWN, AND A LEAK

We swung up and overside and then down into the water through a smother of foam and bubbles, but without the slightest jar. Instantly I forgot the dials and records, for through the window appeared a dense mist of small fry, excitedly swimming about us. Although there must have been something more than a hundred-degree angle between the sun and my eyes, yet every individual fish made an occasional heliograph of itself, and as it turned sideways shot down a dazzling flash from its silvery sides.

My ichthyo-physics were suddenly interrupted by a feeling of chill about my feet and ankles, and, reaching down, I found about eight inches of water. Barton leaned to one side and I saw a perfect cataract of water pouring in from both sides of the door. His saturated condition had made him oblivious of the new source of wetness. From our depth of not more than four feet I called for an immediate ascent.

This shallow test dive had seemed so brief and safe that it had very reasonably been thought that four of the great nuts would hold the door in place instead of the ten used on deep dives. The result was a joking matter, but nevertheless showed how necessary it was never for an instant to relax precautions.

This incident brought vividly to mind the most serious accident we have ever experienced in deep-sea diving. Two years ago we attempted to replace the steel plate in the port socket with a window of fused



Drawn by Albert H. Bonstead.

THE DIVING AREA LIES SOUTHEAST OF BERMUDA

Most of Dr. Beebe's deep-sea researches have been conducted within the dotted circle (lower right). The reefs near North Rock (upper left) afford rich fields for a diver with a helmet to study shallow-water fishes and coral formations (see text, page 692).

quartz, and on our next day at sea we lowered the empty Bathysphere to a great depth in a test dive.

After letting her hang quietly for a few minutes, we pulled her up for inspection. Even when she was only half out of water it was apparent to the experienced eye that something was very wrong. When she swung clear, I saw a needle of water shooting across the face of the new window.

Weighing much more than she should, she was lifted wabbling over the side and lowered to the deck. I looked through one of the old windows and could see that she was almost full of water. There were curious ripples on the surface of the enclosed water.

I began to unscrew the giant wing bolt in the center of the door. After the first

few turns, a strange, high singing came forth; then a fine mist, steamlike in consistency, shot out. Another and another warned me of what I should have sensed when I looked through the window—that the contents of the Bathysphere were under terrific pressure.

I cleared the deck in front of the door of every one, staff and crew. One motion-picture camera was placed on the upper deck and a second close to, but well to one side of, the Bathysphere. Carefully, little by little, two of us turned the brass handles, soaked with the spray; and I listened as the high, musical tone of impatient, confined elements gradually descended the scale. Realizing what might happen, we leaned back as far as possible from the direct line of fire.

Suddenly, without the slightest warning, the bolt was torn from our hands, and the mass of heavy metal shot across the deck like a shell from a gun. The trajectory was almost straight, and the brass bolt hurtled into the steel winch 30 feet away, shearing out a half-inch notch!

This was followed by a solid cylinder of water, which slackened after a while to a cataract, pouring out of the hole in the door, air mingling with the water, looking like hot steam instead of compressed air shooting through ice-cold water. If I had been in the way I should certainly have been decapitated (see illustrations, pages 668, 669).

All my life I had read of the terrific pressures at great depths and had seen bottles and tin cans come up crushed,

but never until then had I had first-hand visual proof. We tested the water temperature and found it 56 degrees Fahrenheit, which showed that the primary break had occurred about 2,000 feet down. When I bailed out the rest of the water we pushed out the new quartz window and found it to be in perfect condition. The whole trouble had been in the packing.

Thus I have seen the results of an implosion in the Bathysphere 2,000 feet down, where in the icy blackness we should have been crushed into shapeless tissues by nothing more substantial than air and water.

Prophecy for August 7 was squalls and uncertain winds. For no special reason I selected it as a possible first day at sea, and the night before ordered steam up in the tug and the boilers

of the barge. At 5 o'clock dawn a glance at the slender, motionless cedar tips beyond my veranda justified my gamble. After a hasty breakfast we chugged down harbor in the *Skink* in pursuit of the ancient *Ready*, with her precious globe of ultramarine just showing above the bulwarks and shining in the rain-washed air.

Farther ahead the great towing cable alternately became taut and slacked off, now dipping below the surface, now snapping up into steellike rigidity, flicking a vertical wave of foam into the air. The tug threaded its way through the narrow hole-in-the-wall, and we lifted quietly on the gentle, breathing swell of the open ocean.

Gentle though the swell was, and flat calm as the sea appeared when we trans-



Photograph courtesy of the Bibliothèque de Tournaï, Brussels, and of the New York Public Library

A 13TH-CENTURY FRENCH MANUSCRIPT PRESENTS ALEXANDER THE GREAT AS A DIVER

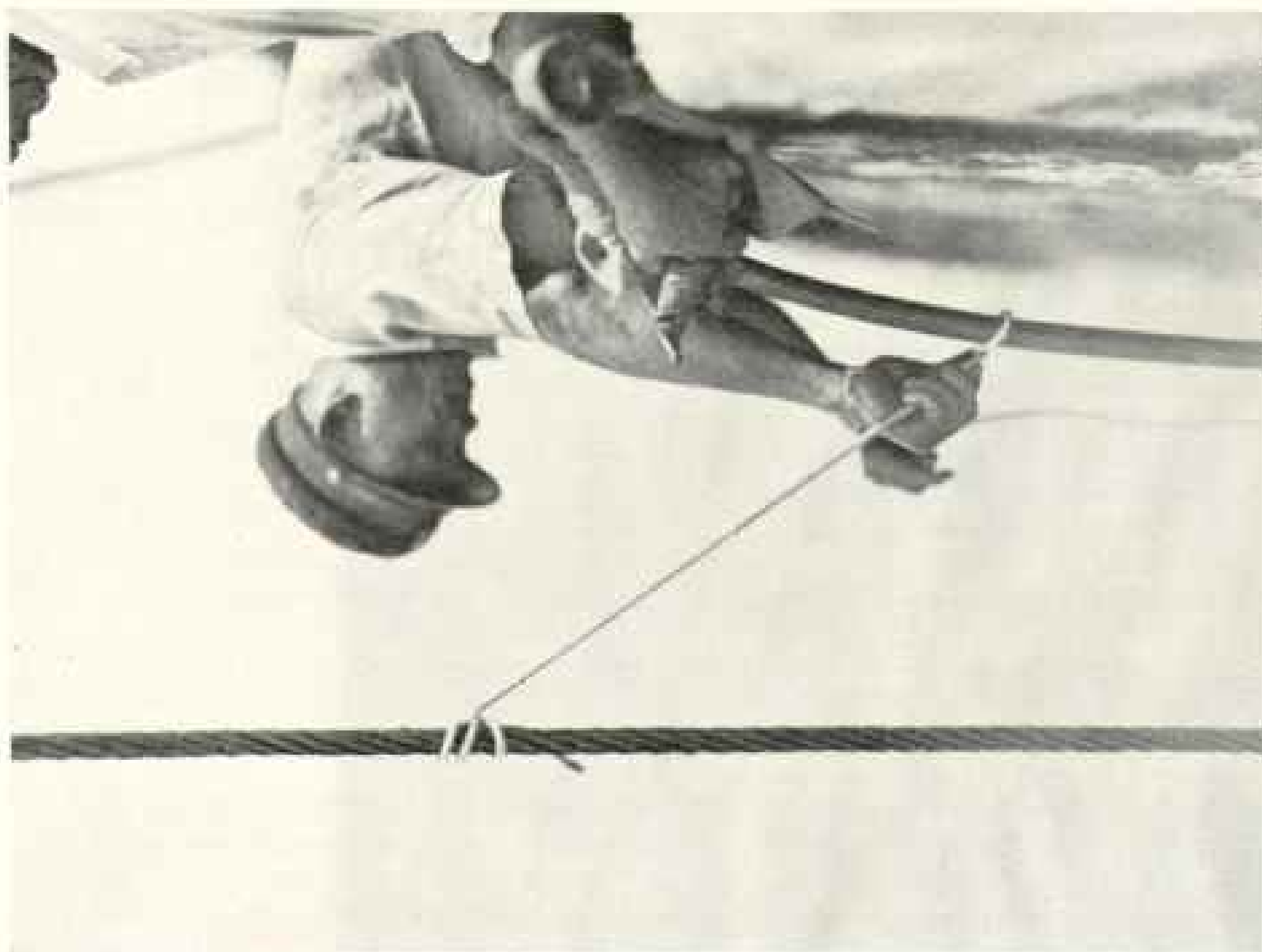
The famous ruler who sighed for new worlds to conquer was, legend says, the first man to go deep into the ocean merely to look at fish. Several versions of the story declare that he saw a monster which took three days to swim past his glass cage!

ferred to the *Ready*, the rise and fall were as inexorable as the movement of some mighty engine, and we had to throw our gear with precision and time our jumps accurately to avoid serious trouble.

A MILE OF WATER UNDER THE KEEL

Two hours later Bermuda was only a string of pale beads seen through a mist of rain along the horizon, and careful sights showed that we were well within our eight-mile circle. Here I knew I had a mile or more of water under the keel, and we slowed down.

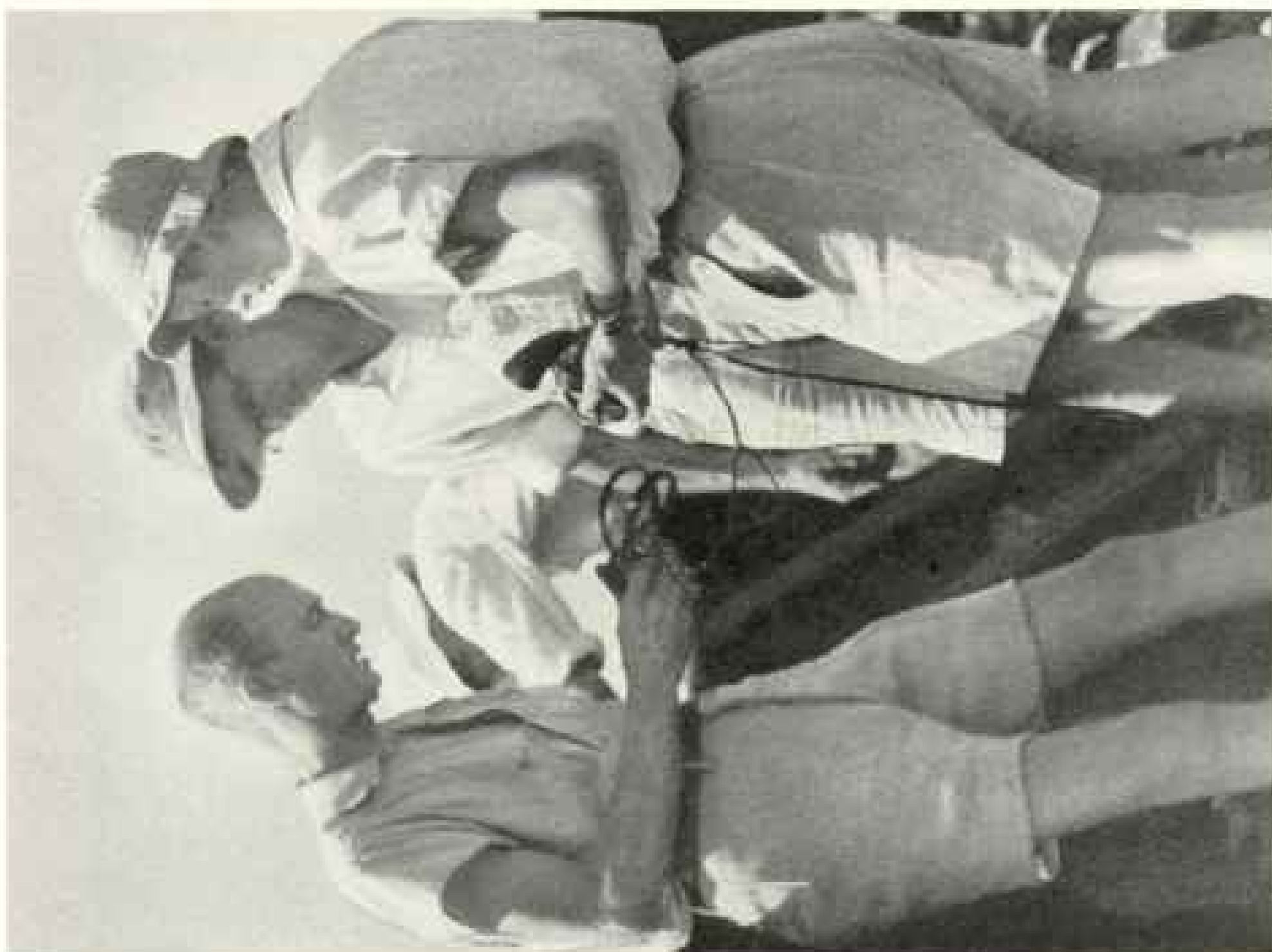
The Bathysphere had been stripped for a test dive, the two instruments left inside being a temperature and humidity recorder and Mr. Barton's automatic camera. The



Photograph by John Tee-Yan

SKILLED HANDS TIE ON THE COMMUNICATIONS CABLE

At intervals of 100 feet the rubber-sheathed strand carrying the telephone and electric power lines is fastened to the main supporting wire. Formerly iron clamps were employed, but these were discarded in favor of rope, which could be cut in case a quick ascent became necessary.



Photograph by David Knudsen

INSPECTION OF TELEPHONES PRECEDES EACH DESCENT

Hundreds of messages pass up and down the slender wires that constitute the only communication with the outside world. Five seconds is the longest period of silence permitted between calls; for those on each end of the line must know constantly that all is well.



"HELLO! IS THIS DAVY JONES'S LOCKER?"

Miss Gloria Hollister and John Tee-Van, Dr. Beebe's associates, indulged in a bit of persiflage as the Bathysphere dangled at nearly half a mile below the surface of the sea on August 11, 1934. They were alert, however, for any sound that might indicate trouble below.



Photographs by David Kaufman

THE ANVIL CHORUS IS EAR-SPLITTING TO THOSE INSIDE

Every one of the ten heavy nuts which seal the 400-pound door of the Bathysphere must be tightened with wrenches struck by heavy hammers. To the explorers within, the din is terrific. The central wing bolt has not yet been screwed into the door.



Photograph by Robert Hartley

HEAD FIRST IN FOR A DIVE!

Dr. Beebe goes aboard in true diver's fashion. When he has settled himself on the cold, hard bottom of the sphere, Mr. Barton crawls in, and the door is bolted tight. Wriggling over the sharp steel bolts is the most painful experience of the whole adventure.

only difference between this dive and a regular one is that we were not inside, and of course no messages came and went over the telephone wires.

When everything was set, each person at his post, and the *Ready* momentarily balanced on an even keel, Mr. Tee-Van gave a signal, Captain Sylvester threw a thread of steam into the mighty winch, and, delicately as a fine watch, the huge drum began to turn, the cable tightened, and the Bathysphere rose slowly, straight upward to the nose of the boom.

It swung there for a moment and then a second winch came into play, and boom and sphere moved outward. When far enough

from the side of the *Ready*, the cable paid out rapidly and, before the oncoming swell could rise and exert its effect, the Bathysphere was safe, several feet under water.

Then the boom winch swung its burden in toward the *Ready* until the cable was within reach of a cluster of men at the bulwarks. These were in charge of the telephone cable, of which more than a half mile lay in many oblong coils along one side of the deck. A file of men lifted this heavy, solid-rubber hose and passed it carefully out and overboard as the Bathysphere descended. Every hundred feet it was fastened by a master carpenter with a cunning knot and sling of rope to the steel cable (672).

DUTIES OF THOSE ON DECK

Within earshot of Miss Crane, the depth-recorder, and in full view of the whole operation, Miss Hollister sits with earphones and mouthpiece, recording everything I see from

within the Bathysphere, relaying my orders to Tee-Van, and sending down whatever information concerning depth, time, and weather I may desire (see illustration, page 673). Perkins Bass and William Ramsey, of my staff, are in full charge of the generators. They are also responsible for the cable marking. Mr. Tee-Van has an extra pair of earphones, in case of emergency, and an abundance of loose, small telephone wire, giving him sufficient play to enable him to walk about at will.

The empty Bathysphere swung overside about 11:30 a. m. Less than an hour and a half later the cable record indicated that the sphere was dangling at a depth of 3,020

feet. Mr. Barton, by an electrical device controlled through the cable, exposed 400 feet of film, and, after a total of three hours of blazing sun, alternating with driving rain and chilling breezes, the Bathysphere was again on deck.

I peered in through the cold, dripping windows, and the test was perfect. Not a drop had leaked through windows, stuffing box, or door. The card of the atmosphere recorder told the story of the air temperature, beginning with 91 degrees Fahrenheit at the surface and touching 51 degrees in the lowermost depths.

Later in the week I threw my dice against unsettled weather, and again I won. At 9:30 a. m. on Saturday, August 11, I looked about from the deck of the *Reedy* and saw the long, low swell of a calm day. We were well within the magic circle, $6\frac{1}{2}$ miles south-east of Nonsuch Island, and at once slowed down, headed upswell, and prepared to dive

More than three and a half years ago I wrote for the NATIONAL GEOGRAPHIC MAGAZINE (see footnote, page 661) an account of a dive to a depth of 1,426 feet. Here I was again on the selfsame ancient barge with the identical Bathysphere and within a mile and a half of the very spot where I had made the former descent. An equal distance to the east marked the spot of a more recent dive to 2,200 feet.

All the sights which came to my eyes are as vivid now as then; yet, on the eve of this new venture, I felt as if the former dives had been nothing but amazing dreams; that my ignorance of the world of life beneath our feet was almost complete.



Photograph by David Knudsen

HEAD FIRST OUT COMING UP!

Second in discomfort to entering the Bathysphere is the tumble over the rough-edged doorway upon emergence. All dignity is tossed to the winds until the divers have regained their balance. Mr. Barton watches at the left while the leader gingerly crawls forth.

However, my chief concern at the moment was to wriggle over the unpleasant bolts with as little damage as possible, coil myself up in the window sector of the Bathysphere, clamp on my telephone outfit, and arrange all my instruments and small but necessary possessions.

Adequate presentation of what I saw on this dive is one of the most difficult things I ever attempted. It corresponds precisely to asking a foreigner who has passed a few hours in New York City, "What do you think of America?" Only the five of us who have gone down even to 1,000 feet in the Bathysphere know how hard it is to find words to translate this world.

At 9:41 we splashed beneath the surface, and, often as I have experienced it, the sudden shift from a golden yellow world to a green one was unexpected. After the foam and bubbles had passed from the glass, we were bathed in green; our faces, the tanks, the trays, even the blackened walls, were tinged. Yet, seen from the deck, we apparently descended into sheer, deep ultramarine.

OCEAN SURFACE BECOMES A CEILING

We were dropped several fathoms, and dangled there awhile until all the apparatus on deck was readapted to the vertical cable close to the ship's side. I made the most of my last glimpse of the upper world. By peering up, I could see the watery ceiling crinkling and slowly lifting and settling, while here and there, pinned to this ceiling, were tufts of sargassum weed. I could see small dots moving just below the weed, and for the first time I tried, and successfully, to focus low-power binoculars through the water. I had no trouble in recognizing a small ocean turbot and a flying fish trailing its half-spread wings as it swam.

A question came over the phone, an answer went, and down we slipped through the water. As I have said, the first plunge erases to the eye all the comforting warm rays of the spectrum. The red and the orange are as if they had never been, and soon the yellow is swallowed up in the green. Although the cheerful rays are only one-sixth of the visible spectrum, yet, when they are winnowed out at a hundred feet or more, all the rest belongs to chill and night and death, helping us to understand why it is not red blood and scarlet flames that paint the real horror of modern war, but the terrible grayness of gas, the ghastly blue of Very lights.

The green faded imperceptibly as we went down, and at 200 feet it was impossible to say whether the water was greenish-blue or bluish-green. I made my eyes focus in midwater and saw small creatures clearly, copepods and others of the innumerable swarms which haunt the upper layers.

At 320 feet a lovely colony of siphonophores drifted past, appearing like spun glass. Others, which I saw at far greater and blacker depths, were illumined; but whether by their own or by reflected light I cannot say. These are colonial creatures, like submerged Portuguese men-o'-war, and, similar to those beautiful beings, are

composed of a colony of individuals which perform separate functions, such as flotation, swimming, stinging, feeding, and breeding, all joined by the common bond of a food canal.

When scores of Bathyspheres are in use we shall know much more about the vertical distribution of fish than we do now. For example, my next visitors were good-sized yellow-tails and two blue-banded jacks, which examined me closely at 400 and 490 feet, respectively. There were so-called surface fish happy at 80 fathoms (480 feet).

At 600 feet the color appeared to be a dark, luminous blue, and this contradiction of terms shows the difficulty of description. As in former dives, it seemed bright, but was so lacking in actual power that it was useless for reading and writing.

There are certain nodes of emotion in a descent such as this, the first of which is the initial flash of animal life. This came at 670 feet, and it seemed to close a door upon the upper world. Green, the world-wide color of plants, had long since disappeared from our new cosmos, just as the last plants of the sea themselves had been left behind, far overhead.

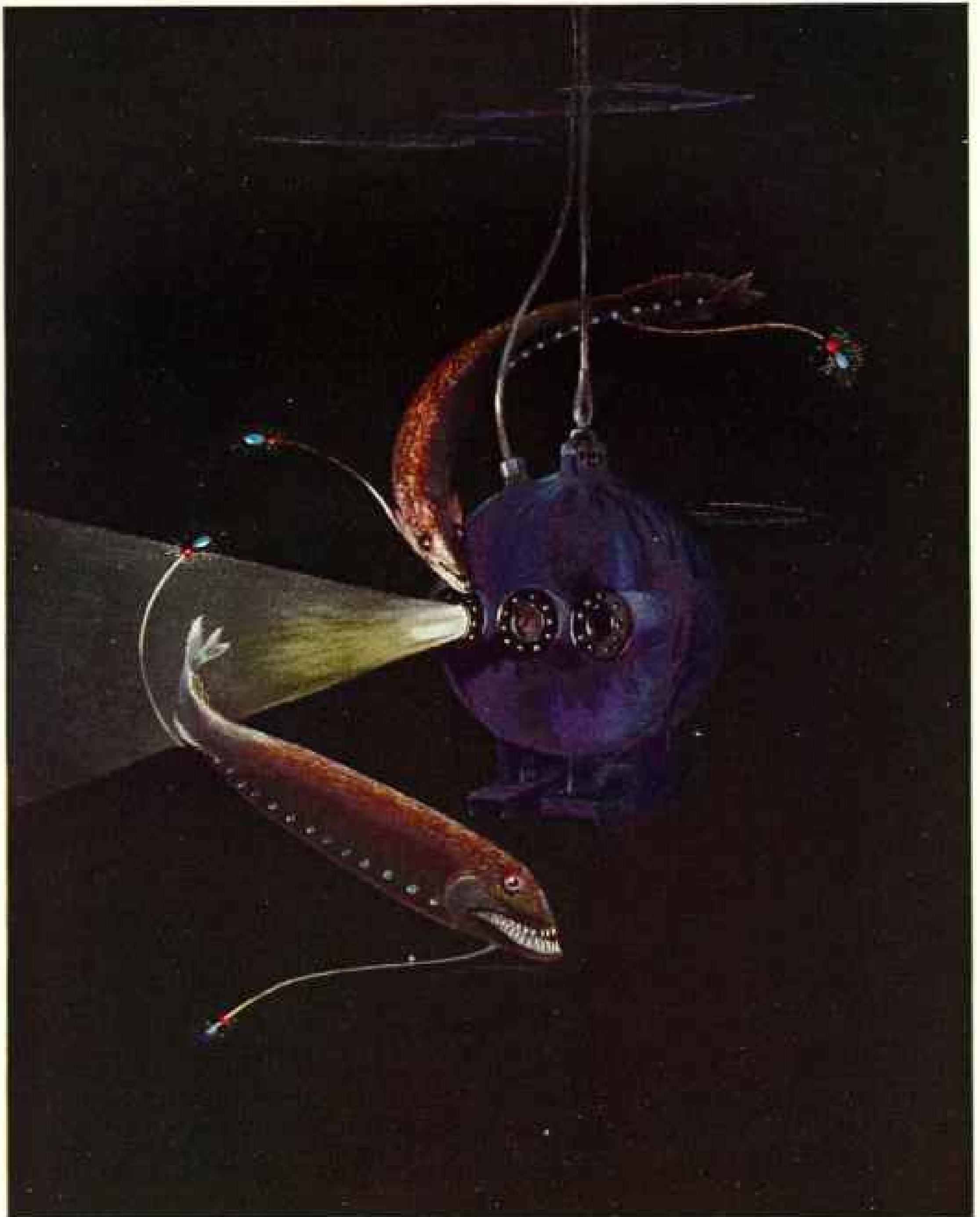
SMALL BEINGS SWARM AT 800 FEET

At 700 feet the light beam from our bulb was still rather dim; the sun had not given up and was doing his best to assert his power. At 800 feet we passed through a swarm of small beings, copepods, *Sagitta*, or Arrow Worms (see Plate XIV), and every now and then a worm which was not a worm but a fish, one of the innumerable Round-mouths, or *Cyclothones*.

At 1,000 feet we took stock of our surroundings. The stuffing box and the door were dry, the noise of the blower did not interfere with the telephone conversation; the humidity was so well taken care of that I did not need a handkerchief over nose and mouth when talking close to the glass. The steel was becoming very cold. I tried to name the water—blackish-blue, dark-gray blue.

It is strange that, as the blue goes, it is not replaced by violet, the end of the visible spectrum. That has apparently already been absorbed. The last hint of blue tapers into a nameless gray, and this finally into black; but, from the present level down, the eye falters and the mind refuses any articulate color distinction. The sun is defeated, and color is banished forever,

FLASHES FROM OCEAN DEEPS



© National Geographic Society

Painting by Elsie Dostelmann. Fish One Twenty-fourth. Natural Size.

GIANTS OF THE DEEP GREET THE BATHYSPPHERE

Which must have seemed the stranger to the other—the odd, steel sphere with its huge eyes and piercing searchlight, or the six-foot monster gleaming like an ocean liner and trailing its own “traffic lights?” Sighted at 2,000 feet below sea level, this big creature was named *Bathysphaera intacta*, or the Untouchable Bathysphere Fish. It has not yet been caught in the nets.



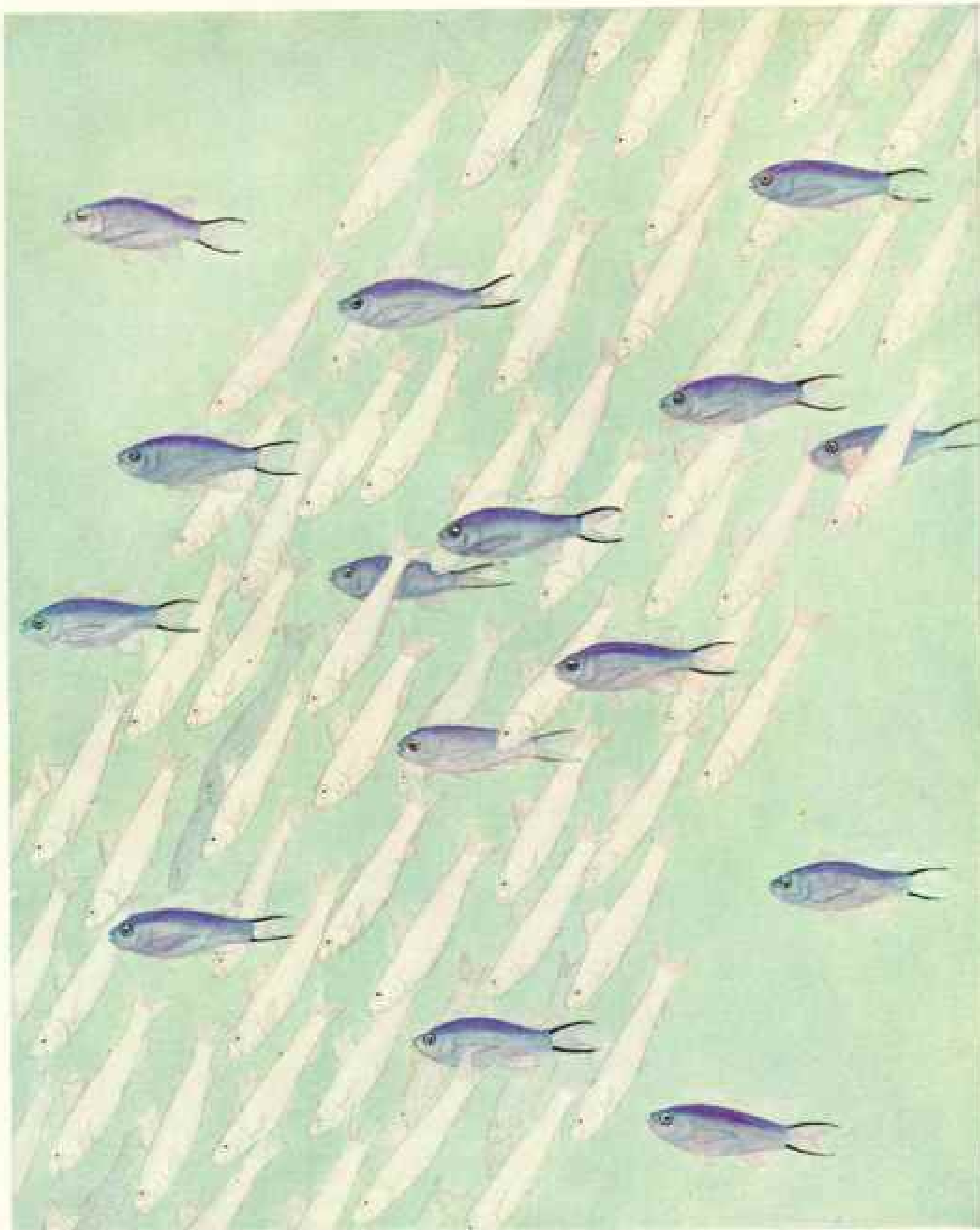
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Painting by Else Bostelmann. One-half Natural Size

ABYSSAL RAINBOW "GARS" EXECUTE "COMPANY FRONT"

At 2,500 feet, at 11:17 a. m. on August 11, 1934, the electric searchlight was switched on suddenly, disclosing these brightly-colored fish balanced on their tails in military formation. They swam slowly and stiffly out of sight, leaving in mind only what the artist has drawn. Doctor Beebe is not positive that his tentative designation of them as gars is correct, but they at least have the most remarkable coloration ever recorded in deep-sea fish.

FLASHES FROM OCEAN DEEPS

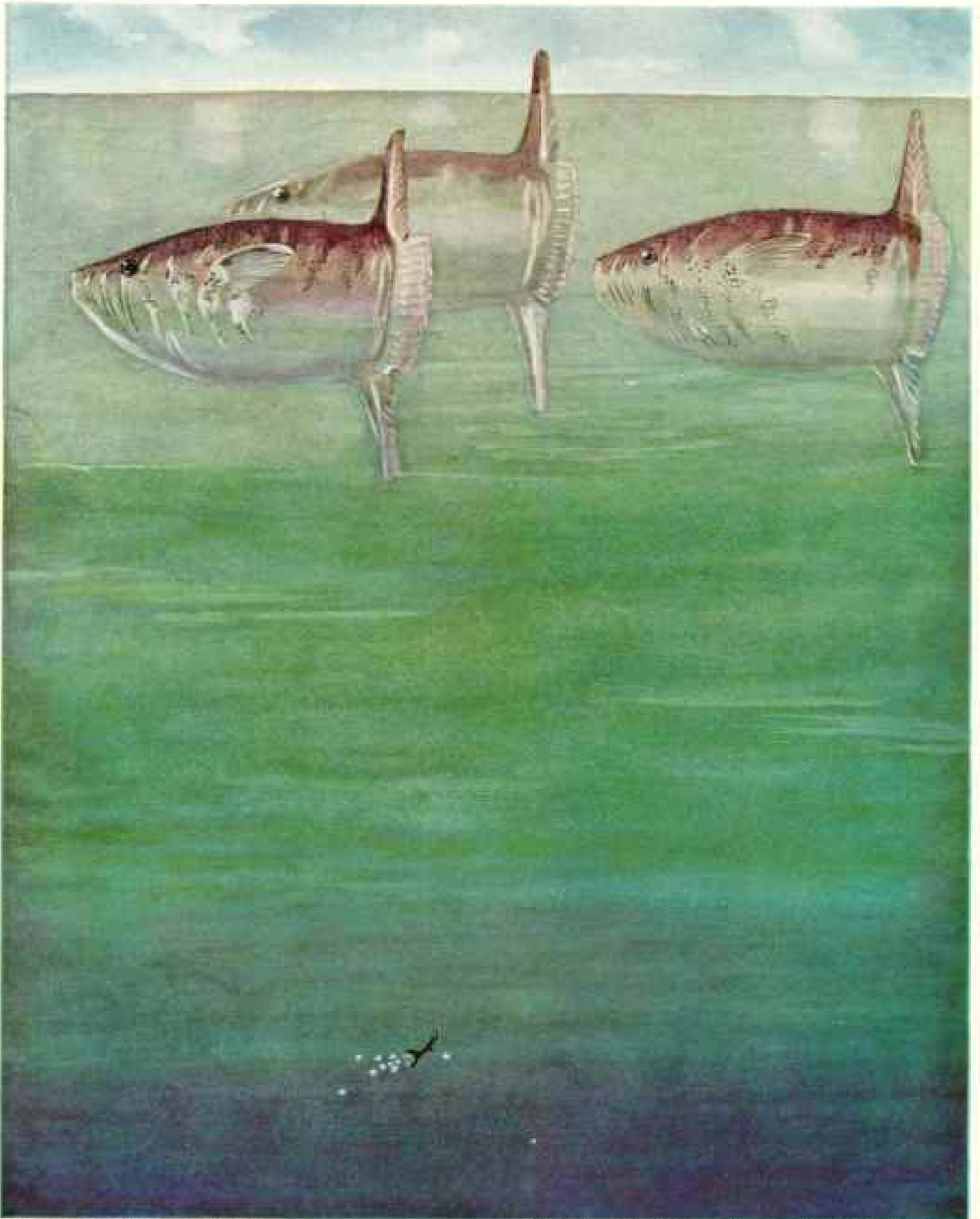


© National Geographic Society

Painting by Helen D. Tee-Van. One-third Natural Size.

TWO SCHOOLS FORM A WARP AND WOOF OF FISH

At the sight of the gleaming Bathysphere, as it slowly descended in shallow water, hundreds of Smooth Sardines (*Sardinella anchovia*) dashed rapidly downward, while scattered Blue Chromis (*Demoisellea cyaneus*) threaded a way more quietly in and out among their frightened neighbors. Neither has appeared close to the shores of Bermuda and, until sighted from the Bathysphere, they had not been included in the island's fauna.



© National Geographic Society

Painting by Else Bostelmann. One-fiftieth Natural Size

OCEAN SUNFISH SPEND THEIR YOUTH IN THE DEPTHS

These slow-moving, thick-set fish (*Ranzania truncata*) are fully eight feet long. Although they are fairly common in the Gulf Stream, there is no record of any being caught near Bermuda. As many as 30 newly hatched young, however, each no larger than the head of a pin, have been taken in nets off that island at a depth of a quarter of a mile, where they are the prey of the Viperfish and other predatory species (lower center).

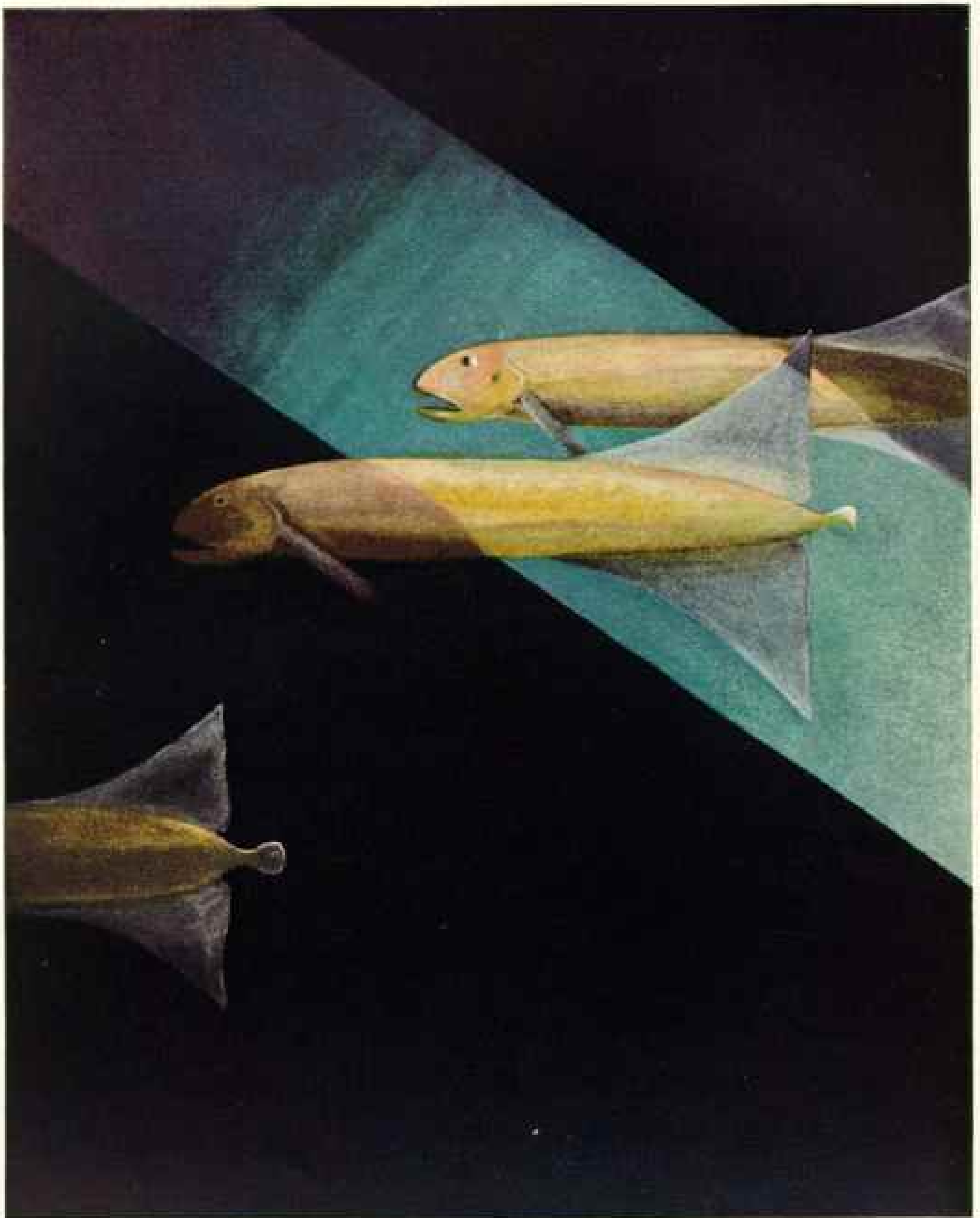


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Painting by Else Bontelmann. Sixteen Times Natural Size.

A FISH-EYE VIEW OF A MICROSCOPIC TRAGEDY

This drawing is a greatly enlarged close-up of the head of the Saber-toothed Viperfish (*Chauliodon sloanei*; see Plate X). This creature is pictured near the bottom of the opposite plate in the act of attacking the tiny young of the Ocean Sunfish. The latter are mostly eyes and sharp spines, showing no promise of the fleshy bulk that they attain in their adult stage, but the fangs and appetite of the ogre of the depths make light of their protective armor.



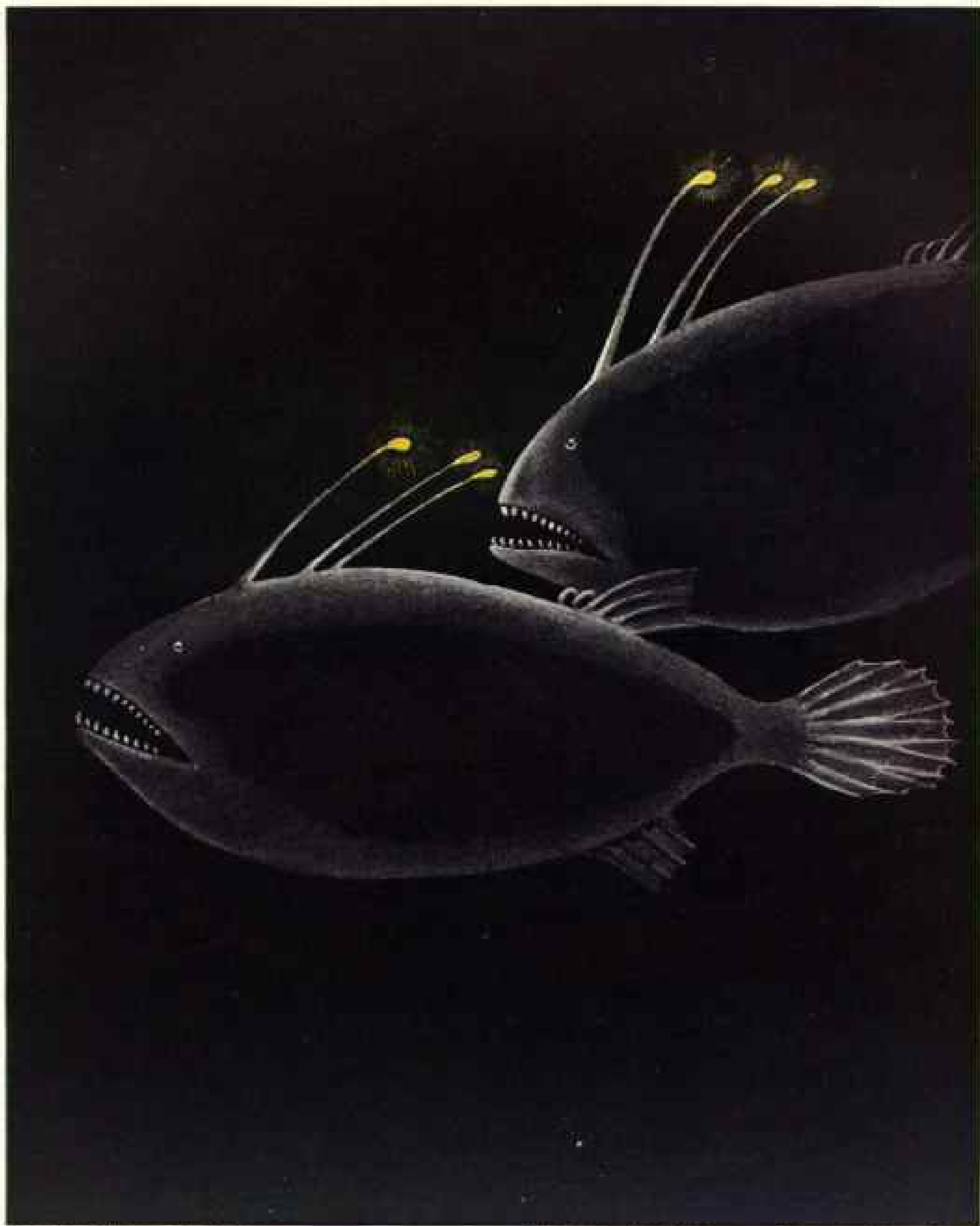
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Painting by Else Bostelmann. One-sixth Natural Size

RARE CORPSE-HUED FISH GLIDE BY LIKE WRAITHS

At a depth of 1,500 feet and again at 2,500 feet this ghostly-looking creature, fully two feet long, was observed as it swam across the swath of light from the Bathysphere. Until a specimen can be captured in the nets, it has been decided to put it in the family Cetomimidae. Nonscientific folk may call it the Pallid Sailfin. Especially conspicuous were its enormous vertical fins and very small tail fin. Its eye is small, and the mouth appears to be toothless.

FLASHES FROM OCEAN DEEPS

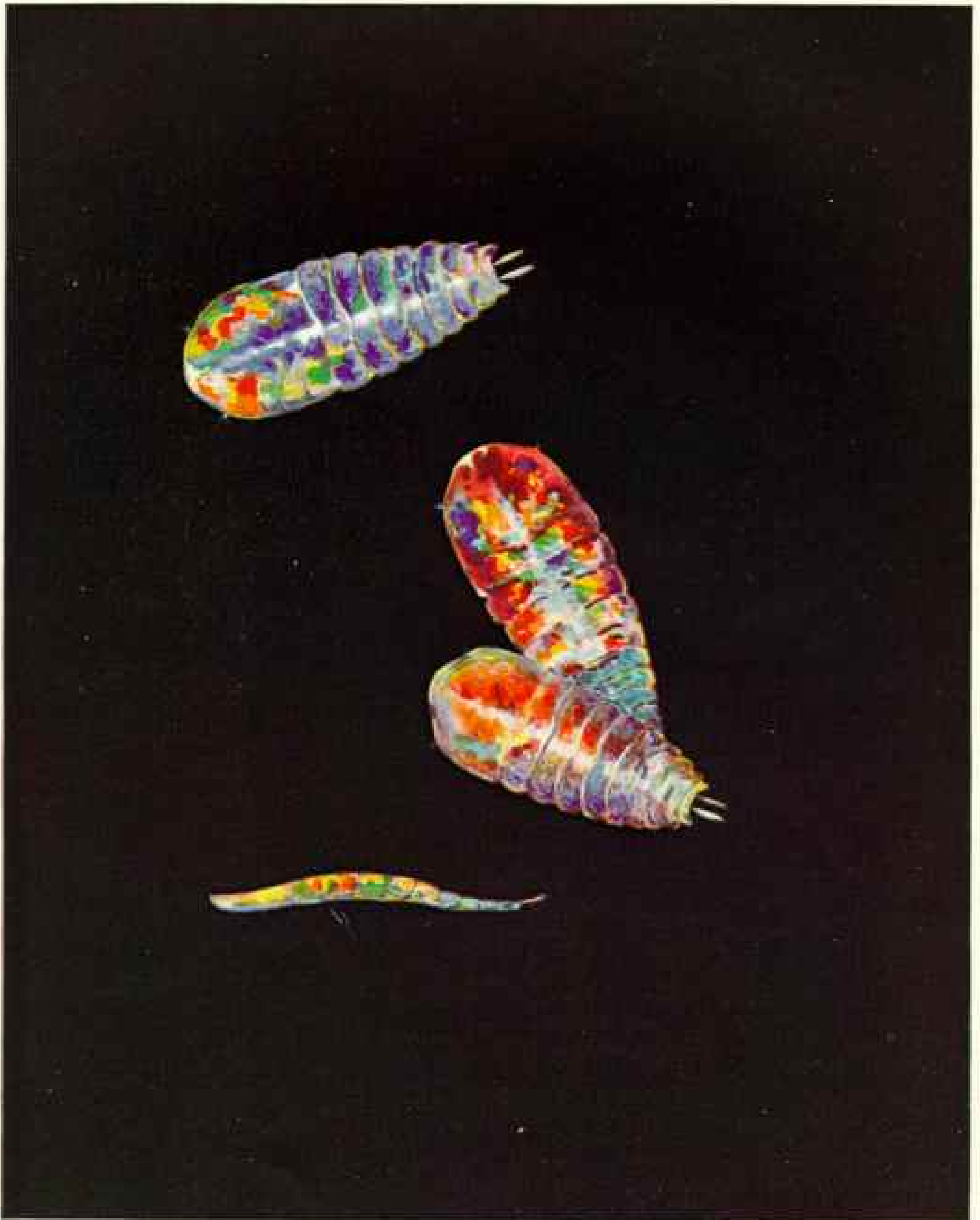


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Painting by Else Bostelmann. Five-sixths Natural Size

THIS FELLOW CARRIES HIS OWN "LIGHTHOUSES"

The Three-starred Anglerfish, new to man, is six inches long. It was clearly outlined for two seconds at a depth of 2,475 feet. It showed a trio of tall, light-tipped masts, and revealed its relationship to the Black Anglers (*Cyclosparas*), although unlike any known species or genus. No paired fins were observed, although they must have been present. The light was pale yellow, and so strong that it was clearly reflected on the dark skin of the back.



© National Geographic Society

Painting by Else Bostelmann. Ten Times Natural Size

HIGHLY COLORED, BUT THEY HAVE NO COLOR OF THEIR OWN!

Sapphirina, opalescent, deep-sea crustaceans, are not large, but they glow like an opal, and, like that stone, by reflected light, not pigment. A large proportion of the small, drifting life of the deep sea is composed of such creatures, members of the large order of Copepods. The latter vie with the insects of the upper world in abundance and variety, and they are important as food for hundreds of different varieties of fishes.

until a human at last penetrates and flashes a yellow electric ray into what has been jet black for two billion years.

I kept the light on for a while, and at 1,050 feet, through a school of little flying snails, there suddenly passed a "large dark body, more than 4 feet long" (so I telephoned it). I shut off the light, but looked into empty gray space without a trace of lumination. The fish had dissolved. When I had the light on again, 10 feet lower, a Pilotfish appeared, showing how easily his kind can adapt itself to a shift of more than 30 atmospheres, and from 15 pounds an inch pressure at the surface to 480 here.

EXCITING SIGHTS CROWD THICKLY

Lights now brightened and increased, and at 1,100 feet I saw more fish and other organisms than my pre-Bathysphere experience had led me to hope to see on the entire dive. Several chunky little Hatchetfish approached and passed through the light; then a silver-eyed larval fish two inches long; a jelly. A dim, very deeply built fish appeared and vanished; then a 4-inch larval eel swam obliquely upward; and so on. The ceaseless telephoning left me breathless and I was glad of a hundred feet of only blue-blackness and sparks.

At 1,200 feet an "explosion" occurred, not at the window but a few feet away, so baffling that I decided to watch intently for repetitions. The large fish came again, and a loose, open school of pteropods and small shrimps bobbed about.

Suddenly, in the distance, a strong glow shot forth (again the mysterious "explosion"), covering a space of perhaps eight inches. Not even the wildest guess would help with such an occurrence (see text, page 701). Then the law of compensation sent, close to the window, a clear-cut, three-inch Black Anglerfish with a pale, lemon-colored light on a slender tentacle. All else my eye missed; I can never give it a name.

A FISH NEW TO SCIENCE

At 1,500 feet I swung for two and a half minutes, and here occurred the second memorable moment in these dives—opportunity for the deliberate, accurate record of a fish wholly new to science, seen by one or both of us, the proof of whose existence, other than our word, must await the luck of capture in nets far more effective than those we now use in our oceanographic work.

First, a quartet of slender, elongate fish passed through the shaft of electric light. They were literally like arrows, about 20 inches long, whether eels or not I shall never know; then a jelly so close that it almost brushed the glass. Finally, without my seeing how it got there, a large fish swung suspended, half in, half out of the beam (see Plate VI). It was poised with only a slow waving of fins.

I saw it was something wholly unknown, and I did two things at once: I reached behind for Mr. Barton, to drag him away from his camera preparations to the window, to see and corroborate, and I disregarded Miss Hollister's insistent questions in my ears. I had to grunt or say something in reply to her, for I had already exceeded the five seconds which was our danger duration of silence throughout all the dives. But all this time I sat, absorbing the fish from head to tail, through the wordless, short-circuiting of sight, later to be materialized into spoken and written words, and finally into a painting dictated by what I had seen through the clear quartz.

The strange fish was at least two feet in length, wholly without lights or luminosity, with a small eye and good-sized mouth. Later, when it shifted a little backward, I saw a long, rather wide, but evidently filamentous pectoral fin. An unusual thing was the color, which, in the light, was an unpleasant pale olive drab, the hue of water-soaked flesh, an unhealthy buff. It was a color worthy of these black depths, like the sickly sprouts of plants in a cellar.

SEEKING THE FAMILY OF A GHOST

There is a small family of deep-sea fish known as *Cetomimidae*, and somewhere in or close to this the strange apparition belongs. Only three species are known, and only 24 individuals have been captured, 16 of which have been in our own deep nets drawn through these very waters. I have called the fish we saw the Pallid Sailfin, and am naming it *Bathyembryx istiophasma*, which is a Greek way of saying that it comes from deep in the abyss and swims with ghostly sails.

The Sailfin was alive, quiet, watching our strange machine, apparently oblivious that the hinder half of its body was bathed in a strange luminosity. Preeminently, however, it typified the justification of the money, time, trouble, and worry devoted



Photograph by John Tee-Van

THE ARTIST'S CORNER AT NEW NONSUCH

In this cheerful studio, whose tall windows overlook the ever-changing blues and greens of Castle Harbor, Mrs. Else Bostelmann prepared many of the color plates reproduced in this issue. The drawings are based on sketches made by Dr. Beebe and from notes of his observations telephoned to the surface during deep-sea dives.

to bringing the Bathysphere to its present efficiency.

At the possible risk of cumbering taxonomy with a *nomen nudum*, I have chosen to give definite names to a very few of these clearly seen fish,* the physical type of which must, for a time, be represented by a drawing made under my direction, with only the characters of which I am certain.

At 1,900 feet, to my wonder, there was still the faintest hint of dead gray light, 200 feet deeper than usual, attesting the

* Preliminary descriptions have appeared in the *Bulletin of the New York Zoological Society*, Vol. XXXVII, No. 6.

almost complete calm of the surface and the extreme brilliancy of the day far overhead. At 2,000 feet the world was forever black. And this I count as the third great moment of descent, when the sun, source of all light and heat on the earth, has been left behind. It is only a psychological milepost, but it is a very real one. We had no realization of the outside pressure, but the blackness itself seemed to close in on us.

MYSTERY STIRS IN THE BLACKNESS

At 2,000 feet and again on the way up I saw at the very end of our beam some large form swimming. On earlier dives I had observed this and had hesitated even to mention it, for it savored too much of imagination backed by imperfect observation. But here it was again. The surface did not seem black, and what outline came momentarily to view was wholly problematic. But that it was some very large creature or creatures, of which we had

glimpses five separate times on dives separated by years, we are certain.

At 2,300 feet some exclamation of mine was interrupted by a request from above to listen to the tug's whistles saluting our new record, and my response was, "Thanks ever so much, but take this: Two very large *leptocephali* have just passed through the light, close together, vibrating swiftly along. Note—why should larval eels go in pairs?"

With this the inhabitants of our dimly remembered upper world gave up their kindly efforts to honor us. On down we went, through a rich, light-speckled 2,400 feet, to rest at 2,500 feet for a long half hour.



"CLEAR AS QUARTZ" MIGHT BE A NEW SIMILE

Although details of the winch 30 feet beyond Dr. Beebe's head may be observed through the fused windows, the Bathysphere's eyes are three inches thick and can easily withstand pressures of half a ton to the square inch at a depth of half a mile.



Photographs from Dr. William Beebe

THROUGH THESE WINDOWS DR. BEEBE SAW A STRANGE WORLD

Two men, a powerful searchlight (right), oxygen tanks, air-conditioning apparatus, and scientific equipment made the 4½-foot Bathysphere during a dive as crowded as a sardine can. Dr. Beebe, with head phones and mouthpiece, occupies his customary place at the left.



Photograph by E. John Long

RIGGED FOR A CONTOUR DIVE, THE BATHYSPHERE SUGGESTS A FREAK FROM MARS

In order to study areas where the ocean bottom shelves off to the deep sea, a "box-kite" device is attached at an angle of 45 degrees. A coupling shift gives the Bathysphere a downward slant. The rudders keep the quartz windows pointed forward as the apparatus is towed slowly along.



Photograph from Dr. William Beebe

"STANDARD EQUIPMENT" FOR HOUSEKEEPING IN THE DEPTHS

The tanks with automatic valves contain oxygen; the cans, chemicals to absorb carbon dioxide and moisture. There are chemical trays, telephone, photometer, barometer, spectroscope, notebook, stereoglasses, flashlight, color chart, fan, temperature-humidity recorder, and first-aid kit. The book, Murray and Hjort's "The Depths of the Ocean," Dr. Beebe has taken on all his deep dives.



Photograph from Dr. William Beebe

HERE THE STAFF ATE AND SLEPT

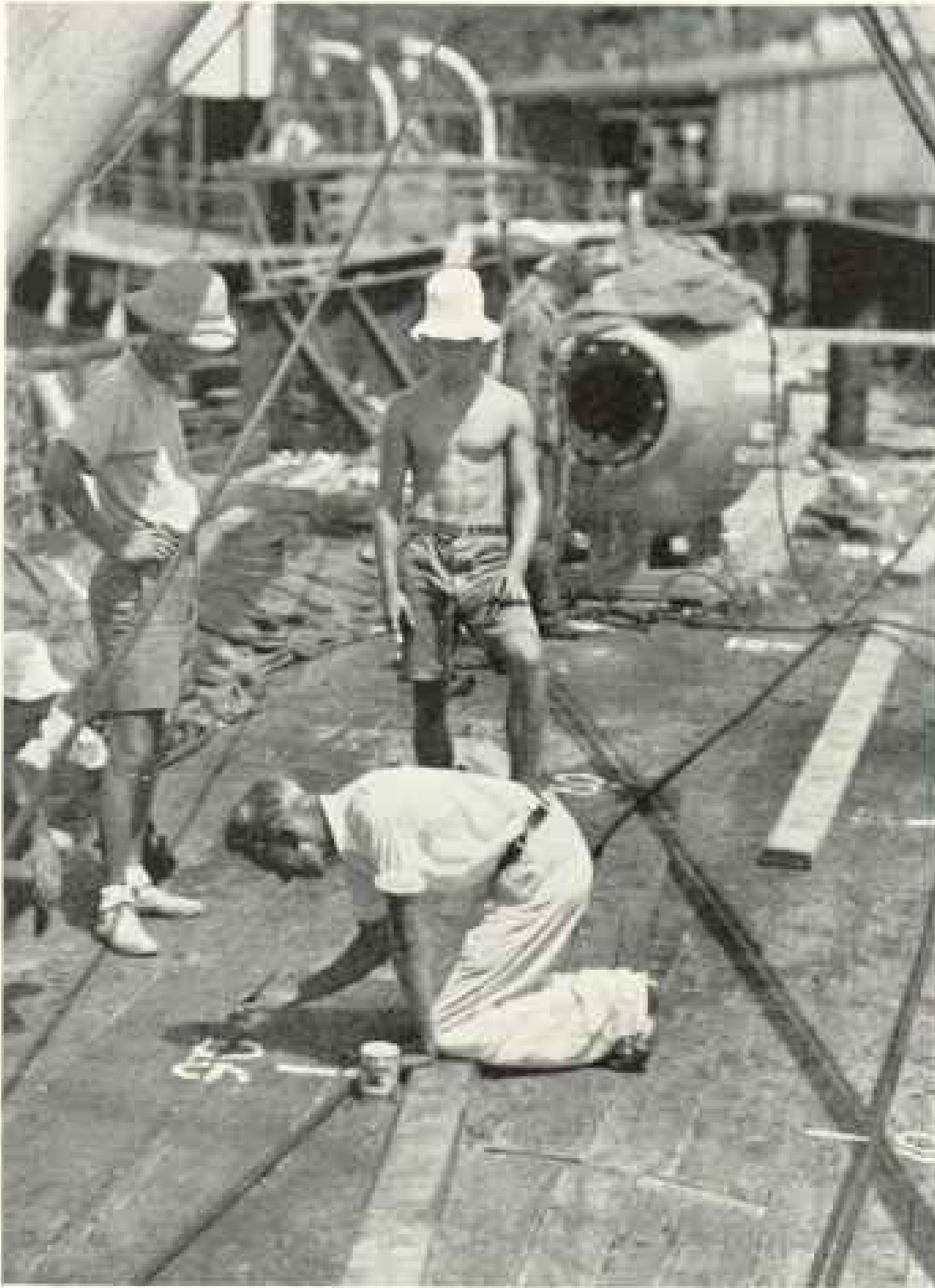
The Bermuda Biological Station, under the directorship of Dr. Wheeler, at St. George West, kindly offered living quarters for the expedition personnel, but research activities were conducted at New Nonsuch, seven minutes' walk to the east.



Photograph by John Tee-Van

PAINSTAKING RESEARCH FOLLOWS EACH DEEP-SEA DIVE OR NET HAUL

The entire staff of New Nonsuch spends hours, and sometimes days, identifying newly found specimens in the laboratory, studying notes, and preparing detailed reports. In this group are, left to right, Dr. William Beebe, John Tee-Van, Jocelyn Crane, Mrs. Else Bostelmann, Gloria Hollister, and (standing) George Swanson.



Photograph by John Tee-Van

FIGURES CHECKED DEPTH MEASUREMENTS

At intervals of 10 feet numerals were painted on the *Ready's* deck along a 100-foot loop of cable leading from the drum to the lower pulley of the supporting boom. A splash of white paint was daubed on the cable as it unrolled from the drum. When the mark had traveled the length of the loop, the winchman knew another 100 feet of depth had been attained.

A pair of large, coppery-sided Scimitar-mouths (*Gonostoma elongatum*) swam past; *Sternoptyx*, the Skeletonfish, appeared in a group of four; a fish as flat as a moonfish entered the beam, and, banking steeply, fled in haste. One flying snail, from among the countless billions of his fellows, flapped back and forth across my glass. Three times, at different levels, creatures had struck against the glass and, utterly meaningless as it sounds, "exploded" there so abruptly that we instinctively jerked back our heads (see text, page 701).

We tried out the full power of the 1,500-watt light, heating the Bathysphere and

window considerably, but not too dangerously. At 11:17 o'clock I turned the light on suddenly and saw a strange quartet of fish to which I have not been able to fit genus or family (see Color Plate II). Shape, size, color, and one fin I saw clearly, but Abyssal Rainbow Gars is as far as I dare go, and they may even not be gars.

About four inches over all, they were slender and stiff, with long, sharply pointed jaws. There they stood, for they were almost upright, and I could see only a slight fanning with a dorsal fin. Keeping equal distances apart and maintaining their upright pose, they swam slowly into the uttermost dark.

LIGHTS FLICKER IN THE DEPTHS

I alternated with Mr. Barton's camera at the window and there were hardly any seconds without lights or definite organisms coming into view. In one period, chosen at random, I counted 46 lights, 10 of which were of unusual size, most of

them pale yellow but a few bluish.

More than two hours had passed since we left the deck, and I knew that the nerves of both my staff and myself were getting ragged. I called for our ascent.

One minute later, at 2,470 feet, all my temporarily relaxed attention was aroused and focused on another splendid piece of luck. A tie rope had to be cut, and in the resultant brief interval of suspension, extended by my hurried order, a new Anglerfish came out of all the ocean and hesitated long enough close to my window for me to make out its dominant characteristics (see Color Plate VII).

I am calling it the Three-starred Angler-fish, *Bathyceratias trilynchus*. It was close in many respects to the well-known genera *Ceratias* and *Cryptosparus*, but the flattened angle of the mouth and the short, even teeth were quite different.

Six inches long, typically oval in outline, and black, it had a small eye. The fin rays were usual except that it had three tall tentacles, or illicia, each tipped with a strong pale-yellow light organ. No pioneer peering at a Martian landscape could ever have a greater thrill than did I at such an opportunity.

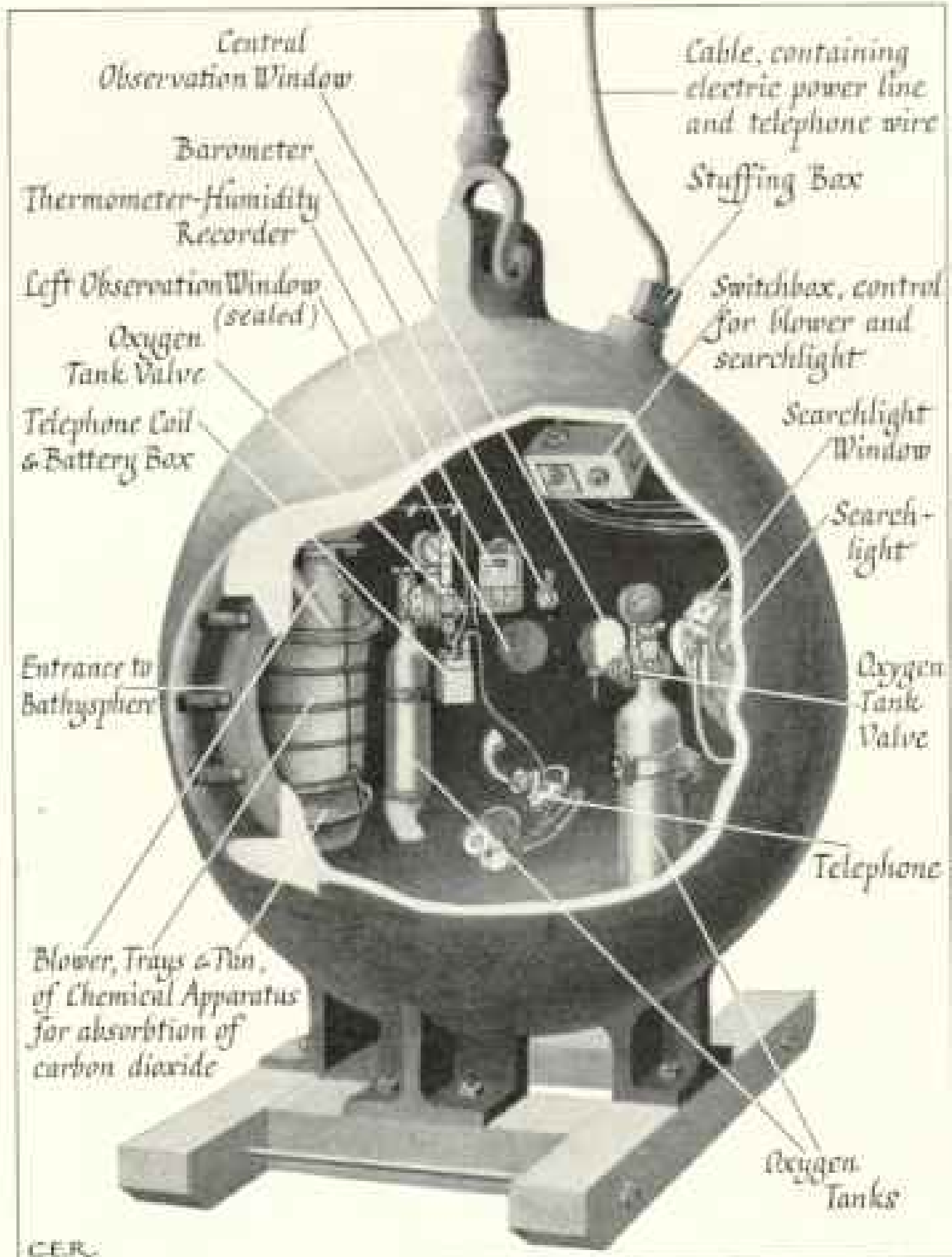
Once more I rearranged my aching limbs. Everything of interest was still relayed through the phone, but I was slumped down, relaxed.

A DEEP-SEA "POWER HOUSE"

Suddenly I leaned forward. At a moment of suspension came a new and gorgeous creature.

I yelled for continuance of the stop, which was at 1,900 feet, and began to absorb what I saw: a fish almost round, with long, moderately high, continuous, vertical fins; a big eye; a medium mouth; and small pectoral fins. The skin was decidedly brownish.

We swung around a few degrees, and from the vantage thus gained I saw its real beauty. Along the sides of the body were five unbelievably beautiful lines of light, one equatorial, with two curved ones above and two below. Each line was composed of a series of large pale-yellow lights, and every one of these was surrounded by a



Drawn by Charles E. Riddiford

SPACE WAS AT A PREMIUM WITH ALL INSTRUMENTS ABOARD.

Because the Bathysphere is so small and the equipment so scattered into odd nooks, its interior cannot be photographed to show the oxygen tanks, valves, gauges, etc., as they were placed during a dive. The artist's drawing, however, cuts away a bit of the shell and discloses the relative location of each item in this deep-sea laboratory.

semicircle of very small but intensely purple photophores (see Color Plate XII).

The fish turned slowly, showing a narrow profile. If it had been at the surface and without lights I should, without question, have called it a Butterfly-fish (*Chaetodon*) or a Surgeonfish (*Acanthurus*). But this glowing creature was assuredly neither, unless a distant relative adapted for life at 300 fathoms.

My name for it is *Bathysidus pentagrammus*, the Five-lined Constellation Fish. In my memory it will live throughout the rest of my life as one of the loveliest things I have ever seen.

Soon after returning to the surface, I reviewed my telephoned notes, especially of the several new fish of which I had been given such excellent sights. I added all the details that came to mind. Then, with my artist, Mrs. Bostelmann, I went into an artistic huddle, made scrawling attempts myself, then carefully corrected her trained drawings. Little by little my brain fish materialized, their proportions, size, color, lights, fins interdigitated with those of my memory.

RECORD IS FORGOTTEN

In the never-ceasing excitement of abounding life I had completely forgotten the idea of a half-mile record. When on deck, in exactly another hour, we were reminded that an additional 130 feet would have done the trick, I had no regrets. A man-made unit of measure is of far less importance than my Three-starred Angler, which otherwise we should have missed.

As for this particular dive, we started up from the lowest depth, 2,510 feet, with 650 pounds of oxygen left in the tank, and reached the surface just as the last hiss of gas escaped from the valve, and the recording ball settled to rest. Unfortunately for any sensational news value, we had a second valve and full tank ready to use!

We had been sealed up for more than three hours; yet when we stepped out, the air inside was as fresh as that on deck. Our mechanical apparatus had worked without a hitch and was ready for a new dive. In fact, in the afternoon we made an hour's contour dive near shore, and mapped about a mile of Bermuda's slopes some ten fathoms under water.

Sunday we devoted to translating and augmenting our notes with added remembered details and getting everything ready for the next dive. Believing that the best kind of rest is a change of activity, on Monday, August 13, we took the *Skink* and went 10 miles out from shore to North Rock, the last geological remnant of old Bermuda, a jagged sentinel still standing against the beating of the open sea (see map, page 670).

The reefs here are the finest in all these islands, with giant heads of brain coral and sea fans more than eight feet high. Here the fish are correspondingly larger and sharks abundant. Diving in the helmet in seven fathoms at the edge of a magnificent reef, I had the amazing luck to see all the so-called

dangerous fish of Bermuda—sharks, barracudas, and green moray eels—within a space of 20 square feet.

All, as usual, were harmless, and only when a five-foot shark stoutly contested the possession of a rare puffer, which I had just stunned with a dynamite cap, was I compelled to bang it on the snout and drive it away. On the last dive five sharks were about and interested in everything I did, but only as vultures are drawn at the sound of a hunter's gun, by the hope of a feast.

The following day we went to sea in the tug *Gladisfen* and drew deep-sea nets across the very place I had dived in the Bathysphere so few hours before. As always, we were delighted with the sight and touch of beings from the icy depths, and at the same time amazed at the meagerness of the haul compared with what I knew of the abundance of life through which the nets had passed. However, each net was filled with glorious creatures, many of which were unknown. Best of all, instant transference into iced salt water revived many of them.

A pair of 10-inch Scimitar-mouths, such as I had seen on the last dive at a depth of 416 fathoms, were alive, and for the first time we had a Black Swallower, *Chiasmodon niger*, swimming full speed about his jar. Unlike most of his kind, he had an empty stomach, not distended with one of his unbelievably enormous meals (see Color Plate IX).

Another treasure was a living, gay-colored, semitransparent, telescope-eyed *Dolichopteryx*, the Long-finned Ghostfish, probably a new species. It was the sixteenth of the whole genus to be taken by man and the first ever to be seen alive.

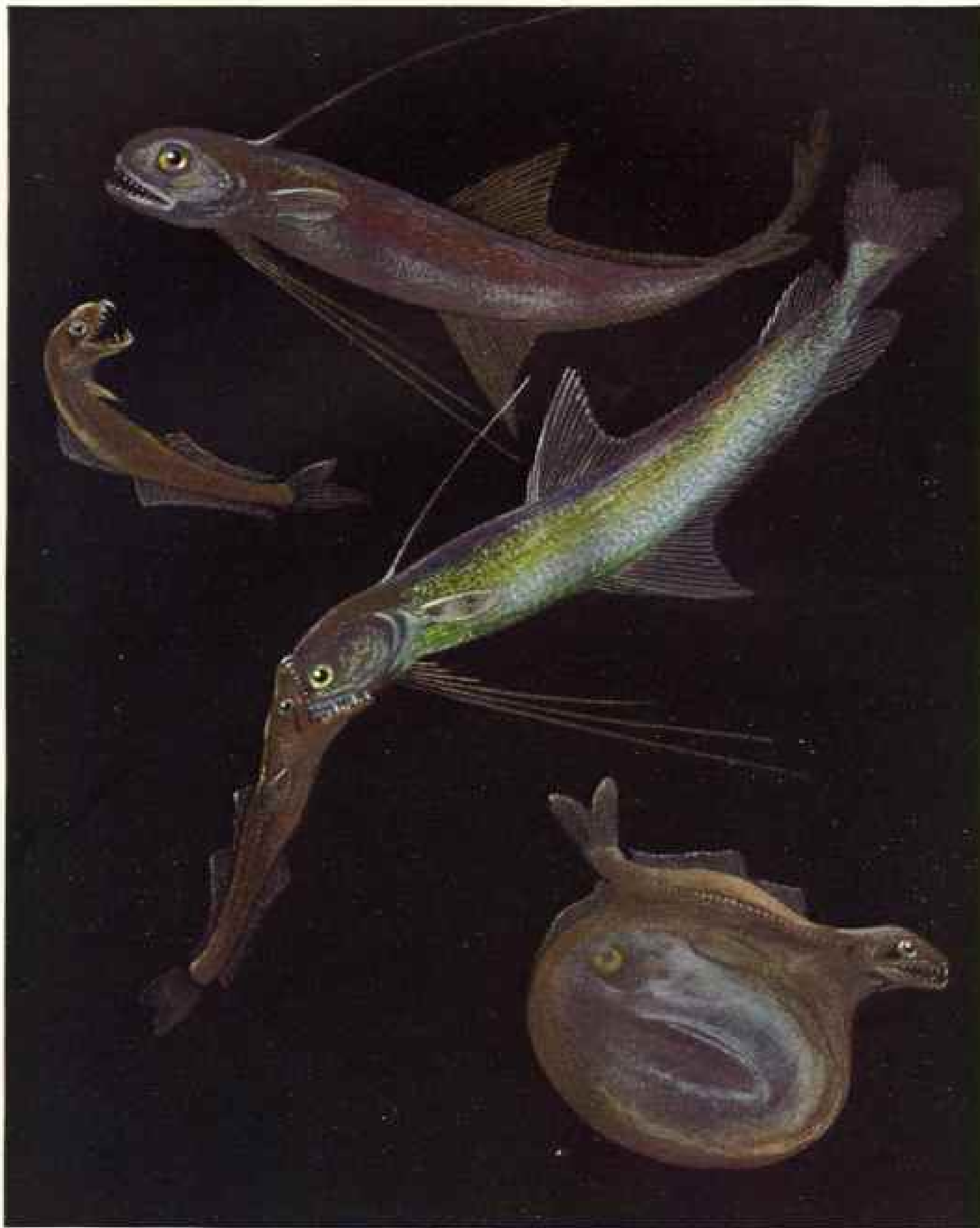
Day after day weather held good, and Wednesday, August 15, was no exception. At 6:45 a. m. we were arranging to leave St. Georges anchorage, the barge *Ready* with the Bathysphere and ourselves, and the tug *Gladisfen* towing.

THE "EXPLOSION" MYSTERY SOLVED

Three hours later Mr. Barton and I were dropped overboard far out at sea. As well as we could determine from sights on the lighthouses, we submerged at the identical spot into which we had splashed four days before.

The same spot, but far from the same visible life. Surprises came at every few feet, and again the mass of life was totally

CARNIVORES OF A LIGHTLESS WORLD



© National Geographic Society

Painting by Else Bostelmann. Natural Size

A DEEP-SEA TRAGEDY DRAMA--IN THREE ACTS!

The Black Swallower (*Chiasmodon niger*) makes a meal of a fish three times its size! Upper left, the smaller fish maneuvers into position; center, the Black Swallower snaps a head-lock on his adversary, a Unicorn Fish (*Bregmaceros maclellandi*); and, lower right, the Black Swallower swims off with the larger fish coiled within its distended stomach. This incident constantly occurs in the depths. By some unknown method of attack the well-named Swallower is able to kill and actually swallow an opponent thrice his length.



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Painting by Elise Bostelmann. Five Times Natural Size

BABY DRAGONS OF THE DEPTHS FIGHT OVER A VICTIM

These two young Saber-toothed Viperfish (see Plate V) are only an inch in length, but Nature has provided them with relatively enormous fangs, which they use with terrible effect in pitched battles hundreds of fathoms down. One of them has seized a Scarlet or Flammenwerfer Shrimp (see Plate XVI), whose dense cloud of protective "flame" did not prevent capture. It will be swallowed whole, and slowly digested.

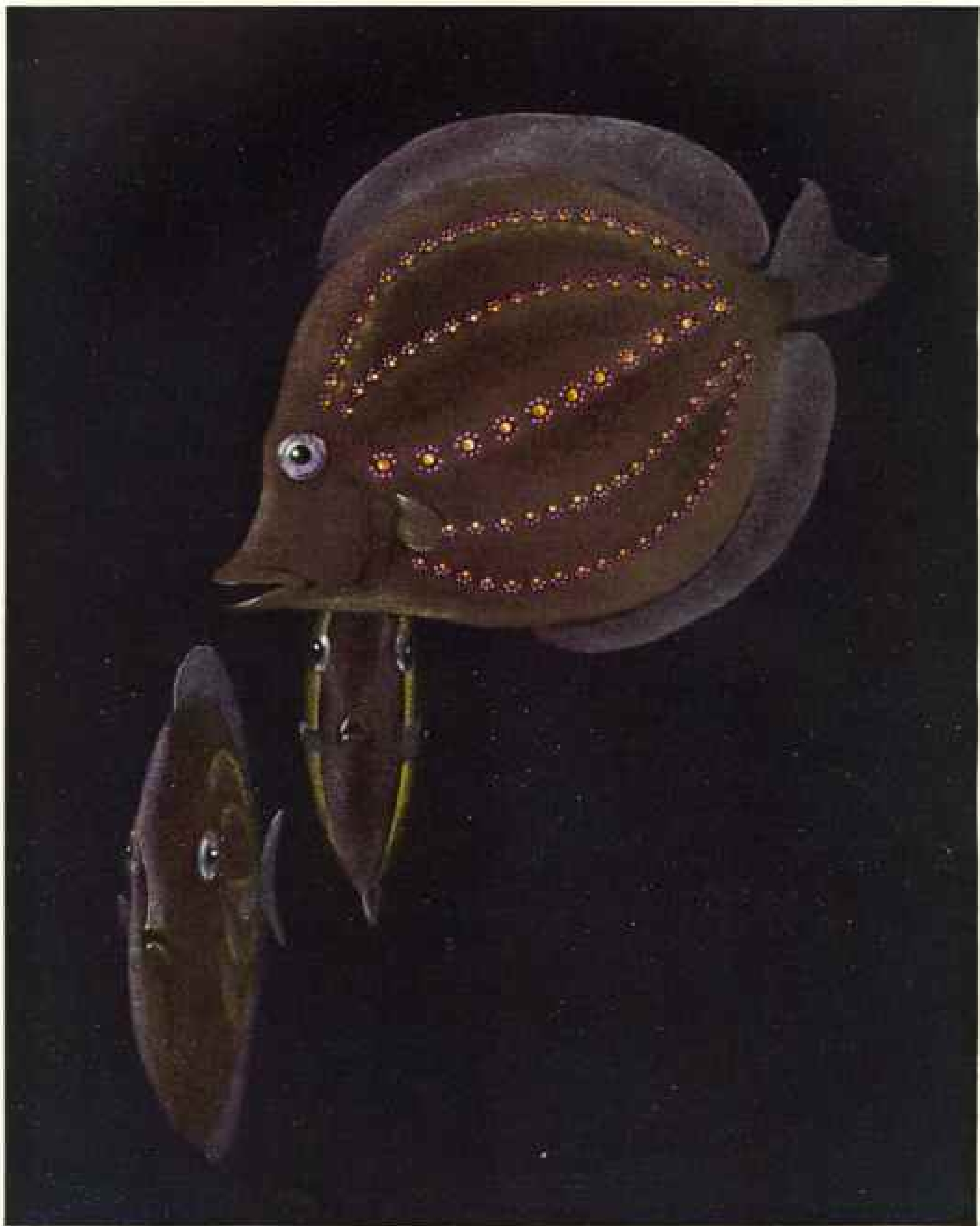


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Painting by Elise Bostelmann. Three Times Natural Size

THESE ARMORED KNIGHTS OF NEPTUNE BEAR LANCES

During trawling operations from the tug *Gladiusen*, the deep-sea nets have brought up myriads of these thin, delicate crustaceans (*Rhabdosoma*), appropriately known as Needle Heads. They form part of the great world of oceanic life which drifts across the Bathysphere's bar of light like motes of dust in a sunbeam; but until they can be studied in their natural habitat, we can but wonder at their peculiar shape. Science knows nothing of their habits.



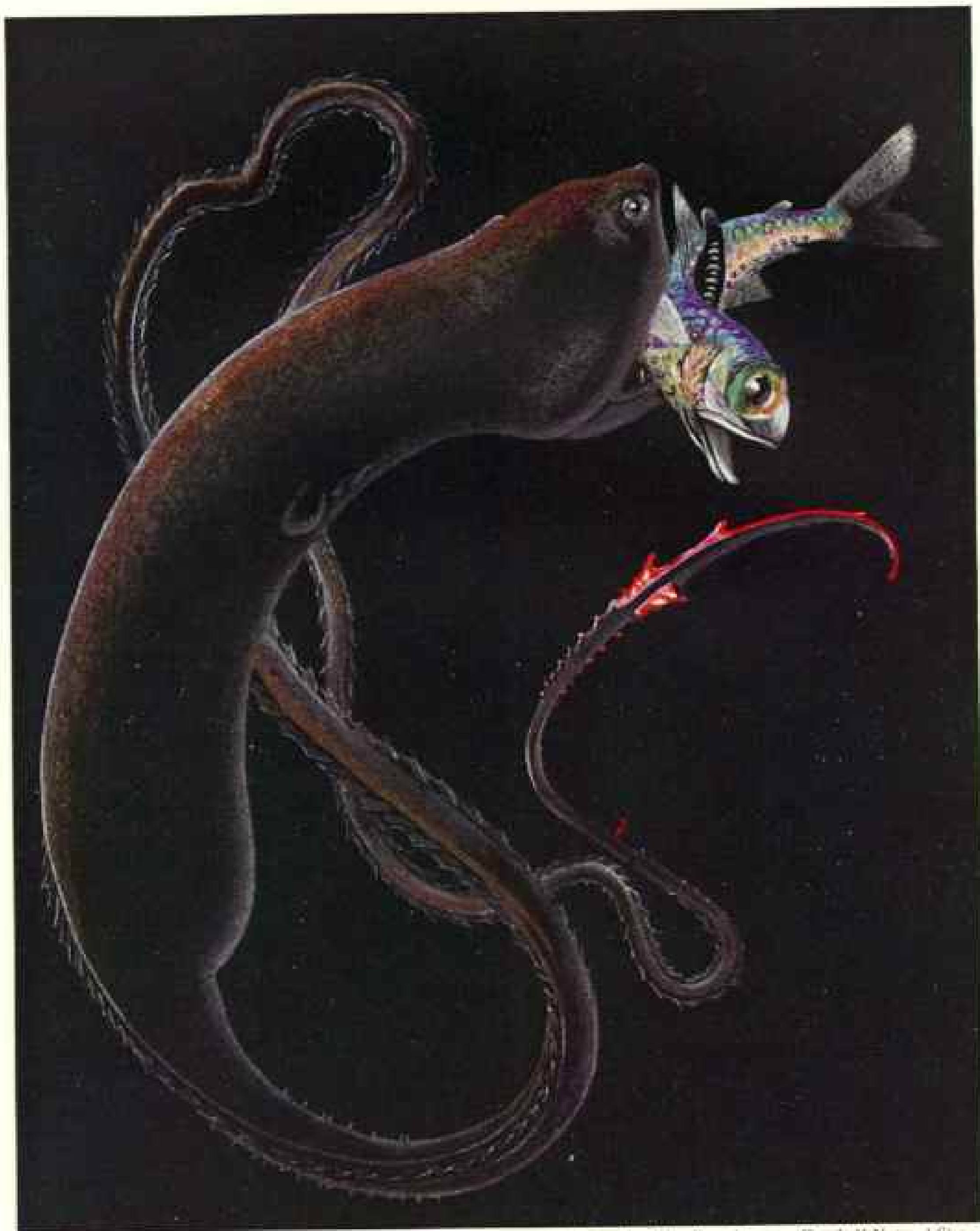
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Painting by Else Bostelmann. Two-thirds Natural Size

BEAUTY FLASHES IN A WORLD OF ETERNAL NIGHT

Brilliantly illuminated as a pulsating aurora borealis, the Five-lined Constellation Fish is one of Doctor Beebe's newest finds. He says of it: "I can only guess that it is distantly related to Butterfly-fish (*Chaetodon*) or Surgeonfish (*Acanthurus*). I had a side and front view of one at 1,900 feet and saw its shape, eye and light organs distinctly, and estimated its length at six inches." Head-on, the Constellation Fish has a sad, rather wistful expression, giving no hint of its brilliant flanks.

CARNIVORES OF A LIGHTLESS WORLD

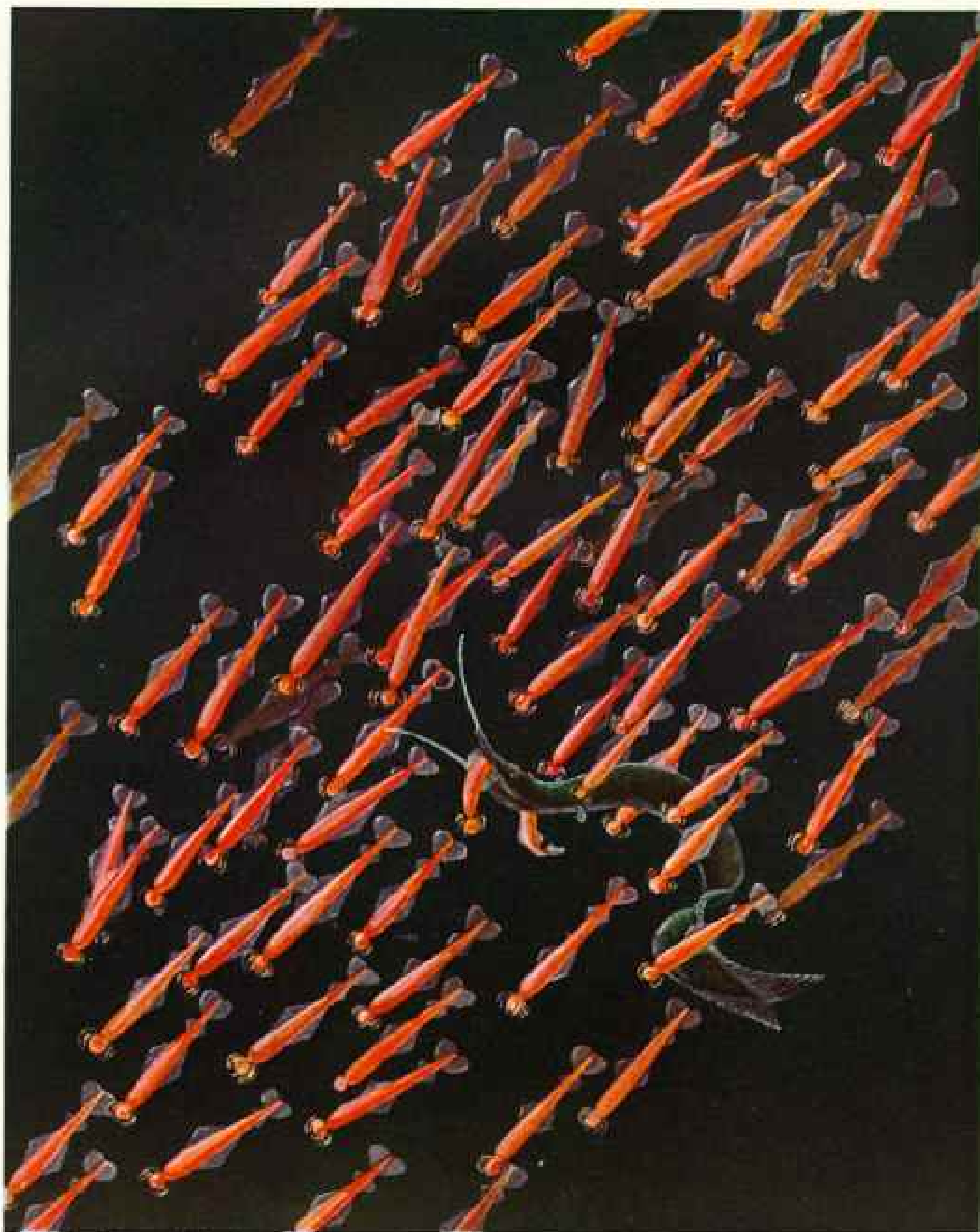


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Painting by Else Bostelmann. One-half Natural Size

THE LARGEST BERMUDA DEEP-SEA FISH EVER TAKEN IN A NET

Since making his explorations in the Bathysphere, Doctor Beebe is convinced that he captures only the smaller, slow-moving creatures by trawling. "The morons of the deep," he calls them. The Great Gulper Eel (*Saccopharynx harrisoni*), 55 inches long, is the biggest specimen that has yet been brought to the surface from the depths. Here it is devouring a Giant Lanternfish (*Myctophum affine*), probably lured within striking distance by the flaming-red light organ near the tip of its tail.



© National Geographic Society

Painting by Elise Bostelmann. Natural Size

AN "AIR RAID" HALF A MILE BELOW THE NEAREST AIR!

There is something suggestive of futuristic warfare, or a mass attack by hostile Martians, in this rain of Scarlet Arrow Worms (*Sagitta*), far beneath the surface of the Atlantic. Arrow Worms, whose shape is strikingly similar to that of an aerial torpedo, vary in color, being pale and transparent at the surface and scarlet in the great depths. They feed on small fry and are in turn avidly devoured by such fish as the Tailless Eel (*Cycema afrum*), in the manner shown above. Since there are no plants in this sunless world, every creature is perforce carnivorous.

CARNIVORES OF A LIGHTLESS WORLD

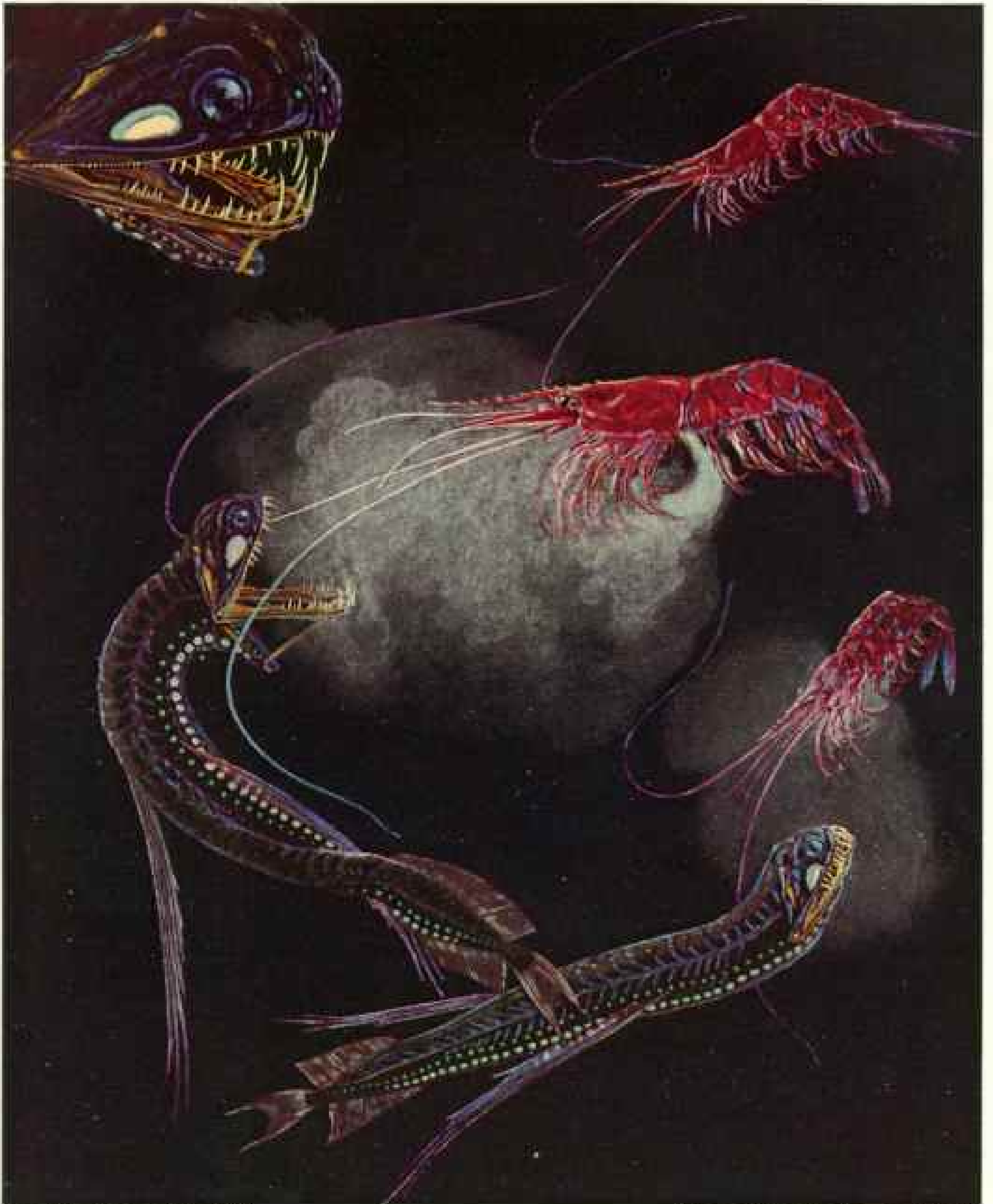


© National Geographic Society

Painting by Elsie Bostelmann. Figures Various Sizes

BIG BAD WOLVES OF AN ABYSSAL CHAMBER OF HORRORS

Often absurdly grotesque are the creatures seen from the Bathysphere. The Telescope-eyed Fish (*Opisthoproctus*), upper left, suggests an aquatic baboon; while the Shining-toothed Angler (*Dalophichthys*), lower left, recalls the Cheshire Cat in "Alice in Wonderland" whose grin was the last part of it to disappear! Others are: upper center, Black Whalelet (*Melanocetus*); upper right, Viperfish (*Chaulioides*); left center, Scarlet-and-gold-lighted Dragonfish (*Mutacosteus*); right center, Gulper Eel (*Gastrostomus*); extreme left, Lanternfish (*Diaphus*), and lower right, Pygmy Angler (*Aiceratius*).



© National Geographic Society

Painting by E. J. Geake. Natural Size

FIGHTING WITH "FLAME" HALF A MILE DOWN

Like *Flammenwerfer* of the World War, the Scarlet Shrimp (*Acantheephyra purpurea*) shoots forth a cloud of luminous fluid to blind its assailant (*Photostomus guernei*). This is as effective a means of defense in the complete darkness of the deep sea as the smoke screen of sepia ink thrown out by squids in clear, shallow water. This defense was noted again and again from the Bathysphere, and, sometimes when the explosion came directly against the thick quartz windows, those within dodged back as from a direct blow.

unexpected, the total of creatures seen unbelievable.

I have spoken of the three outstanding moments in the mind of a Bathysphere diver—the first flash of animal light, the level of eternal darkness, and the discovery and descriptions of a new species of fish. A fourth came to me on this last deep dive, at 1,680 feet, and it explained much that had been a complete puzzle.

I saw some creature several inches long dart toward the window, turn sideways, and—explode! This time my eyes were focused, and at the flash, which was so strong that it illumined my face and the inner sill of the window, I saw a large red shrimp and an outpouring fluid of flame (see Color Plate XVI).

AN ABYSSAL SMOKE SCREEN

Many "dim gray fish" now resolved into distant clouds of light, and all the previous "explosions" against the glass became intelligible. At the next occurrence the shrimp showed plainly before and during the phenomenon, illustrating the value of knowing what to look for.

That a number of the deep-sea shrimp have this power of defense is well known. I have had an aquarium aglow with the emanation. It is the abyssal equivalent of the sepia smoke screen of a squid at the surface.

Another advance in technique was unconscious and only accidentally came to realization. On a succeeding dive I went down 1,500 feet and took Mr. Tee-Van. He wondered at my ability to identify organisms which to him, on this first descent into the dark zone, were only individual lights.

I had learned instinctively to ignore the light as soon as possible and look to left or right of it. Exactly as the spiral nebula in Andromeda can be seen most clearly by looking a little to one side, so the sudden flashing out of a light is less blinding when viewed indirectly, and simultaneously its author may more than likely come into focus.

At 1,800 feet I saw a small fish with illumined teeth, lighted from below, with distinct black interspaces; and 10 feet below this my favorite sea dragons, *Lamprolophus*, appeared, they of the shining green bow (see Color Plate V, NATIONAL GEOGRAPHIC MAGAZINE, January, 1932). Only 16 of these fish have ever been taken, and seven of these came up in our own nets. The record size is about eight inches. Here before

me were four individuals all more than twice that length and probably representing a new species.

At 2,100 feet two large fish, quite three feet over all, lighted up and then became one with the darkness about them, a tantalizing glimpse which made me more than ever long for bigger and better nets.

A very large, dim, but not indistinct outline came into view at 2,450 feet for a fraction of a second, and at 2,500 feet a delicately illumined ctenophore jelly throbbled past. Without warning, the large fish returned, and this time I saw its complete, shadowlike contour as it passed through the farthest end of the beam. Twenty feet is the least possible estimate I can give to its full length, and it was deep in proportion.

For the majority of the "size-conscious" human race this marine monster would, I suppose, be the supreme sight of the expedition. In shape it was a deep oval; it swam without evident effort, and it did not return. That is all I can contribute, and while its unusual size so excited me that for several hundred feet I kept keenly on the lookout for hints of the same or other large fish, I soon forgot it in the (very literal) light of smaller but more distinct organisms.

What this enormous creature was I cannot say. A first and most reasonable guess would be a small whale or blackfish. We know that whales have a special chemical reaction in their blood which makes it possible for them to dive a mile or more and come up without getting the "bends." This depth of 2,450 feet would be paltry for any similarly equipped cetacean. Less likely, it may have been a whale shark, which is known to reach a length of 40 feet.

VISION OFTEN TRICKED

Any one who from an airplane high above the earth has tried to spot another plane somewhere near, in full view, will appreciate the even greater difficulty of focusing, in this three-dimensional, Stygian blackness, upon some creature suddenly appearing six inches from our faces or 45 feet away. Again and again, before the eye can refocus, the flash and its owner have vanished.

Mr. Barton saw no trace of the large creature I have mentioned, although I called out to him and got him at the window immediately. Soon after, when we were both looking out, he saw the first living *Stylophthalmus* ever seen by man, which completely escaped me, although it must



Photograph by John Tee-Van

THE WINCH TOLD THE STORY

Not satisfied with the official record kept by Miss Crane, the man in charge of this equipment kept his own score with chalk (see illustration, page 690). It checked exactly—3,028 feet! The winchman sits beside his reckoning board between Capt. James Sylvester (commander of the *Ready*) and Dr. Beebe.

have been within a foot of the window. This is one of the most remarkable of deep-sea fish, with eyes on the ends of long periscope stalks, almost one third as long as its body.

My missing the fish was all the more disappointing because I had recently been thoroughly studying these strange beings, and in fact had "abolished" their entire family after proving that they were the larvae of the Gleaming-tailed Serpent Dragons, *Idiacanthus* (see Plate IV, NATIONAL GEOGRAPHIC MAGAZINE, January, 1932).

THREE THOUSAND FEET DOWN

At 11:12 a. m. we came to rest gently at 3,000 feet, and I knew that this was my ultimate floor; the cable on the winch was very near its end. A few days ago it had appeared blacker at 2,500 feet than could be imagined, yet now to this same imagination it seemed to show as blacker than black. It seemed as if all future nights in the upper world must be considered only relative degrees of twilight. I could never again use the word *black* with any conviction!

I looked out and watched an occasional

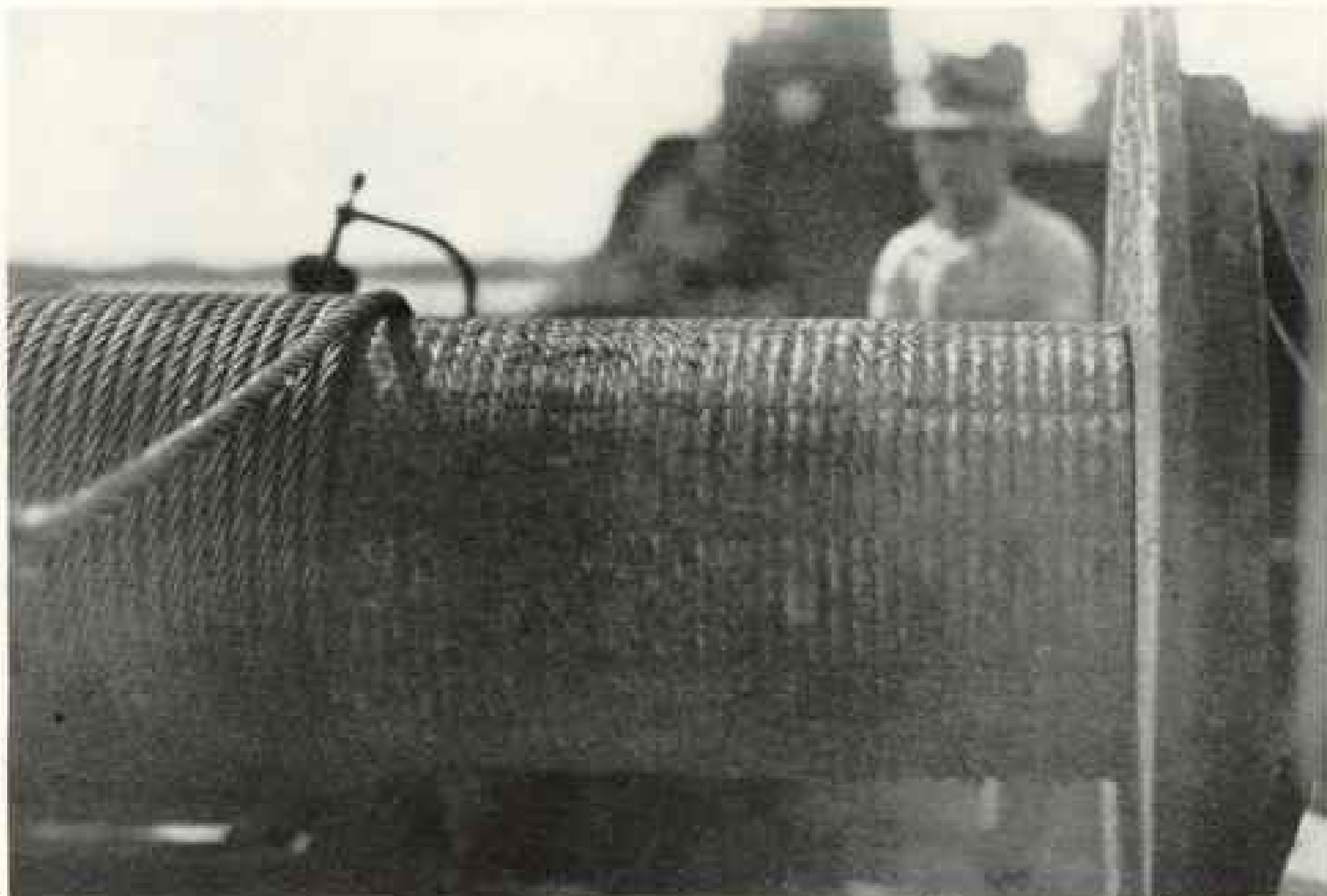
passing light and for the first time I realized how completely lacking was the so-called phosphorescence with which we are familiar at the surface. There, whenever an ordinary fish passes, it becomes luminous by reflection from lights of myriads of minute animals and plants floating in the water. Here each light is an individual thing, often under direct control of the owner.

A second thing which occurred to me as I sat coiled in the Bathysphere, *more* than half a mile down, was the failure of our powerful beam of light to attract organisms of any kind. Some fled at its appearance; others seemed wholly unconcerned, but not a single copepod or worm or fish gathered along its length or collected against the starboard window from which it poured.

QUIET BROODS IN THE DEPTHS

Even in this extremity of blackness I sensed the purity of the water, its freedom from sediment and roiling; six miles from shore and a full mile above the bottom insured this.

There was no diffusion of light, no trails, no refraction. When sparks or larger lights



Photograph from Dr. William Beebe

ONLY A FEW TURNS LEFT ON THE DRUM!

With the naked wooden case showing and a strain of nearly four tons on the supporting cable, Capt. James Sylvester, in charge of the *Ready*, refused to let out any more wire when 3,028 feet was reached on August 15. Creaking and groaning, the cable, still wet, gave off sparks as the strands were ground together during rewinding.

moved, they were as distinct as when they were motionless. But reflection was noticeable, as upon the eye or skin from a subocular or a lateral photophore, or upon my face when a *Flammenwerfer Shrimp* "exploded" close in front of me (see Color Plate XVI).

Now and then I felt a slight vibration and an apparent slacking off of the cable. Word came that a cross-swell had arisen, and, when the full weight of *Bathysphere* and cable (nearly four tons at this depth) came upon the winch, Captain Sylvester let out a few inches to ease the strain. There were only about a dozen turns of cable left upon the reel, and a full half of the drum showed its naked, wooden core. We were swinging at 3,028 feet, and would we come up? We would.

MORE BIG FISH AT GREATER DEPTHS

Whatever I thought about the relative value of intensive observation as compared with record-breaking, I had to admit that this ultimate which we had attained showed a decided increase in the number of large fish—more than a dozen from three to

twenty feet having been seen—and a corresponding greater number of lights, though not in actual size of their diameters.

Before we began to ascend, I had to stop making notes of my own, so numb were my fingers from the cold steel of the window sill. To change from my cushion to the metal floor was like shifting to a seat on a cake of ice.

WATER LOOKS HARMLESS FROM INSIDE

Of the blackness of the outside water I have already written too much. As to pressure, there *seemed* no reason why we should not be outside in a diving helmet.

I thought of a gondola 60,000 feet up in the stratosphere with a pressure of one pound to the square inch.* And then, through the telephone, we learned that at this moment we were under a pressure of 1,360 pounds to each square inch, or more than half a ton. Each window held back more than 19 tons of water, while a total of 7,016 tons was piled up in all directions

* See "Exploring the Stratosphere," by Capt. Albert W. Stevens, in the *NATIONAL GEOGRAPHIC MAGAZINE* for October, 1934.



Photograph by David Knudsen

AIR-CONDITIONING IS NOTHING NEW TO BATHYSPHERE DIVERS

The trays of soda lime and calcium chloride now on deck absorbed carbon dioxide and water vapor given off by the crew within the confined quarters of the iron ball during descent. Fresh oxygen was supplied at the rate of a liter a minute and a small electric blower kept the air in circulation. Inspecting the trays after a dive are, left to right, John Tee-Van, Perkins Bass, and Dr. Beebe.

upon the Bathysphere itself. Yes, we had heard clearly, and we told them we were ready to be pulled up at once!

At 2,929 feet I heard a metallic twang through the phone, and when I asked what it was I got some noncommittal answer. I found out later that one of the guy ropes used in spooling the incoming cable on the drum had suddenly given way with a terrific report—a ghastly shock to everyone on deck until they realized it was an auxiliary rope and not the cable. Truly, we in

the Bathysphere had the best of it at all times.

The only other place comparable to these marvelous nether regions must surely be naked space itself, out far beyond atmosphere, between the stars, where sunlight has no grip upon the dust and rubbish of planetary air, where the blackness of space, the shining planets, comets, suns, and stars must really be closely akin to the world of life as it appears to the eyes of an awed human being in the open ocean a half mile down.

HUNTING USEFUL PLANTS IN THE CARIBBEAN

BY DAVID FAIRCHILD

Agricultural Explorer, United States Department of Agriculture

AUTHOR OF "HUNTING FOR PLANTS IN THE CANARY ISLANDS," "THE JUNGLES OF PANAMA," "A HUNTER OF PLANTS," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

AN UNINHABITED island! What a thrill the words bring. And to land on one in the Tropics is the experience of a lifetime. It is like going down under the sea, or standing on the rim of a crater, or going up in a balloon, or falling in love.

As the boat neared the deserted little island of Beata we searched the skyline with our glasses, wondering what sorts of plants were there, for we approached it not as Crusoes, but as plant explorers for the United States Department of Agriculture.

SEEKING NEW PLANTS, NEW FOODS

On Mr. Allison V. Armour's research yacht *Utowana* we were cruising the Caribbean for drought-resistant plants, for new foods to enrich the American menu, for any valuable member of the vegetable kingdom which might conceivably flourish on our shores.

In the Bahamas we had sought in vain the wild type of cotton from which the sea-island cotton came,* but had gathered hundreds of frangipanis, those exquisite, fragrant-flowered trees which are native there, although more generally associated with oriental graveyards and South Sea islands.

We had passed through the Windward Passage between Haiti and Cuba, bound for Beata, off the southwest coast of the Dominican Republic, and now that tiny isle lay before us, green and inviting (see Special Map Supplement with this issue of *THE GEOGRAPHIC*). Above the other vegetation waved what seemed like slender bamboo stems with tufts of leaves at the top. First to detect them was Harold Loomis, of the Department's Division of Plant Exploration. Could there be a native bamboo here? Not at all likely, for none of the tall bamboos of slender habit are denizens of the West Indies.

Each turn of the propeller made these objects clearer, and gradually they stood out plainly as the slender stems of a fas-

cinating palm, new to the books and possibly new to science.

Was it in fruit? How tall was it? Would it become some day a palm for our gardens in Florida, or perhaps an ornamental house palm? Of course Loomis was the most anxious to get ashore, for he was the palm man of the party.

Mr. Armour was at the wheel. He had landed once before on this same island, and as we neared the shore he admonished us of the ways it might best be explored. Nevertheless, with a mad rush we all made for the new forms of trees and shrubs on the rocky cliffs and instantly became entangled in almost impenetrable thickets of spiny vegetation. Had the ground been passably level, we could have cut our way through, but we walked on knifelike edges and needle-sharp pinnacles of eroded limestone rocks which, even if there had been no vegetation at all, would have made going tedious.

When we had exhausted ourselves in the first rush, we drifted back to the shore with our booty and worked our way along the shelf of rocks, walking over countless ancient conch shells which lay in windrows on the old elevated beach, until we heard Loomis, who had made for the cliffs above in search of his palm, scrambling down to the shore.

He appeared dragging it with him and stood it up beside him for me to photograph (see illustration, page 710).

ONE SPECIES KNOWN, ANOTHER NEW

Until we brought it back to America, we fondly hoped it might be new to science. However, that genius of a collector, the Swedish naturalist, Ekman, had discovered it in Haiti. From the seeds we collected there are now many little palms growing in a greenhouse in Florida.

Now that the world has been thoroughly combed over by scientists, it is rather rare to discover a new plant, as our experience with the palm shows. Yet on this same lonely island we made such a find.

Our prize was a fine ornamental tree about 20 feet high, related to the hibiscus

* See "The Golden Isles of Guale," by W. Robert Moore, in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1934.



Photograph by P. H. Dossett

RED FRUIT LURES A PLANT-HUNTER UP A TREE

It is a hard climb, but Harold Loomis was rewarded by getting the first living seeds from Cook's Saona Island palm, which now may add its splash of color to subtropical gardens and conservatories. Although the fruit is not edible, the author enjoyed the taste of a chip from the trunk. He suspects that if it were in the Orient the tree, like the sago palm, might be used for starch.

and bearing cream-colored flowers the size of large saucers. Dr. Frederick L. Lewton, of the United States National Museum, who has specialized on the family to which it belongs, has found it to be a new genus and has named it for Mr. Armour—*Armouria beata*. Unfortunately, only two of the seeds we collected from it have grown.

We cut our way through the brush without realizing that it was overgrown with manchineel trees, but the effects of the oil glands of their leaves soon reminded us that the West Indies has poisonous trees worse than our familiar poison ivy. In former days the manchineel was believed to be as deadly as the famous upas tree of Java.

There is a strange fascination in making your way slowly and painfully through the scrub, pushing against the tangle of vines that catch at your clothes and your flesh, cutting down a small tree here, or hacking a trail through some spiny bush there, watching all the time to see that you don't turn your ankle on some sharp rock or plunge your foot into some pothole and break a leg.

But another island awaited us—Saona, off the southeast coast of Hispaniola. We knew of it through a curious circumstance.

My friend, Dr. O. F. Cook, in his investigations in the National Museum in Washington, had come upon a fragment of a palm specimen collected there years ago. Observing characters on it which made him believe it was new, he had named it *Pseudophoenix saonae*, for the island.

He had never seen the living palm, nor had we; but when the boat came within half a mile of the coast of Saona, and we espied through our glasses a splash of red against the dark foliage, we presumed it was a bunch of red fruits of the palm that Cook had described (see illustration above).

This scarlet spot on the landscape was the objective of our first landing on the island. Although we found also a beautiful strand tree, with glossy foliage and fragrant flowers, and collected quantities of seeds of a rather rare palm with huge fan-shaped leaves, it is the memory of that scarlet-fruited palm of Cook's which makes me want to return to the little island.



Photograph by P. H. Dorett

THE "UTOWANA" ANCHORS OFF A ROBINSON CRUSOE ISLE

Few scenes in all the West Indies have more charm than those about Man-of-War Bay, Tobago, whose scenery some see reflected in Defoe's immortal tale (see text, page 723). Its isolation from the outside world, its rocky cliffs covered with orchids, its densely forested hills, full of palms and epiphytes, the boom of its restless surf—all combine to make it a fitting abode for romance.

It was afternoon, and the long shadows through the forest gave it a strange, fairy-like appearance. As we crept through the undergrowth, here and there, staring at us with their beadlike eyes from the moist forest floor, were giant hermit crabs, bright vermilion in color, the largest I had ever seen. I could not help collecting some to take back as pets to friends in Washington.

Loaded with the palm's brilliant red fruit clusters, each about all a man could carry, we returned to the yacht and hung them up to ripen on their stems on the after hatch. As I write, three years from that afternoon, it is a satisfaction to know that there are boxes filled with little seedlings of Cook's palm at the Introduction Garden in south Florida, and that some day their clusters of scarlet fruit may brighten private gardens and solaria.

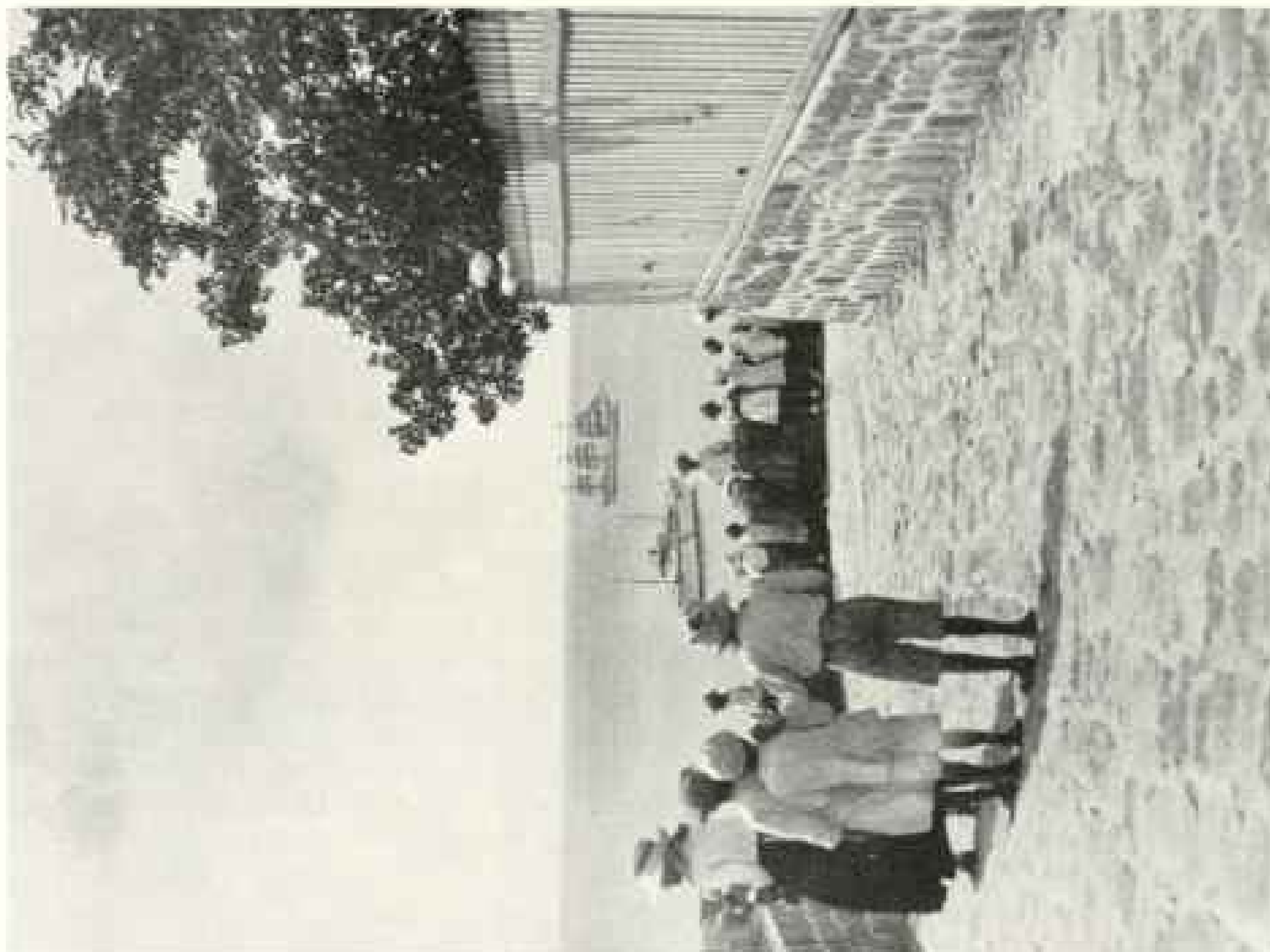
HERE A FOREIGN POWER FIRST SALUTED AN AMERICAN FLAG

Rough weather prevented us from landing on the volcanic island of Saba, and we went ashore instead on near-by St. Eusta-

tius, another of the Dutch West Indies. There, in 1776, a Dutch governor ordered the first salute fired to an American flag by any foreign power (see illustration, page 711).

We visited the only remaining bit of virgin forest left in the island, climbing an extinct volcano to do so. After the low brush of the Bahamas, and even the taller forests of Beata and Saona, the rain forest of the crater seemed marvelously rich. Great aroids and ferns formed the undergrowth, and tall leguminous forest trees were hung with lianas of all sorts.

The peak of Mount Misery, on the island of St. Kitts, rose from the sea at dawn next day. A dark cloud on the horizon grew as we approached until it became a mountainous island, so high as to require a day to scale it, with roads, villages, forests, and vast fields of sugar cane. With our glasses we watched the early-morning activities of the countryside; we even heard the cocks crowing, the church bells ringing, and the neighbors talking. The effect might be likened to a fine pastorage.



Photograph by H. F. Lounsb

SCIENTISTS EXPLORE WHERE SMUGGLERS ONCE ANCHORED

While eager youngsters watch, the plant-hunting yacht *Utopiana*, in concert with an old three-master, moors off Orange Town, St. Eustatius. In American Revolutionary times this small Dutch island was the center of a huge trade in munitions and supplies for the Colonies, and when, in 1781, a British fleet under Rodney captured it, the contraband was sold at auction.



Photograph by Jacqui Gayer

HEAD-CARRYING LEAVES THE HANDS FREE FOR TALKING

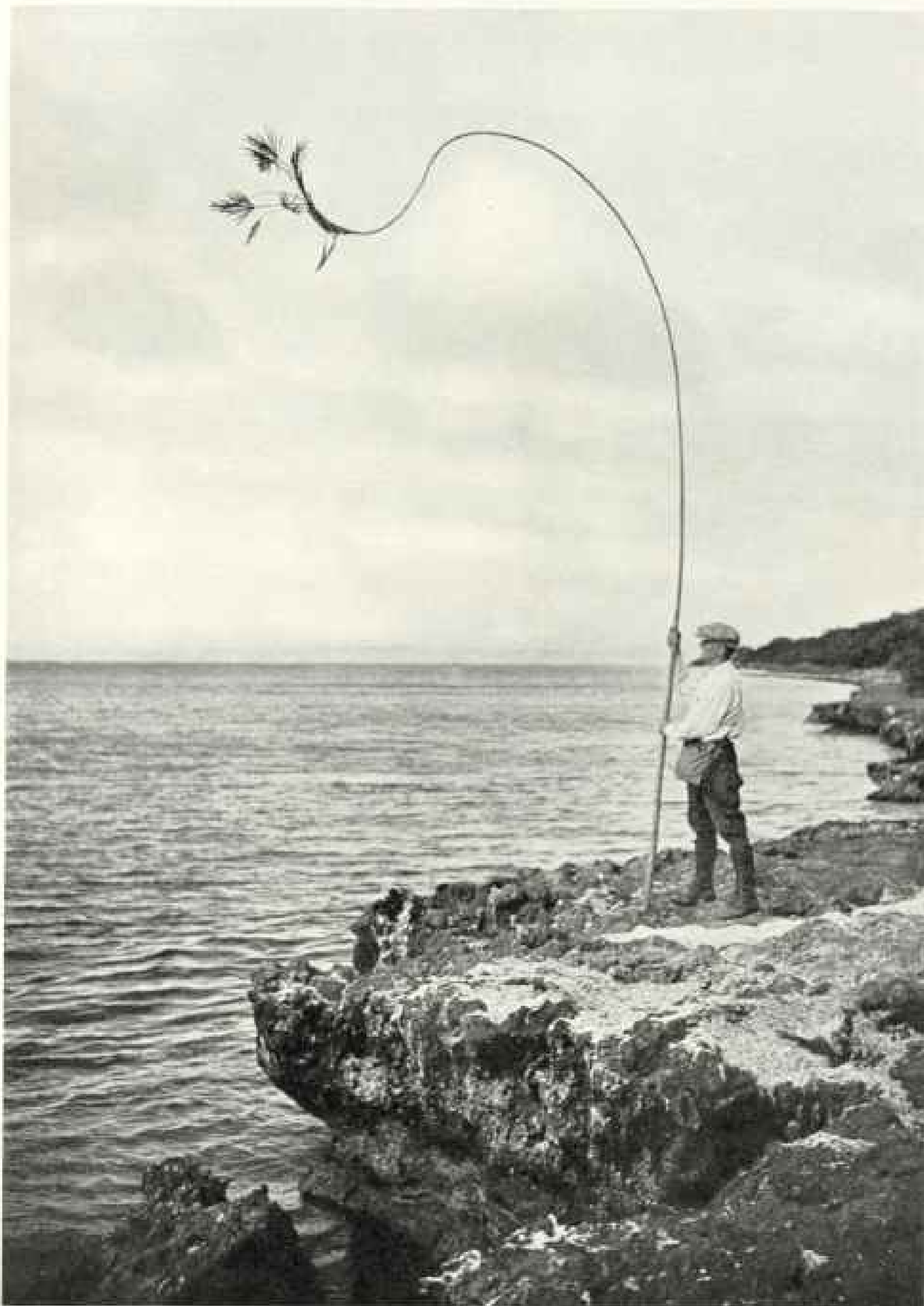
Although England has held the island of St. Lucia for more than a hundred years, its Negroes mainly speak a French patois, now gradually giving way to English. Gay kerchiefs serve as pods beneath the baskets and add a touch of color as market-bound women stride along mountain roads or pause on the streets of Castries for a bit of animated conversation (see page 715).



Photograph by Richard B. Hall

THE VIVID BLUE AND GREEN WATERS OF NASSAU HARBOR GLEAM TWO HOURS BY AIR FROM MIAMI

Off at the left stretch the white bathing beaches of Hog Island, once a pirate lair. Tradition says that in its lee the notorious "Blackbeard," Edward Teach, playfully set fire to a ton of brimstone in his ship's hold and bragged that he stayed in his own little inferno longer than any member of his cutthroat crew. On the coral strand of New Providence Island, at the right, lies Nassau, metropolis of the Bahamas. There the visitor gets a foretaste of Caribbean life.



Photograph by Dr. David Fairchild

ON A TINY ISLE GROWS THE EKMAN PALM, "CROOKED AS A DOG'S HIND LEG"

This rare specimen was dragged from the rocky cliffs of uninhabited Benta by Harold Loomis, who holds it (see text, page 705). Constant bowing before Caribbean winds has given it a permanent crook in its neck, but even hurricanes seem powerless to destroy it. One of the world's slenderest, it is 27 feet tall and not much larger at the base than a tennis racket handle. In sheltered places it grows straight as a flagstaff.



Photograph by H. F. Loomis

HERE BOOMED THE FIRST FOREIGN SALUTE TO AN AMERICAN FLAG

From a cannon such as these the Dutch governor of St. Eustatius ordered a salute fired when a vessel from Baltimore sailed into Orange Town harbor in November, 1776, proudly flying the Grand Union colors. The American Colonies were not yet recognized as an independent nation, and for his act the governor was recalled.

By the following noon we were in the dense rain forest on the slopes of Mount Misery with Harold E. Box, an entomologist, and two of his friends, collecting palm seeds and aroids, and listening to entertaining accounts of island vegetation.

It was strange to find many sorts of tropical fruit trees, which must have been introduced in times past from the Orient and other places, growing wild in the mountains. From the size of their trunks we knew they had been there for a half century or more.

A sense of the age of the West Indies civilization came over me during our first morning in St. Kitts. Suddenly I realized that there was nothing untamed or primitive about the landscape. So far as virgin forest was concerned, I might as well have been walking in New Jersey pastures.

No wonder I felt thus; for by 1630 there had been 6,000 English settlers on the island. The record of nearly 200 years of fighting between the French and English for its possession shows the importance that was placed upon these little tropical islands by the nations of Europe.

I read in a colonial history, written in 1837, that even in those early days there were growing on the island the orange and the shaddock, the latter called after a captain who is said to have brought it from Africa. The history mentions also the "avocado," the grenadilla, and the "forbidden fruit," which is "a species of the shaddock, only smaller and more delicate, while the outer skin is less coarse."

It seems possible from this description that the "forbidden fruit" of the early chronicler was the same as that which the Florida "crackers" rather stupidly named the "grapefruit," and that it originated as a seedling somewhere in these West Indian islands.

The stretches of sugar cane which almost cover the island of Antigua with monotonous pale green looked discouraging from the boat. But with the aid of Mr. C. F. Charter, an enthusiastic young Englishman, we found a pretty yellow-flowered *Cipura*, a scarlet-flowered *Galactia*, two palms, and a tabebuia tree, all of which may some day come to light in our Southern States.



Photograph by José Anjo

HERE LORD NELSON'S FIGHTING FLEET FITTED FOR ACTION

Massive pillars mark the site of the famous admiral's dockyard on the island of Antigua and take the visitor back to the days when the Caribbean was the main arena of naval struggles for supremacy in the New World.

As we approached Dominica at sunrise, it was very beautiful and very tropical, with mist-covered mountain peaks more than 4,000 feet high, and deep, mysterious, almost sinister, gorges. It is a horseback country; had it been better supplied with roads we could have seen more of it.

However, if there had been nothing in Dominica but its botanic garden, we should have been repaid a hundredfold for the days passed there. It has one of the most attractive tropical gardens in the world.

"THE PRINCES OF THE PLANT WORLD"

The glory of such a garden lies in its palms. Those who have seen them only as potted plants cannot appreciate that they are, as Linnæus called them, "the princes of the plant world."

They form an immense family of perhaps 2,000 species, ranging in size from dwarfs to giants 130 feet tall.

Countless generations of primitive children have grown up beneath their shifting shadows; myriads of people for thousands of years have lived on their fruits, built houses from their leaves, made weapons

and tools from their stems, and dressed in their leaves. The cargo ships which ply the tropical seas carry palm products to the factories of the Temperate Zone, and in increasing volume the palms help feed and wash mankind with their fats and oils.

I wandered all over the Dominica garden with Mr. Joseph Jones, its creator, and, since we had been offered seeds of the several species of palms, I felt that we had found a veritable mine of material.

Palm seeds are difficult to transport, for many of them do not hold their vitality long. Though the seed itself may be hard and firm, the almost microscopic plantlet which is packed away neatly in the hard kernel is as perishable as a sprouted mustard seed. It will not stand drying out, nor has it any resistance to the molds that are almost sure to gather around the usually oily palm seed-coats.

AIRPLANES AID PLANT IMMIGRANTS

With the facilities afforded by the research yacht we were able to care for the palm seeds given us, and thousands of seedlings, now safely growing in Florida, speak



Photograph by Jacob Gayet

LIFE IN ST. JOHNS MOVES IN THE TEMPO OF THE OLD SOUTH

Wherever he has settled in the New World, the Negro has used the basket and the donkey or the mule for transport. On this British island of Antigua human heads still bear incredible loads and tiny donkeys look as if they should change places with their riders.

for the facilities which Mr. Armour put at our disposal. Also, by air express Mr. Armour landed perishable seeds in Washington in less than six days from the time the seeds were gathered from the trees in British Guiana. I remembered how many of my collections made in the West Indies in 1898 had been dead when they arrived in Washington after a month or more in the steaming hold of some passenger ship.

The rarest and one of the loveliest flowering trees is here in the Dominica garden. *Baikia insignis* is its name. To stand beside one of the large flower clusters and wait for dusk, and then to watch the slow unfolding of those immense paper-thin petals of ghostly white, fringed with thin bands of old gold; to see these emerge from long finger-shaped buds, soft, velvety, and deep brown as a lady's suede glove, is an experience never to be forgotten.

A ROAD TO A BOTANIST'S PARADISE

On the charming island of St. Lucia the roads, far superior to those of Dominica, wind among amazing scenes of tropical vegetation. In the central mountain region

these scenes reach a climax. I do not remember having seen more nearly perfect tree ferns and heliconias, aroids, and bamboos, than along a stretch of the highway there.

COLLECTING OFFERS EXCITEMENT

Howard Dorsett, Loomis, and I passed a day collecting in the mountains and saw the pink and brown fruit clusters of the tall Euterpe palm, which pushed up through the forest below us. To climb down the slippery slopes of a tropical hillside is exciting, for a sheer drop may lie right ahead where some fascinating find lures.

The market at St. Lucia was full of the largest and most attractive dasheens I have seen. This delicious vegetable, the tuber of a plant related to the calla lily, appears to be one of the staple foods of the inhabitants. Some road workers along the way were eating their lunch as we passed. I peeped into their dinner pails and baskets and found that almost all were eating large slices of boiled dasheen.

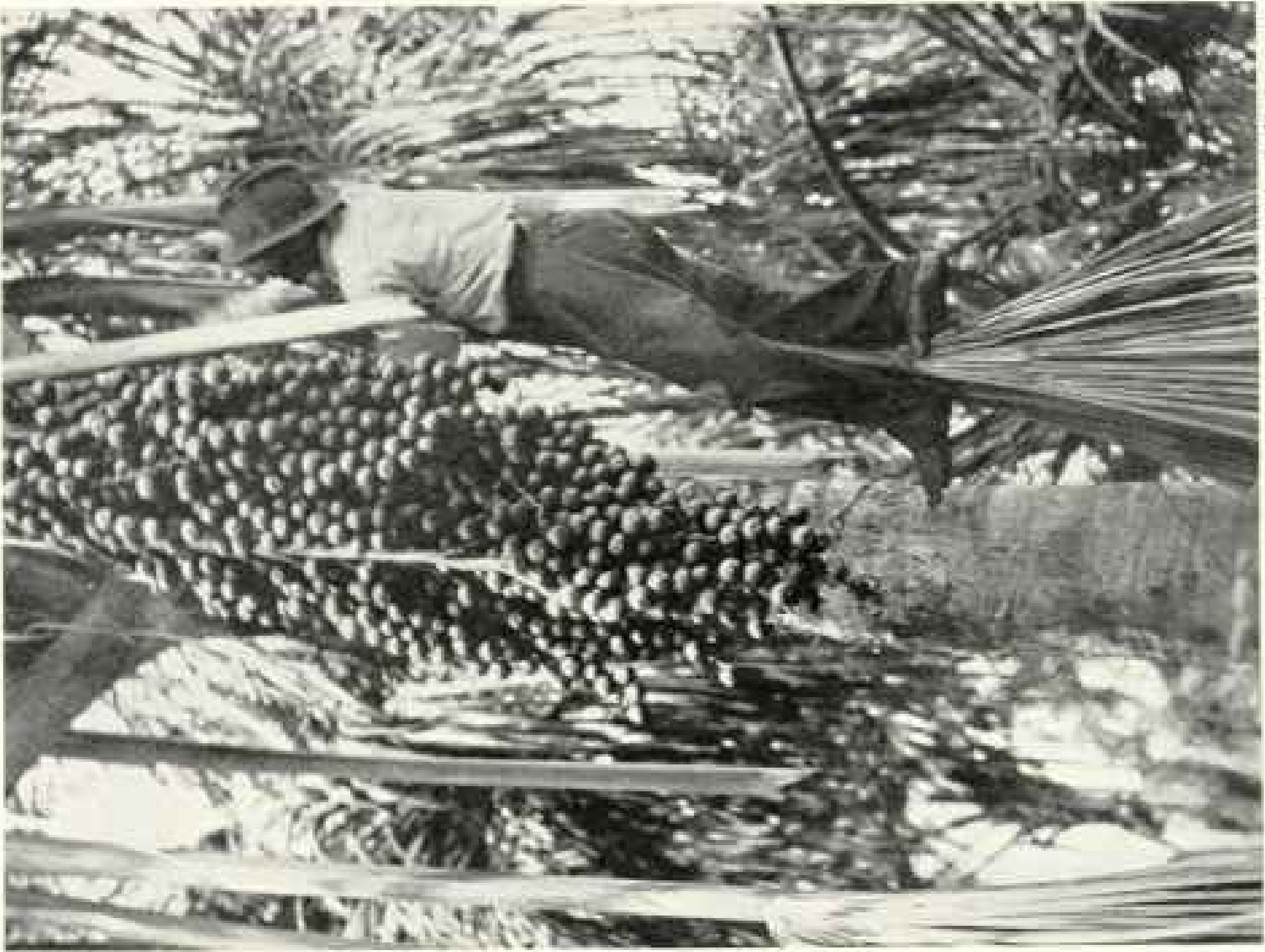
Mr. Armour and I selected the best specimens we could find in the market,



Photograph by Dr. Karl Jordan

HUGE CACTI ADD A BIZARRE TOUCH TO ST. KITTS SCENERY

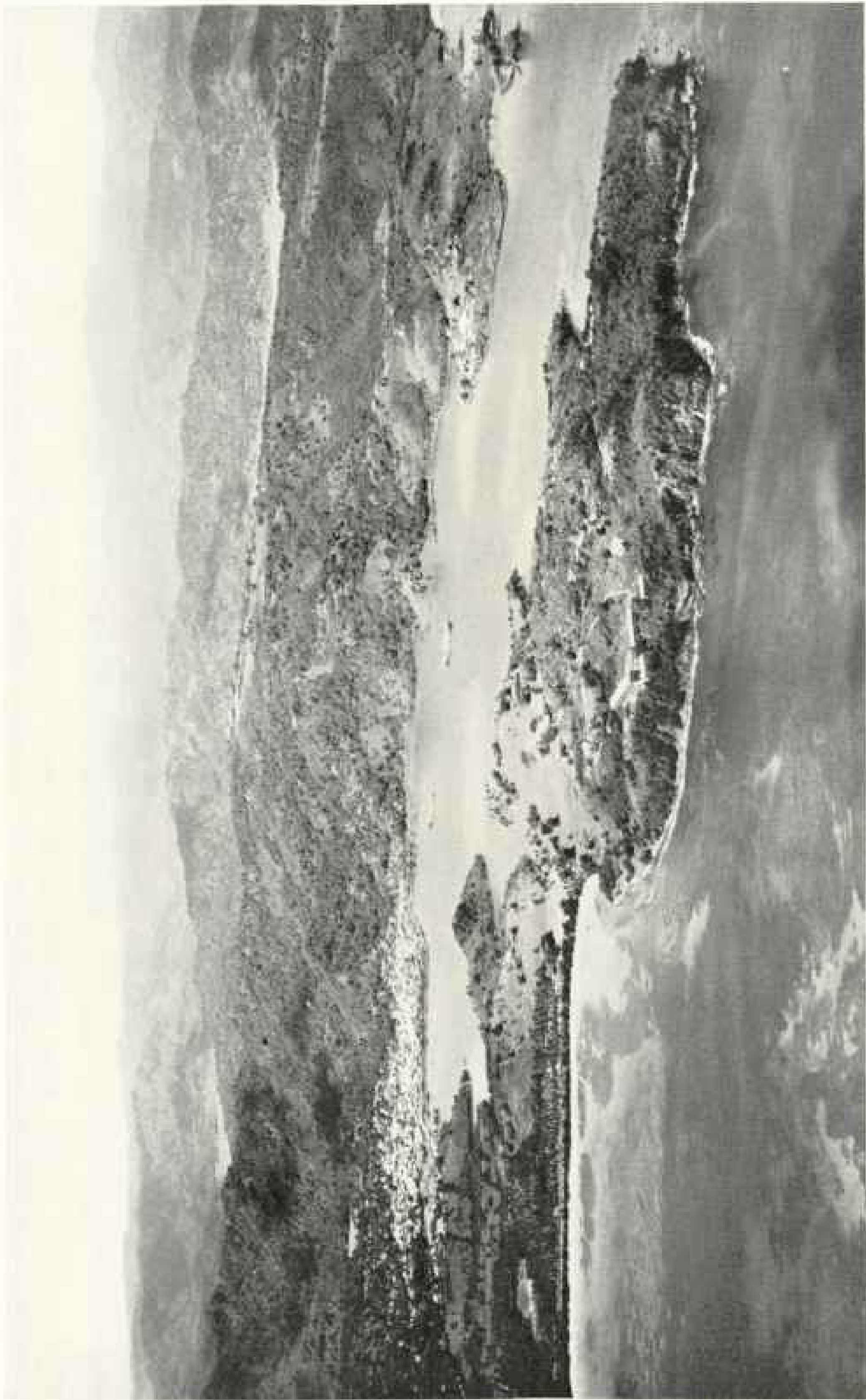
Such growths are commonly associated in the popular mind with deserts, but they are to be found in wet lands, too. They are sometimes used for fences, and when their huge white blooms open on moonlight nights they make an unforgettable sight. Some regions in Jamaica are literally infested with this giant, which has become a weed.



Photograph by P. H. Dorsett

HACKING DOWN A 100-POUND CLUSTER

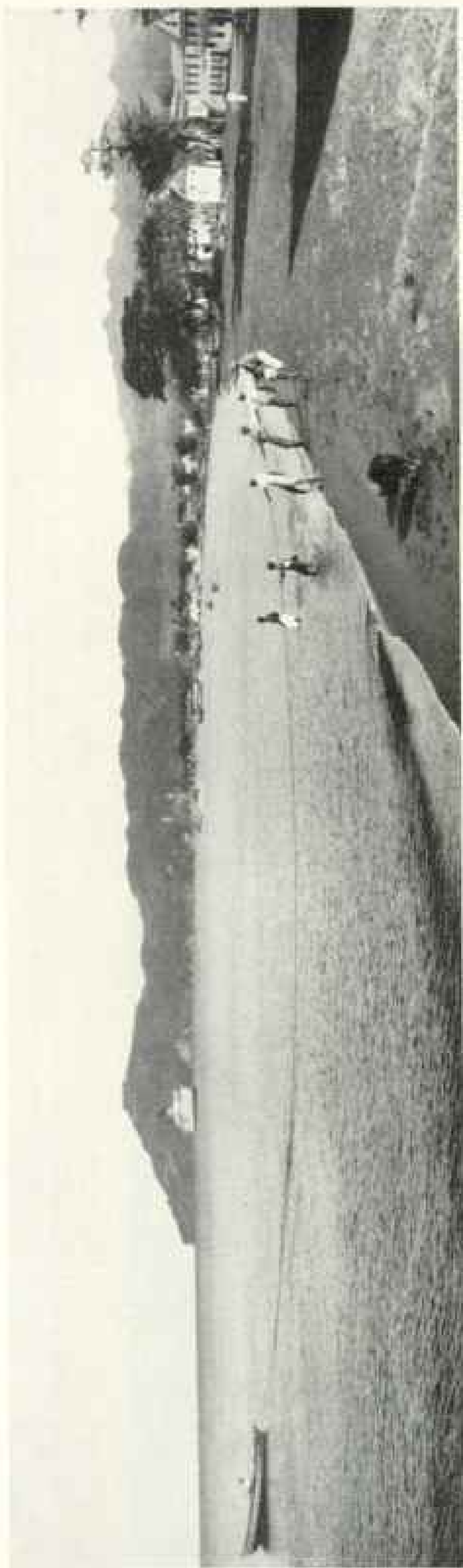
Perched on a dead leaf of the Mauritia palm, 50 feet up in a vast tropical swamp, a native swings his machete until the mahogany-colored fruit plunges into the shallow water. Small palms from the seeds gathered near Georgetown, British Guiana, are growing in south Florida, but whether they can adapt themselves to the alkaline conditions of the Everglades is a question.



Photograph by Capt. Albert W. Stavres

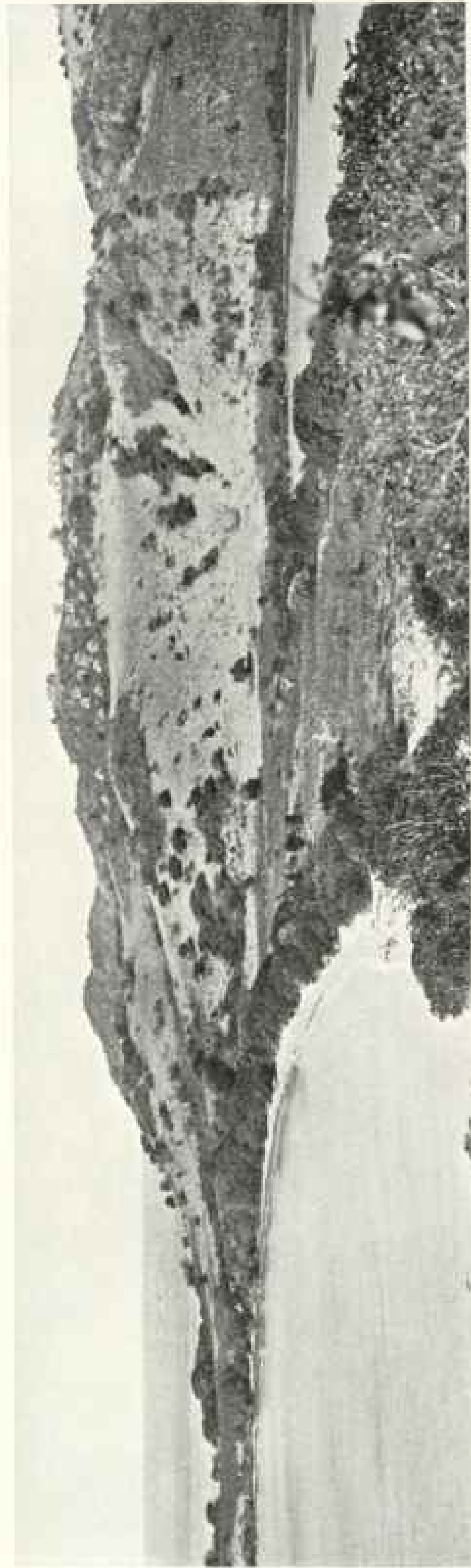
DEADLY SNAKES ONCE INFESTED THE VERDURE-COVERED MOUNTAINS OF LOVELLY ST. LUCIA

Now these lurking perils, including the venomous fer-de-lance, or "yellow viper," have been virtually wiped out with the aid of the devastating mongoose. The author's plant-seeking party roamed in safety through tropical forests filled with graceful palms and tree ferns. At the left, Castries, the capital, nestles at the head of its superb landlocked harbor. Around it, on land and sea, centered for years the struggle of the French and English for supremacy in the West Indies.



Photograph by José Anjo

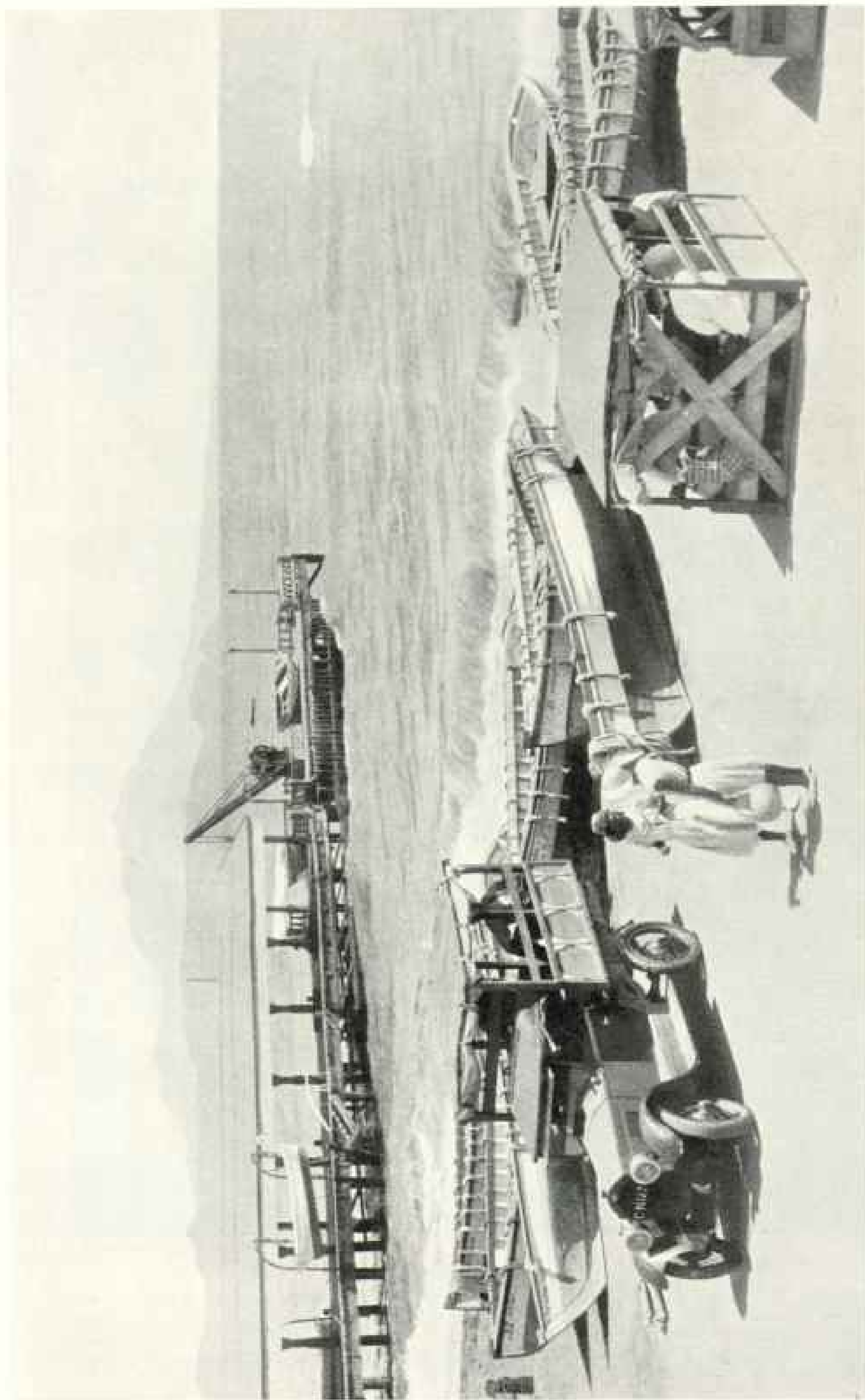
ON ST. VINCENT'S BEACHES BLIGH LANDED HIS BREADFRUIT TREES



Photograph by Dr. David Fairchild

IN A SINGLE AFTERNOON ONE CAN RAMBLE ALL OVER TINY MAVERO, IN THE GRENADINES

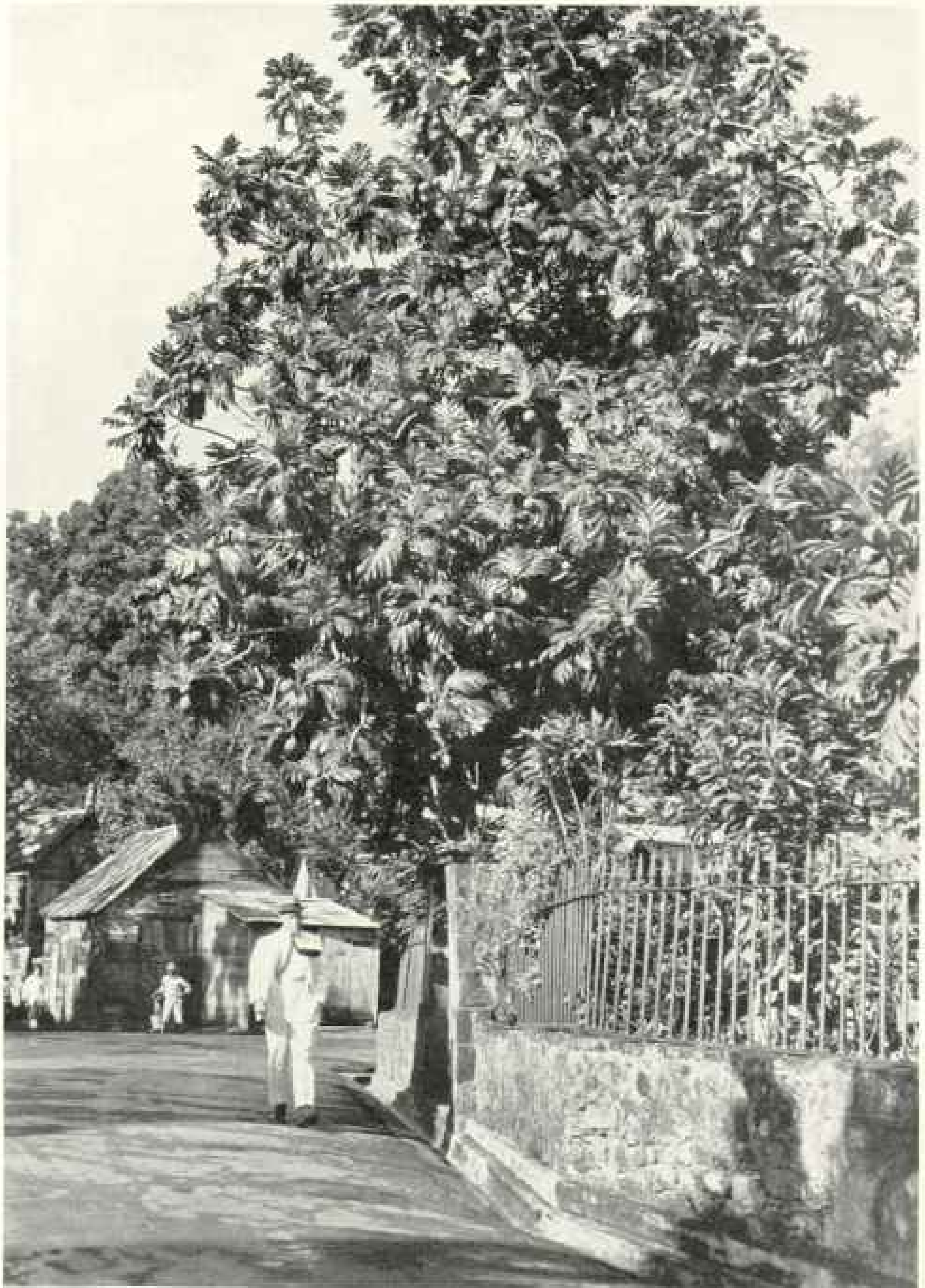
Its white sand beach sparkles in the sunshine, but, alas, it is bordered with poisonous manchineel trees, which raise blisters more troublesome than those from poison ivy.



Photograph by Ella Burnett

COLUMBUS CALLED THIS ISLAND SAINT CHRISTOPHER, BUT THE NICKNAME "ST. KITTS" HAS STUCK

Basseterre's boat-strewn water front is the end of the line for busses, which bring passengers from the interior in the morning. On arriving here, the body, with its seats, is removed and serves as a waiting room, while the chassis is used for local hauling jobs around the city. On the sands at the right squats one of these removable bodies, well filled with passengers for the return trip in the afternoon. One of the girls in the foreground crochets as she talks.



Photograph by Jacob Gayser

BREADFRUIT CAME AS AN IMMIGRANT FROM THE SOUTH SEA ISLES

This tree at Castries, on St. Lucia, recalls that in 1793 Lieutenant Bligh of the British Navy brought some to the West Indies, despite the famous mutiny of the *Bounty* and his subsequent 3,600-mile voyage in a small boat, after being set adrift by the mutineers. Boiled and served with butter as a vegetable, the fruit tastes like a rich and delicate potato, but it does not take the place, as experimenters once hoped, of bread (see text, opposite page).



Photograph by Dr. David Fairchild

NATURE SUPPLIES EXCELLENT UMBRELLA SUBSTITUTES

As these children of St. Lucia trudged home in the rain, they protected themselves with three-foot *Cocoloba pubescens* leaves, which when the tropical downpour ceased served equally well as parasols. Trees of this species are now growing in south Florida, and plants of it in tube have been exhibited at the New York Flower Show.

and for days afterward Ernest, the steward, served us with masterpieces of dasheen chips, dasheen stuffing for poultry, baked, scalloped, and boiled dasheens, and so on. He realized the possibilities of the dasheen for many dishes for which the potato is less well suited, and prepared recipes which I sent to the Dasheen Growers Association at Callahan, Florida.

Thanks to the enthusiasm of Mrs. C. W. Doorly, the wife of the Administrator of St. Lucia, our gardens in Florida are being enriched with a new root vegetable called the "lleren," or "topi-nambour," *Calathea allouya*. The little tubers of this plant are sold in small bunches at the market in St. Lucia and some of the other islands. They are the size and shape of pullets' eggs and are usually boiled by the country people before they are taken to market, but we found them more delicious if baked and served hot, like baked potatoes.

St. Vincent boasts the first government-established botanic garden in the Western World, dating from 1763. It became one of the finest gardens in the Tropics; but, because of political difficulties and perhaps misunderstandings, it was abandoned after 50 years, and the plants were moved to Trinidad.

ODYSSEY OF THE BREADFRUIT

It was into Jamaica and St. Vincent that Lieutenant Bligh introduced the breadfruit and many other oriental trees collected on a subsequent expedition to Tahiti after the mutiny of the *Bounty* (see opposite page).

If the Negro laborers of the "sugar colonies" could be fed on breadfruit, it was thought it would be unnecessary to import so much flour and other expensive foodstuffs from Europe.

The planters of Jamaica gave Bligh an enthusiastic welcome and presented him



Photograph by P. H. Dorsett.

A FEW CANDIES MADE THE AUTHOR THE PIED PIPER OF TOBAGO

Word traveled fast, and every child in Charlotteville turned out to get his share of the sweets brought safely ashore despite a spill of the landing party into the surf of Man-of-War Bay (see text, page 723). Both the author (left center) and Mrs. Fairchild (right) were soaked.



Photograph by H. F. Loomis.

LITTLE TOBAGO IS UNSPOILED AND IDYLIC

How many millions of children in reading Robinson Crusoe have imagined a scene like this among the coconut palms! Yet the island's days of isolation seem now to be numbered. Air travelers can leave at sunrise on Wednesday from Trinidad, across the way, and be in New York in time for breakfast on Friday.

with 1,000 guineas, but before long it became evident that one factor had been overlooked, the factor of taste. The African blacks did not like the breadfruit so well as they liked bread; to them it was no better than their plantain. The effects upon the flour imports were nil, and the planters were disillusioned.

Although the immediate effects were disappointing, the thousands of breadfruit trees which now are scattered throughout the islands attest the growth of the taste for the fruit among the inhabitants.

THE GRENADINES ARE STORY-BOOK ISLANDS

The tiny islands of the Grenadines are fascinating; like little fragments of the world, they stand apart, completely left behind by the passage of events.

I recall on Bequia the little group of black school children who followed us across the trail to the valley of Friendship late one afternoon, eager to catch lizards for us, prompt with information about the enormous fruited tamarind which grew on the hillsides. They were enthusiastic about the chief food they knew, the pigeon pea, which, when properly cooked, is as delicate and palatable as the lentil of Bible history. Everywhere the hillsides were planted with this shrubby legume, and its yellow flowers made the pathways bright with color.

Bequia has an area of about 10 square miles; Cannouan is about one third that size. When we landed among the surprised natives in the early morning, the schoolmaster joined us.

On the superb white beach I was surprised to find the bonavist bean, *Dolichos lablab*, growing in profusion in pure sand. It is a species which I have often grown in Florida and found delicious when used as a puree or in soups. Should a share of the attention bestowed on the ordinary garden pea be given to this bonavist bean, we might have a popular new vegetable.

The curse of these little Grenadines is the manchineel tree, which lines the beaches everywhere (see page 716).

Of the four islands of the Grenadines visited, Mayero remains in my memory as the most romantic. In an afternoon Loomis and I went all over it, and as a result we have growing in our gardens a lot of little plumeria plants from the wind-swept eastern side of the island, a pretty new ficus from the summit, and a single tiny seedling



Photograph by H. F. Loomis

CLIMBERS, BEWARE THE CARESS OF THE "PORCUPINE TREE!"

After once brushing against it and having its black, needle-sharp spines break off and lacerate in the flesh, one learns caution. The points which protect these young *Acrocomia* palms are shed as the trees grow older. There were once forests of them on Antigua, but now only a few stately specimens remain.

of a handsome calliandra bush whose deep crimson flowers took my fancy.

Carriacou, the largest of the Grenadines, has roads and a small botanic garden. We saw a fine stand of mahogany, the result of reforestation to conserve the rainfall.

On the hill above the town, where we went searching for leguminous plants, we found a new shade tree and a promising new ficus tree used as a windbreak.

One of the oldest botanic gardens in the West Indies is in Grenada. Thanks to the



Photograph by Capt. Albert W. Stevens

THIS DESOLATE LAKE HELPS TO PAVE THE WORLD'S CITIES

When Sir Francis Drake calked his ships with ooze from "ye Great Pitche Lake on Trinidad," he little suspected that out of it would come thousands of miles of asphalt highways for rubber-tired cars. From the air it looks like a big mud puddle. A man can walk across the semisolid surface, patched and veined with muddy water.

love for plants of almost all its British governors, it is still kept up and attracts many tree lovers.

In the nineties I had traveled with my old friend, Barbour Lathrop, out to the Spice Islands, where I saw the nutmeg in its native home, and heard how the Dutch resisted the taking of this tree to Grenada and other tropical islands. Therefore I was particularly interested in seeing the plantations in Grenada, where the nutmeg tree was introduced from Banda, in the Banda Sea.

On one of the old plantations some of the trees are nearly a century old. Of all the fruit cultures I know, that of the nutmeg is the neatest and most orderly. There is something unreal in the exquisite golden-yellow, pear-shaped fruit, which when ripe

opens and shows the chocolate-colored nut covered with its scarlet network, the mace of commerce, itself an important spice. The fruits always seem to open in just the same way, to be of nearly uniform size and color, and to nestle among leaves as polished as those of the European holly.

When I walked under the trees in one orchard I was aware of the same dense shade and moist atmosphere and the strange glamour that I had felt in the Spice Island plantations of the East.

HOUSEWIVES DEMAND ROUND NUTMEGS

As nutmeg growing was profitable for the Dutch in Banda, so it seems to have been for the British planters of Grenada. Since 1865 the nutmegs of Grenada have come into the market in increasing quantities and,

roughly, a third as many come now from this island as from Banda.

Grenada nutmeg growers are bothered because their trees produce too many oblong nuts. Even if a long one is just as easy to grate and has practically the same aroma as a round one, century-old tradition demands the spherical shape.

Approximately 6,000 tons a year is the average consumption by occidentals of this remarkable spice, of which nobody wants more than a few small particles at a time. The welfare of two of the most beautiful little islands in the world, one in the Eastern and one in the Western Hemisphere, is tied up with man's taste for this nut.

When we arrived in the early morning at Port-of-Spain, Trinidad, we were aware of a marked change. Subtle differences in the water and the sky tell the initiated that he is nearing the continental Tropics, which in climate and other aspects are very unlike the small oceanic islands. Trinidad lies just off the delta of the mighty Orinoco, and its flora and fauna are those of South America.

There were wonderful mornings in the botanic garden, in charge of Mr. R. O. Williams, where we were joined by the former director, Mr. W. E. Broadway, who has watched grow from seed many of the finest specimens in this gallery of Nature's masterpieces.

In this garden is one of the finest collections of palms in the Western Hemisphere, but they form only one chapter in a complete book of strange, fascinating plants. The *camoensia*, with its magnificent gold-edged flowers of purest white, was in bloom near the Governor's residence. A tree of *portlandia*, with immense white blossoms, stood near the entrance. A new and brilliant-red perennial, *Scutellaria ventenati*, filled one of the borders, and the ground under a magnificent spreading forest tree was covered with flowers shaped like mouse-traps, belonging to that most remarkable of the families of trees which inhabit the tropical forests of America, the Lecythidaceae.

THE HOME OF AN ORCHID HUNTER

Mrs. Fitt, a daughter of my old friend, Eugène André, the orchid hunter, invited us to call, and as we drove into their place I was struck by the fact that we were passing under a pergola completely covered with a single hybrid orchid, *Vanda teres* X *V. hookeriana*. Miss Joaquim. It had grown

so dense that it made almost a tunnel of the pergola. When it is in bloom, in the late spring, I am assured that it is one of the wonders of Port-of-Spain.

When Mrs. Fitt told me that she had an avenue of sealing-wax palms, *Cyrtostachys renda*, in her commercial nursery, and that they were in fruit, we went at once to see them, for this is one of the most aristocratic of palms, and I had been trying for years to introduce it into the United States. It is striking at all times, because of the brilliant red of its leaf sheaths, but when to this are added delicate pink fruit clusters and deep blue-black fruits, its beauty is amazing. It thrills me to see the hundreds of tiny seedlings coming up in our gardens from the seeds Mrs. Fitt gave me.

"WASHED ASHORE" ON A CRUSOE ISLAND

We passed three unforgettable days at Man-of-War Bay, on the north coast of Tobago, an island which is said to have furnished Defoe with some of the tropic setting for his tale of Robinson Crusoe (see page 707); this he combined with incidents suggested by the experiences of Alexander Selkirk, marooned on Juan Fernández Island, off the coast of Chile.*

The scene was so friendly as we sailed into that superb harbor, the golden sunshine lighting up the coconut palms and the flame-colored erythrinæ, and bringing into high relief the moving fishermen on the beach, that nothing could stop the whole scientific contingent from piling pell-mell into the boat which Mr. Armour had especially built for landing on shelving beaches. We quite forgot his instructions not to overload it. Though we saw the great quiet rollers, we failed to be disturbed by them until we came close to the shore.

We were just thinking that one oarsman was not enough to land a boat with seven people on such a shore when the next wave gently raised the stern and tipped us all out into the surf. Sea sand in our hair and eyes, and drenched with salt water, we scrambled ashore after the manner of Crusoe himself.

We made plans to have a large surfboat meet the launch next morning; but the arrangement missed fire, and the fellows who came off were some inexperienced boys who

* See "A Voyage to the Island Home of Robinson Crusoe," by Waldo L. Schmitt, in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1928.



Photograph by F. H. Dousett

VAST SAVANNAS RECALL THE FLORIDA EVERGLADES

Here in the Guianas, however, the swamps are filled with ferns instead of "saw grass," and the water which soaks the muck is not alkaline, but as acid as that of a blueberry bog. The author holds a 10-foot *Mauritia* palm leaf (see illustration, page 714).



Photograph by H. F. Lounsbury

BUSH NEGROES PREPARING FOR A DANCE

These girls and women are descendants of slaves who revolted about 1762 and escaped into the jungle of Surinam to live their own simple, unsophisticated lives. Well-built houses, neatly swept streets, and characteristic, carved utensils indicate a high degree of community discipline (page 732).

knew no more about surf riding than we did, and Loomis and I got another ducking. The boys got a calling down from the older men, and we passed the day in wet clothes. But what a day!

COLLECTING ORCHIDS FROM A LAUNCH

Edgerly, the native guide, led us a hard scramble up the slippery slopes of Pigeon Peak. We sought the *Astrocaryum* palm, which is native there. It is lovely and slender-stemmed, but has vicious spines all up and down its trunk. To get their seeds we had to cut down the palms, and one of the trunks, falling across the steep, slippery pathway, hemmed me in against the hillside. The only way out was over its brittle spines, which seemed waiting to break off in me if I stumbled. I realized how quickly a danger may arise in the jungle. Alas, the seeds we collected that day have not grown!

We could see from the boat that the rocky cliffs of the harbor were covered with the Virgin orchid, *Diacrium bicornutum*, and from the way the surf was dashing against the rocks it seemed probable that this beautiful white orchid was bathed in salt mist all the time. I had never seen orchids so near the surf before, and since it was a rather rare species in cultivation in America, Mr. Armour and I decided to try collecting a quantity from the launch.

The sailors in their bathing suits did the work, while we stood off in the launch and kept clear of the rocks upon which the huge rollers would have smashed us if any-



Photograph by F. H. Damon.

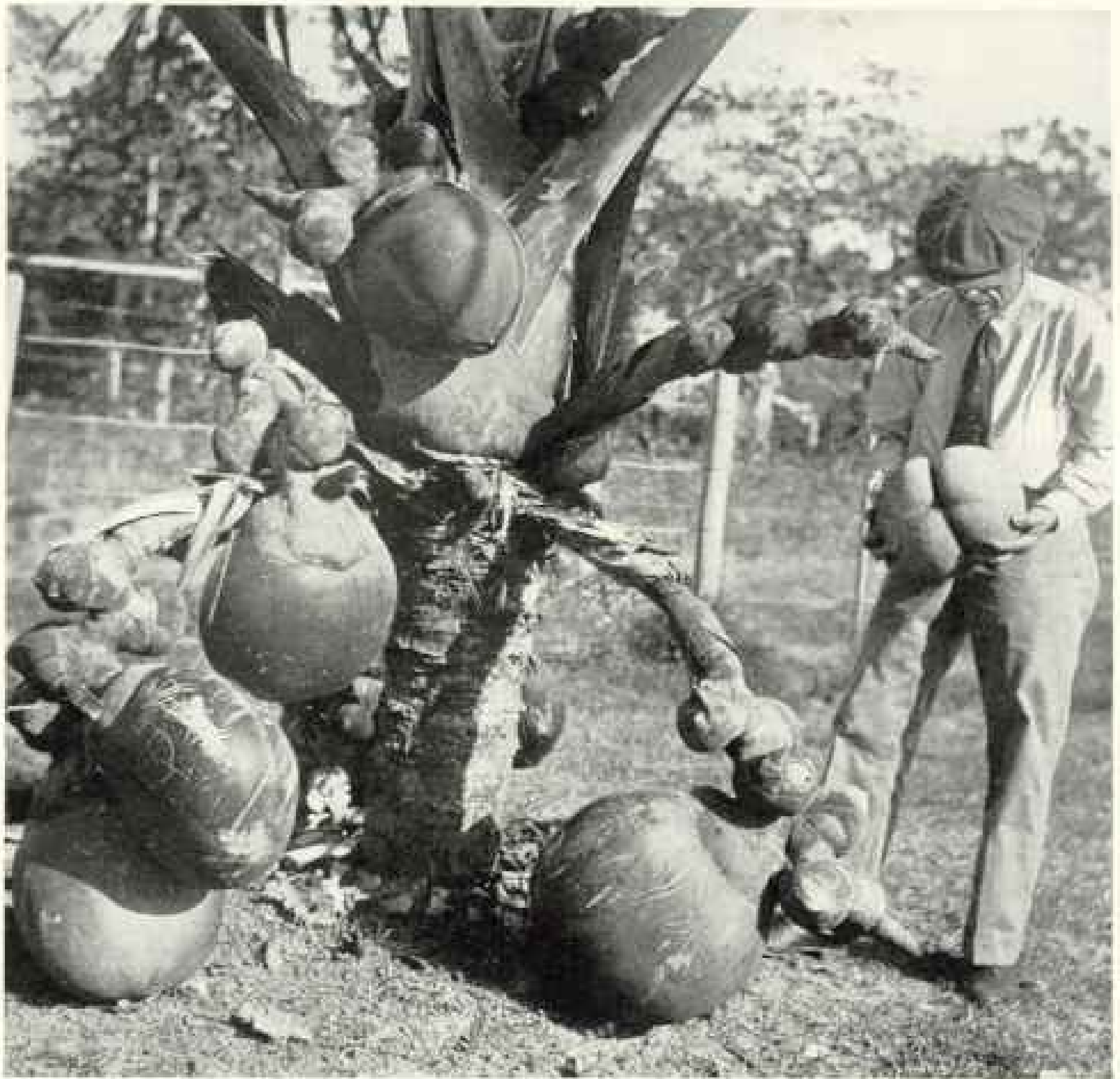
THIS AIR PLANT DIED ON ITS WAY FROM TOBAGO

Its flowers of green, blue, and vermilion were as fascinating as Chinese jade and lacquer; but, though Nancy Bell Fairchild helped pull it from a tree high up in the forest and carried it down the mountain side on her head, it did not survive the journey to the United States. Some one else must get it for the oak trees of south Florida.

thing had gone wrong with the motor. It was a hot day and the sun burned us through our thin pajamas.

Reluctantly we dragged ourselves away from this idyllic island, and in two days were plowing through the muddy waters of the swiftly flowing Demerara River and anchoring off the old town of Georgetown, British Guiana.

It is perhaps incomprehensible that in 1667 the Netherlands should have given what is now New York in exchange for a patch of South America's coast. The price of sugar had much to do with this transaction; also the fact that slaves could easily



Photograph by Dr. David Fairchild

ONE OF THE STRANGEST FORMS OF PLANT LIFE ON OUR PLANET

The almost incredible coco-de-mer palm, here growing in the botanic garden of Georgetown, British Guiana, bears eight large fruits, each weighing 40 pounds or more. Three of them rest on the ground. They take 10 years to ripen. For centuries the huge black seeds, called "double coconuts," drifted ashore in the Orient and remained a deep mystery, until discovery of the Seychelle Islands disclosed their source. From there the seed from which this specimen grew was brought.

be brought over from West Africa to work the cane.

Mankind's craving for sugar has made many changes in the world. The Canary Islands were almost ruined when Demerara and the West Indies took to growing sugar cane, which was introduced to America by Columbus on his second voyage. Now the overgrowth of cane areas here and in the Orient, and the extension of the sugar-beet fields of Europe and America, have created an overproduction of sugar and consequent difficulties in the countries of the Caribbean.

In the botanic garden of Georgetown long canals were covered with that marvelous

Amazon waterlily, the royal waterlily, *Victoria regia*.

A 40-POUND NUT TAKES 10 YEARS TO RIPEN

More interesting than the canals, or even than the large pond full of manatees, those strange mammals of the sea, were two rare palms seldom seen in botanic gardens anywhere: the beautiful stemless nipa palm of the Orient, which graced the borders of the pond, and which some day I trust can be grown in the southern tip of Florida, and a fine specimen of the double coconut, or coco-de-mer, brought from the Seychelle Islands about 20 years ago.

The coco-de-mer is one of the rarest palms in cultivation, and it is one of the most curious plants of this planet. It bears the largest nut known, and this nut takes ten years to ripen. Although I had read and heard much about the plant, I was astonished at its strange appearance (see opposite page).

Mr. Sydney Dash, the Director of Agriculture, kindly insisted that we make an attempt to transplant a small coco-de-mer to Florida, but the attempt was not a success. However, one of the nuts which he also gave us has surprised us, after a year of suspense, by sending up its strange-looking shoot.

Back of Georgetown there stretched away to the Amazon Valley some of the greatest savannas of the world—vast level plains, like the Everglades of Florida, covered with rank-growing sedges, grasses, ferns, and palms which, in the rainy season, stand several inches deep in water.

Mr. R. R. Follett-Smith, the soil chemist of the Demerara Department of Agriculture, offered to take us out there, and we found ourselves one morning speeding along the seawall, headed east.

A seawall 30 miles long and 10 feet high is just what one would expect pioneers from the Netherlands to build when they found the soils of the delta were richer than those of the highlands and far more accessible. In the swamps inside the wall hundreds of cattle waded in water up to their bellies, browsing on the marsh grasses which grew luxuriantly all about them. They seemed to be none the worse for their continual contact with the mud.



Photograph by Jacob Gayer.

A TOUCH OF THE ORIENT GRACES PARAMARIBO

This East Indian woman, wearing nose button and bracelets of hand-chiseled silver, is one of many transplanted to Surinam, where their industry and frugality have given them a strong foothold. Vegetarians, they like long, slender snap beans, white navy beans, tomatoes, and the starchy sweet potato.

We left the highways and took to the native *corails*, or canoes, paddling through fascinating canals overgrown with vegetation, to a point where two of the long canals met and we could see off across the savanna.

About a mile up one of these canals we came to the first patch of *Mauritia* palms, vast forests of which stretch away through the lowlands of Demerara to the Amazon River. From a distance they suggest our Florida cabbage palms, but when one stands under them they appear immensely larger and more majestic, rising sometimes 100 feet, with huge fan leaves and perfectly amazing clusters of polished brown fruits.



A SINGLE GREENHEART TIMBER IS ALL A DONKEY CAN PULL.

Dense, durable, and so heavy it will not float, this tropic wood is used mainly in wharf and ship construction. Fortunately for the diminutive draft animal, Paramaribo is flat and the heavy log rides smoothly on wheels that look as if they might be from a gun carriage.



Photographs by Jacob Gayer

PARAMARIBO ALWAYS LOOKS SPICK AND SPAN

Well-kept, tidy streets and simple, substantial architecture indicate that there is some measure of control over building operations as well as street maintenance in the city. Bicyclists and pedestrians pass sedately at leisurely pace.



MAN FITS HIS STRENGTH AND SKILL AGAINST THE RAPIDS OF THE SURINAM RIVER

These Bush Negroes took the author to the home of the wild pineapple (see text, page 737). While the boatmen turned their dugout around, the passengers waited on some slippery rocks in midstream. There Dr. Fairchild found a curious fresh-water snail apparently never described before.



Photographs by P. H. Dornett

THE SPECIAL TRAIN'S "DINER" HEARTENED HUNGRY PLANT HUNTERS

They sped through the wild interior of Surinam, a region penetrated only by this narrow-gauge railroad and by rivers with dangerous rapids (see text, page 731, and illustration, above). The veteran naturalist, Dr. G. Stabel (fifth from left), interpreted the moving panorama.



Photograph by P. H. Dorsett

GUESS THE AGE OF THESE GIANT SHADE TREES

If they were oaks in New England, they might be a century old or more; but, being a quick-growing species in rainy, tropical Surinam, they probably have lived about three decades. They thrive in the Testing Garden (see text, opposite page) despite the somewhat oppressive-sounding name of *Enterolobium cyclocarpum*.

It took three men to carry one cluster, which after much effort they had succeeded in chopping off, and then the fruits dragged on the ground (see page 714).

Georgetown has an interesting little museum in charge of Dr. Walter E. Roth, who knows, as few can ever know, those shy races of aborigines which are scattered from the coast to the Amazon.

BAMBOO BLOWGUNS FOR POISONED ARROWS

We found Dr. Roth putting away with extreme precaution some poisoned arrow points which the Macusis use in their blowguns. The points had been dipped in

the juice of the native strychnine fruit and were dangerous to handle.

"What are the blowguns made of?" I asked.

"Of a bamboo with joints 15 feet long," he replied, and quoted Von Schomburgk as authority.

I turned to the book and learned that in the back country of Demerara there grows the *Arundinaria schomburgkii*, having hollow stems without a joint for 15 feet. I once found a bamboo in Sumatra with joints five feet apart, which I thought were the farthest apart of any in existence. Some day I am going back to South America for Von Schomburgk's bamboo.

We pushed on from Demerara to the lightship that marks the mouth of the Surinam River, and on up until we anchored just off the Governor's residence, in the spick-and-span town of Paramaribo. On its clean streets and sandy, calcareous soil, the whole life seemed to be slowly but carefully regulated

with Dutch precision and orderliness. Even walking on the grass in front of the Governor's residence is cause for arrest, as Loomis discovered when he tried to back off on the lawn to photograph a palm.

The Governor, Dr. A. A. L. Rutgers, was a botanist and had previously been the Director of Agriculture in Buitenzorg, Java, and he appreciated the aims of the expedition. When Mrs. Rutgers, who also had lived many years in Java, learned that several of the party had been there, too, she arranged an old-fashioned "rice table" with all the accessories, prepared by a Javanese cook from the Javanese village (page 732).

Dr. G. Stahel, in charge of the Testing Garden, is thoroughly versed in the botanical problems of the Tropics. One of his first remarks was, "Now, Dr. Fairchild, you shall be the first American to see the flagellates I have found, which kill the Liberian coffee trees in this colony. I have been waiting for some one to come and see them."

This is the first time it has been proved that a tree disease is caused by these microscopic parasites. Through Dr. Stahel's microscope we watched the flagellates with their wiggling tails as they swam about in the sieve tubes in the inner bark of his sick coffee tree. Flagellates cause many animal and human diseases, and whether some of the other obscure plant diseases which have puzzled pathologists may not be due to similar microscopic animals is a question. Dr. Stahel suspects they are.

In a chartered train on a narrow-gauge railroad we went to see the vast hinterland and the Bush Negroes. These essentially wild men, descendants of West African slaves who escaped from slavery about 1762, soon after their arrival in the Guianas, have scarcely been touched by our civilization.

We stopped to visit a typical Carib Indian village, the first I had ever seen. The native Indians are a rather unresponsive people whose way of life is far removed from our encroaching civilization and they will not change. After all, why should they? They have a right to like their way better.

At Kabel we left our train and climbed into large, carefully built dugouts, which



Photograph by Jacoli Güyer

THIS NURSEMAID HAS DINNER ON HER MIND

To anyone who has never seen pots and saucepans borne on the head, the feat may seem a cause for some wonder as well as amusement, but it is an everyday sight in Paramaribo. In some West Indian islands such work is reserved for women, and a man would be as ashamed to carry a load in this way as some men in Europe are to be seen with a parcel

were manned by Bush Negroes. The men were splendid-looking specimens; their brown bodies glistened in the sunlight, and they laughed and chattered as they handled the long paddles. The Surinam is wide and swift at Kabel, and full of rapids which require great skill to negotiate.

The waters are infested with perai, those small voracious fish which hunt in schools and attack and tear to pieces any living, warm-blooded creature, so that one does not casually cool one's body by a dip in the river. Dr. Stahel even warned us against trailing our hands in the deep water, for fear the fish might nip our fingers.



Photograph by H. F. Loomis

AHEAD OF THE "UTOWANA" RISES "NAPOLEON'S COCKED HAT"

To approach the fascinating crater island of Saba at dawn, to see it come up out of the sea more than 2,000 feet into the air, and to know landing is impossible unless the wind is in the right direction—this is the maddening experience of many who have to pass it by.

Under the overhanging branches of trees, covered with masses of creepers, we glided downstream to Kadjoe. Several dugouts, made of the carapa tree, indicated the harbor of the village, where a Negress was bathing, safe from the predatory fish, in the shallow water near the shore. It was sultry and the sun was burning hot, but as we stepped into the mud-beaten paths under the forest trees it was cool and pleasant.

I was struck by the orderliness and neatness of the village. The little low houses, copies, I think, of the huts of their ancestors in the African bush, were carefully built, with a true sense of proportion, and often they had interesting carvings about the

doorways. The stools, trays, and drums also showed distinctive carvings (see illustration, page 724).

Dr. Stabel and I were paddled farther down the river, where we stepped off the rocks into the jungle, and he showed me the pineapple in its original wild home. I collected it for the plant breeders, who want it to make the cultivated pineapple more vigorous and more resistant to disease.

A PATCH OF JAVA
IN SURINAM

For years the Dutch planters have been bringing over Javanese coolies to work their fields, until now there are about 30,000 in the colony. Dr. Stabel took me out to Lelydorp to see one of their largest villages. The houses were strange, faint reproductions of the charming bamboo cottages of Java, for the walls were made of crooked staves instead of the beautiful "billik" that is so generally used in Java for the walls of houses—a

coarse, woven matting made of thin strips of bamboo. The pattern of a Javanese house seems to be just as fixed as the nest of an oriole. Lacking the materials with which he is accustomed to build it, the Javanese does what any oriole would do—he uses substitutes.

I looked about for Javanese plants and was surprised to find that so few had been introduced in 30 years by these immigrants. A few tali bamboos were there, from which the house walls are made in Java; a single durian tree; the famous mangosteen; and the rambutan. The betel vine, used by betel-chewing habitues, had been set out in plantation form.

The jackfruit, too, had been planted, and when I seemed delighted to see the fruit once more—for it is comparatively rare in the West Indies—its owner climbed the tree and cut one off for me. As I looked to see what he was doing, the huge fruit fell with a crash and spilled its yellow contents over several square yards of ground, to the consternation of the other Javanese standing by, who rushed forward to save the fragments.

He cut another and lowered it carefully, and we had it on the yacht, where Ernest made a delicious compote from its fleshy arils before it got too ripe and began to attract the tart comment of Dorsett whenever he passed it on the after hatch. When it is over-ripe, it has some of the wealth of aroma of the durian.

At Martinique we were busy with a collection of yams and dasheens. We saw some superior sorts being grown for the peasants by the agricultural experts at Tivoli and Mr. Dervegeant kindly offered us some.

I use the word "peasant" advisedly, for it was my impression, as we drove through the island and talked to the farmers, that there was something curiously reminiscent of the French peasant in the independent attitude of the natives of Martinique. They seemed better able to care for themselves than some natives of other islands, who had learned little except to work in the cane fields.

The island of Guadeloupe still showed plainly the destruction which the last hurricane had wrought, and the stories of death and disaster were still on people's lips. We



Photograph by Bramby from Galloway.

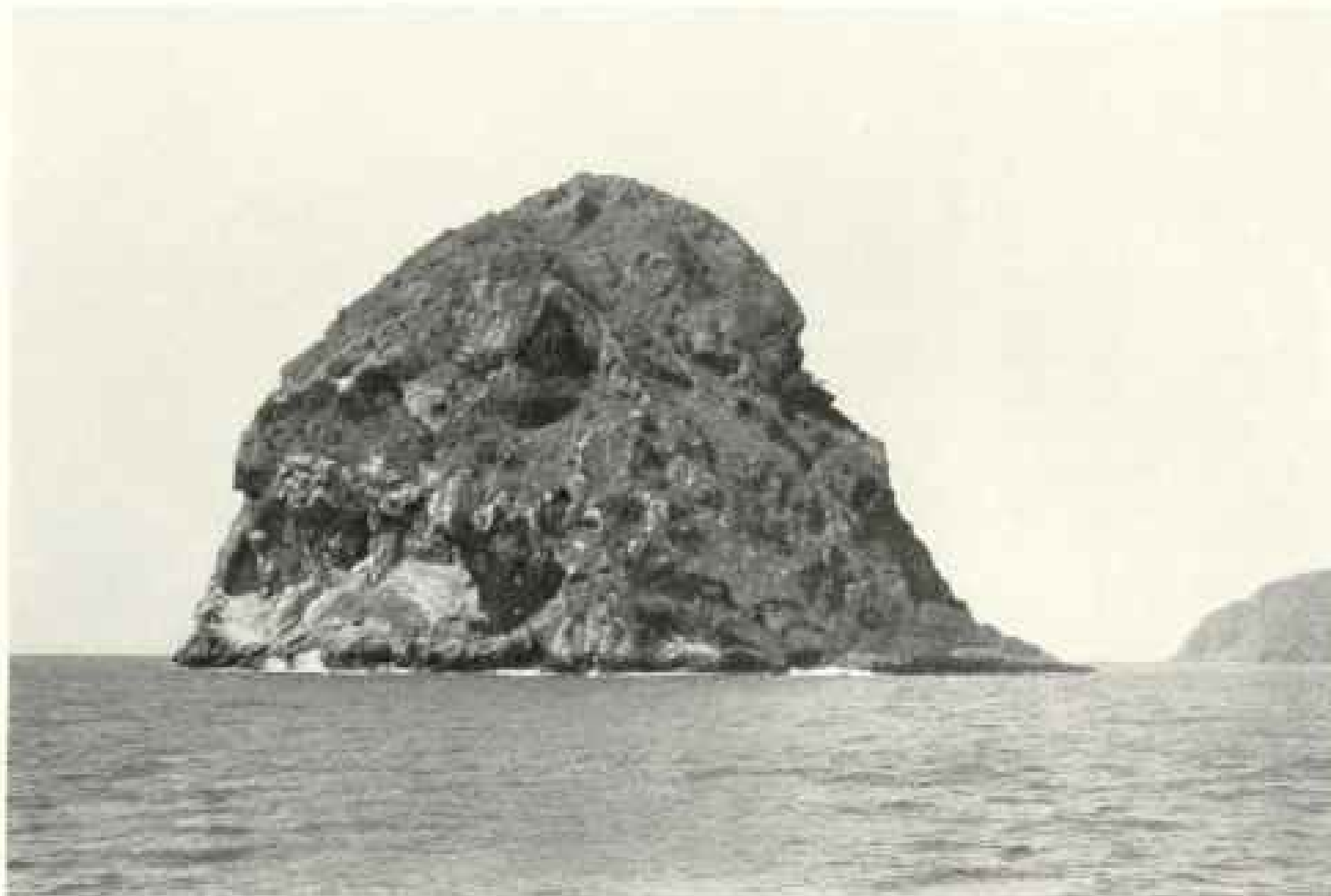
HERE YOU CLIMB UP 900 FEET TO REACH BOTTOM.

It's not so impossible as it sounds, for Bottom is a village in the crater of Saba, a steep-sided extinct volcano (see text, below, and illustrations, pages 734 and 735). Baggage and freight are borne up such steps as these on the heads of Negroes whose lung power amazes panting visitors.

visited it to find which trees had withstood the terrific winds, so that we might try them in our own hurricane area.

A VILLAGE IN AN EXTINCT CRATER

I find it hard to write of Saba without exaggeration, so vividly does the day we spent there stand out in my mind. The memories of it are as haunting as those that both Capri and the little isle of Banda, in the Banda Sea, brought into my life years ago. I have memories of charming Dutch children with soft voices and friendly ways, of sturdy fishermen and boatloads of fish, of cottages perched like swallows' nests far up on the hillside, of a simple village life



Photograph by H. F. Loomis

HIS MAJESTY'S SHIP "DIAMOND ROCK" STANDS OFF THE MARTINIQUE COAST

In recognition of the daring of British naval officers and men who hauled big guns up its sides and defended it against the French in 1803, the rocky island was officially listed by the Admiralty as one of Britain's men-o'-war. It is now a French possession.



Photograph by Ewing Galloway

AT SABA THE SEA IS EVER READY TO SMASH AND KILL

One who has not been in a small boat and felt the force of a mighty roller sweeping the craft toward the rocks can hardly appreciate the excitement of this scene. Even the island's experienced fishermen are tense and vigilant, for they know the dangerous power of the waves that dash on their boulder-covered beach.



Photograph by Dr. David Fairchild

IN PRETTY COTTAGES ON SABA OLD SAILORS FIND "SNUG HARBOR"

After fighting the storms of the North Atlantic, many a mariner returns to pass his last years here, at lofty Windward Side, or at one of the little Dutch island's other two towns. The young woman in the foreground said she kept in touch with the outside world with the aid of the NATIONAL GEOGRAPHIC MAGAZINE (see text, page 736). At the left are cacao trees, from the seeds of which chocolate is made.

in which there are no strangers, and of a shut-in valley of terraced gardens across which you hear the voices of the people.

No large vessel can land at Saba, for there is only a tiny beach between great boulders (see opposite page).

The little island is an extinct volcano, and one of its three villages is literally the bottom of the crater, although 900 feet above the sea.

Five square miles of land, most of it as steep as the gable roof of a house; 1,600 people, mostly of Dutch descent; a history that runs back about as far as that of New England; and a genealogy of hardy, sea-

faring folk, like that of the old inhabitants of Martha's Vineyard—that is Saba.

Although some of the inhabitants are black, and a mutual tolerance exists, there are few evidences of marriages between the races.

As the volcanic cone came into sight and we drew near enough to assure the watchers on shore we intended to land, we could see the children running like goats down the "Ladder" that leads from the village to the water. There are two landings, and when they saw we were headed for the other one, they ran back, came down the stairway, and met us halfway up the hill to Bottom.



Photograph by Ella Barrett

OLD AND NEW MEET AND PASS

When Lafcadio Hearn was writing his poetic stories of Martinique, only oxcarts creaked their slow way across its mountain roads. Now between Fort-de-France and the new city of St. Pierre, which has arisen on the ashes of the volcano-buried town he loved, vehicles that would amaze him roll swiftly along the trails.

Those rosy-checked, enthusiastic children were girls and boys of Dutch descent, but they spoke perfect English. From their reception one would have imagined we were relatives coming home from the Netherlands. With laughing chatter they conducted us, panting and dripping, to pay our respects to the Administrator.

We had not expected to find much for our collections in Saba, and we didn't. We botanized over the hillsides on the roughly made terraces, where pumpkins, sweet potatoes of rather poor quality, and the bonavist beans were grown, the last mentioned, to my surprise, forming an important part of the diet (see text, page 721).

THE GEOGRAPHIC IDENTIFIED HIM!

As Miss Butler, of Windward Side, was showing me the tanks back of her father's house in which the season's supply of rain water was caught, she suddenly looked at me and inquired, "I think I have seen your name on the inside cover of the NATIONAL GEOGRAPHIC MAGAZINE, haven't I?"

Bang went the illusion of isolation! We were right around the corner from Sixteenth

and M Streets, in Washington, D. C. I photographed Miss Butler and determined to tell the staff of THE GEOGRAPHIC that again I had failed to find a spot where THE GEOGRAPHIC was not known.

Mr. Armour, with Mrs. Fairchild, returned to the yacht early and gave the residents a tea party. Nothing compared in novelty, so far as the children were concerned, with the ice water.

This tiny but highly intelligent community is one of the few white groups in the West Indies, and, although isolated beyond almost any I have visited, keeps in touch with affairs of the outside world.

By this time the shadow of the approaching end of the expedition began to affect me and kept me pretty constantly at my desk, where my job was to determine the botanical relationships of the plant material we had all collected, and of the new accessions constantly brought in by Dorsett, Loomis, and L. R. Toy, three assiduous collectors of anything that looked promising for cultivation in the United States.

Barbuda, with only two white people among 1,000 blacks; Anguilla, where we



Photograph by H. F. Loomis

BEHIND THE SCENES ON THE PLANT-HUNTING YACHT "UTOWANA"

In pajamas, Howard Dorsett and the author (left) gloat over the prizes of a hard day's foraging on verdant St. Lucia. All specimens must be identified and examined for insect or fungus pests. Some will be dried and others planted in small greenhouses aboard. Fast work is essential, for to-morrow a new island may come into view.

hoped to find wild cotton but didn't; little St. Martin, seven miles long, half Dutch and half French; and beautiful Tortola—all added their quota to our treasure store.

We had our last day's collecting on the strange little island of Mariguana, where, in the cool spring rain, we wandered about through the typical Bahaman brush until our clothes were torn and tattered, in a vain effort to add a last specimen of value to our collection.

Best of all were the thrills that came to me day after day at my little table under a double porthole, through which the morning sunlight would come and go with the shifting of the ship, as I studied the constant stream of new and strange plant forms whose flowers, leaves, and seeds peered up at me through my hand lens and microscope. Each had its particular appeal. Each required a decision regarding its name, its use, its chances of living in America, what to do with it when it was introduced, and how best to prepare it, pack it, and ship it by air express or by boat.

How many hundreds of species we passed

judgment on I do not know, but we decided to take the chance of introducing 700 of them.

PLANTS FOR GARDENS, STREETS, ORCHARDS, AND MEADOWS

Shade and street trees, windbreak trees and hedge plants, garden vegetables and border flowers, pergola vines and ornamental shrubs, fruit trees and forage plants—these make up the chief categories of the 700 species and varieties collected, not to mention the rather extensive collection of palms and the bags of cotton seeds which formed a particular part of our quest.

It is too soon to tell what fate awaits the seeds and plants we gathered. That some have already died we know, and we predict that others will fall by the way, but we believe that there will be a goodly number of successes, as there have always been from other expeditions.

Perhaps, years hence, those of us who took part in the expedition may be reminded by some of them of a thrilling winter spent in the Caribbean hunting plants.

THE SOCIETY'S NEW CARIBBEAN MAP

Mexico, Central America, and the West Indies—Gateway of Discovery

THE Caribbean region, glamorous gateway through which exploration first penetrated the Western Hemisphere, is shown in clear and up-to-date detail on the National Geographic Society's new map of Mexico, Central America, and the West Indies.

The map, in ten colors, reaches members as a special supplement with this issue of *The Magazine*.

Here Columbus discovered America—some islands and parts of the coast from Honduras to the mouths of the Orinoco. Within the compass of the map is shown far more than the Admiral ever saw of the New World. He believed himself off the coast of Asia. Bewildered, he probably would have traded half his mutinous crew for a little of the geographic knowledge contained in this modern chart.

LURE OF GOLD—SPANISH MAIN!

Here began the search for Indian gold which lured Balboa to the discovery of the Pacific Ocean, Cortez to the conquest of Mexico, De Soto to the finding of the Mississippi—and to a grave in its depths.

On the Central and South American mainland was the storied "Spanish Main." Cities sprang up and vessels laden with treasure cast off for Cádiz. Piracy and privateering flourished. Swift English, Dutch, and French raiders preyed on Spain's slow, clumsy bullion ships. The Spaniards quaked at the bloody exploits of Morgan and Blackbeard, who lurked like ravenous barracudas amid the islands.*

To-day this region is split into eager young republics seeking to make the most of their heritage of natural resources. Ships ply the surrounding waters laden not so much with gold and silver as with petroleum, sugar, coffee, and bananas.

The United States Navy, guarding the Panama Canal from strategically located bases, controls, in the interest of peace, the shipping lanes where buccaneers once lay in wait—the Straits of Florida, the Windward Passage, between Cuba and Haiti; the

* See "The Haunts of the Caribbean Corsairs," in the *NATIONAL GEOGRAPHIC MAGAZINE* for February, 1922.

Mona Passage, between Puerto Rico and the Dominican Republic, and the Anegada Passage, east of the Virgin Islands, shortest route from Europe to the Canal.

Between North and South America fly huge passenger planes.

An eloquent red line on the map marks the route of the Inter-American Highway. From Nuevo Laredo, on the Rio Grande, it winds down through Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. The part constructed up to January, 1934, is shown by a solid line and the unfinished portion by a broken line, as far as Panamá City. From there it will be carried on eventually to South America, thus uniting the two continents and all the countries between by road.

The dense jungles of the American Tropics are among the hardest places to map, but the cartographers of the National Geographic Society have depicted them in greater detail than ever before on this scale. Special insets give "close-ups" of Puerto Rico, the Virgin Islands, Bermuda Islands, Isthmus of Panama, Jamaica, and Cuba.

MAP ACCURATE TRAVEL GUIDE

Like *The Society's* previous Caribbean map, which was highly praised by aerial navigators, this one is so planned and drawn that, in spite of the impossibility of exactly portraying part of a globular earth on a flat sheet of paper, all areas appear in their true form and direction from each other. A navigator by air or water may lay down a course on this map, fly or sail along it, and be sure of coming to his desired destination.

On the inset map of the Isthmus is plainly shown the latest engineering miracle in connection with the Panama Canal—a brand-new man-made lake, the Madden Reservoir, created by a dam 950 feet long. It will control the waters of the Chágres River, which in the rainy season becomes a turbulent stream and causes a troublesome current across the Canal lane. The water impounded also will provide a reserve for release into the Canal in the event of a water shortage. A third function of the \$15,500,000 project, now nearly completed, is the production of hydroelectric power.



Photograph by John Oliver La Gorce

STEAMERS AND NATIVE BUMBOATS NOW, INSTEAD OF PIRATE BARKS

Typical of the romantic and languorous West Indies is this giant Bahama Negro, an ebony poem of motion as he sculls his merchandise-laden craft from wharf to yacht over the limpid waters of Nassau Harbor.

The inset of the Bermuda Islands is of special interest because of the scientific achievements of Dr. William Beebe and Otis Barton in Bermuda waters last summer, under the sponsorship of your Society. Easily located is Nonsuch Island, off which the divers descended in their Bathysphere to a depth of 3,028 feet (see page 661).

On the map appear exactly 5,460 place names. A departure since the previous map is the use of foreign nomenclature for places in foreign lands. Thus, Nicaragua's Mosquito Coast is now the Costa de Mosquitos. Cuba's Isle of Pines is Isla de Pinos, and Havana is Habana. Tortuga Island, a favorite haunt of early buccaneers, becomes Isle de la Tortue because it belongs to French-speaking Haiti.

An ancient name is officially revived and the island of Haiti is Haiti no longer, but Hispaniola, a Latinized form of the name La Isla Española, bestowed upon it by Columbus in 1492. Thus the old Indian title of Haiti, meaning "mountainous country," is reserved for the Negro Republic, occupying the western third of the island.

The map is made easy to read by the large scale of 1:5,702,400. One inch on the map represents 90 miles on the ground. Relief is shown by hachures, and altitude by figures printed at frequent intervals.

The political boundaries are indicated by harmonious coloring, so that they are instantly seen without the necessity of tracing an elusive line to ascertain whether a place is in Mexico or Texas, in Panama or

Costa Rica, if it happens to lie near the border.

For the sea-going geographer a dotted line indicates depths of 100 fathoms or less, while extreme depths also are shown.

Most profound of all, and incidentally the deepest spot in the entire Atlantic Ocean, is the Nares Deep, just north of Puerto Rico. The keel of a ship passing over it is much more than five miles above the ocean floor, for the latest official sounding there, as noted on the new map, is 27,972 feet.

Contrasting with the "deeps" of the ocean, we find a "high" in Colombia, where, almost on the seacoast itself, the Sierra Nevada de Santa Marta rises to 19,030 feet. Second place goes to Mexico's Citlaltepeltl, "Star Mountain," 18,077 feet.

In the American Tropics, too, the Gulf Stream, warm water heating plant for much of the world, has its beginnings. Rebounding from the Central American coast, the current swings northward into the Gulf of Mexico and emerges from the Straits of Florida as a deep stream many miles wide.*

What may seem like geographical contradictions may be gleaned from a careful study of the map. For instance, ask someone whether the Panama Canal is east of Florida, and he will look at you with doubts until you show him on the map. A ship bound from the Atlantic to the Pacific is going *southeast* when it passes through the Canal, not west.

IF THESE PLACES COULD SPEAK!

One can hardly set a finger down anywhere on the map without touching some spot to which a stirring story is attached.

In the Republic of Haiti appears La Citadelle, famous stronghold of the black king, Christophe, of more than a century ago. Two little towns near by perpetuate the comic-opera names of two of his dusky noblemen, the Count of Limonade and the Duke of Marmelade.† On the south coast of Cuba, not far from San Juan Hill, of Rough-rider fame, is Daiquiri, tiny port where the first American soldiers landed in '98.

On the outer fringe of the Bahamas is San Salvador (Watling Island), generally regarded as the spot where Columbus first

set foot in the New World on an October morning 442 years ago. He named it for the Savior and claimed it for his Spanish sovereigns, but it is now under the British flag. In fact, Columbus, looking over the map to-day, would search in vain for any vestige of Spanish sovereignty. The only European nations represented in the area are Great Britain, France, and the Netherlands.

In the Dominican Republic, on the island of Hispaniola, is one of the strangest and most fascinating areas in the Western Hemisphere—that around Lake Enriquillo. Several small streams empty into the lake, but it has no visible outlet. It has been falling slowly for many years and is now about 150 feet below sea level.

OCEAN HAS ENGULFED AN EMPIRE

In this Caribbean region as a whole, long chains and clusters of islands, like the half-drowned tops of mountains, bear witness that mighty natural forces have been at work. In the Bahamas a feat of scientific detective work by means of soundings has recently disclosed ancient river valleys on the ocean bottom at a depth of 15,000 feet. What was once dry land is now buried under nearly three miles of water!

Look over some of the names on the map. What an insight we get into the feelings of the early explorers by a name such as Cabo Gracias á Dios, which marked the southward turn after days of sailing along the Honduras coast. "Cape Thanks to God." Tradition says Columbus named it when he sailed down the coast on his final voyage.

The Caribbean Sea—it preserves the memory of the warlike and cannibalistic Caribs. The Mosquito Coast was the home of the Mosquito Indians. Nicaragua was the name of a doughty native chieftain. Costa Rica means "Rich Coast," and Venezuela is "Little Venice" because early explorers, finding the Indians living in huts on poles over the water, were reminded of Italy's ancient canal city. In Jamaica is Spanish Town, so called because the English sailors could not get their tongues around the Spanish name, Santiago de la Vega.

So it is that in reading THE GEOGRAPHIC, in studying history or current events, in planning a fishing trip, a flight to Jamaica, or the establishment of a branch of an export business, you may find your Society's new map a valuable source of reference and an aid to a better understanding of the countries to the south.

* See "The Grandest and Most Mighty Terrestrial Phenomenon," by John E. Pillsbury, in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1913.

† See "Haitian Vignettes," by Capt. John H. Craig, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1914.



LORDLY MONTEZUMA STROLLED AMONG THESE AHUEHUETES

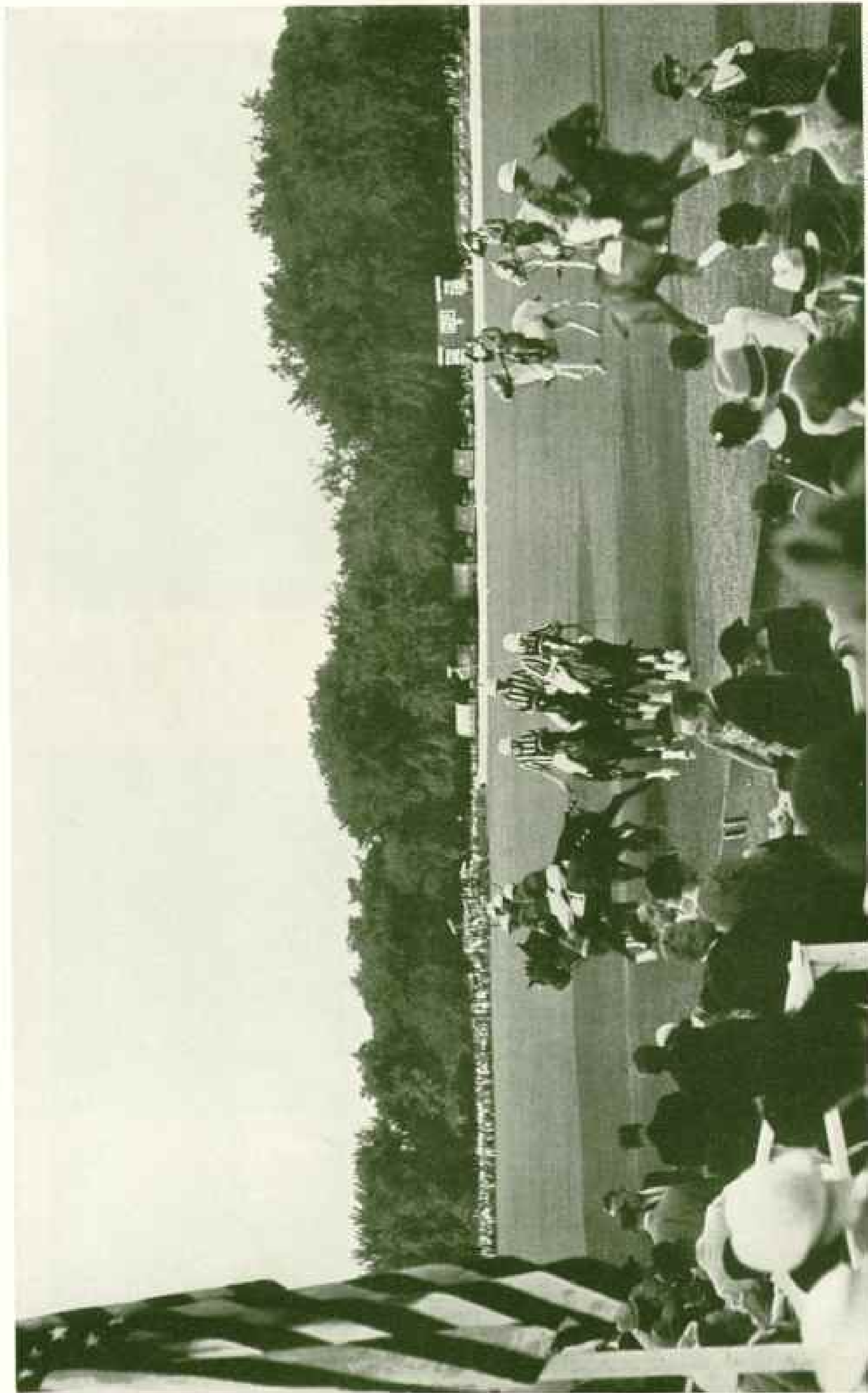
The age of these giant cypress trees only a tree-ring expert may judge, but they were not young when the proud Aztec monarch sought their shade. Birds and flowers abound in the tropical setting of this statuary-dotted woodland of Chapultepec Park, Mexico City.



Photographs from George F. Paul

A ROMANTIC RENDEZVOUS IS THE FOUNTAIN OF FROGS

Señors and señoritas of Mexico City linger for hours in this idyllic spot of Chapultepec Park, where queer heronlike birds have gazed at each other for years around the inside of its tiled wall, and a turtle tirelessly supports the central gusher.



Photograph by Edwin L. Wisbard

A HARD-FOUGHT POLO MATCH CEMENTS FRIENDSHIPS BETWEEN NATIONS

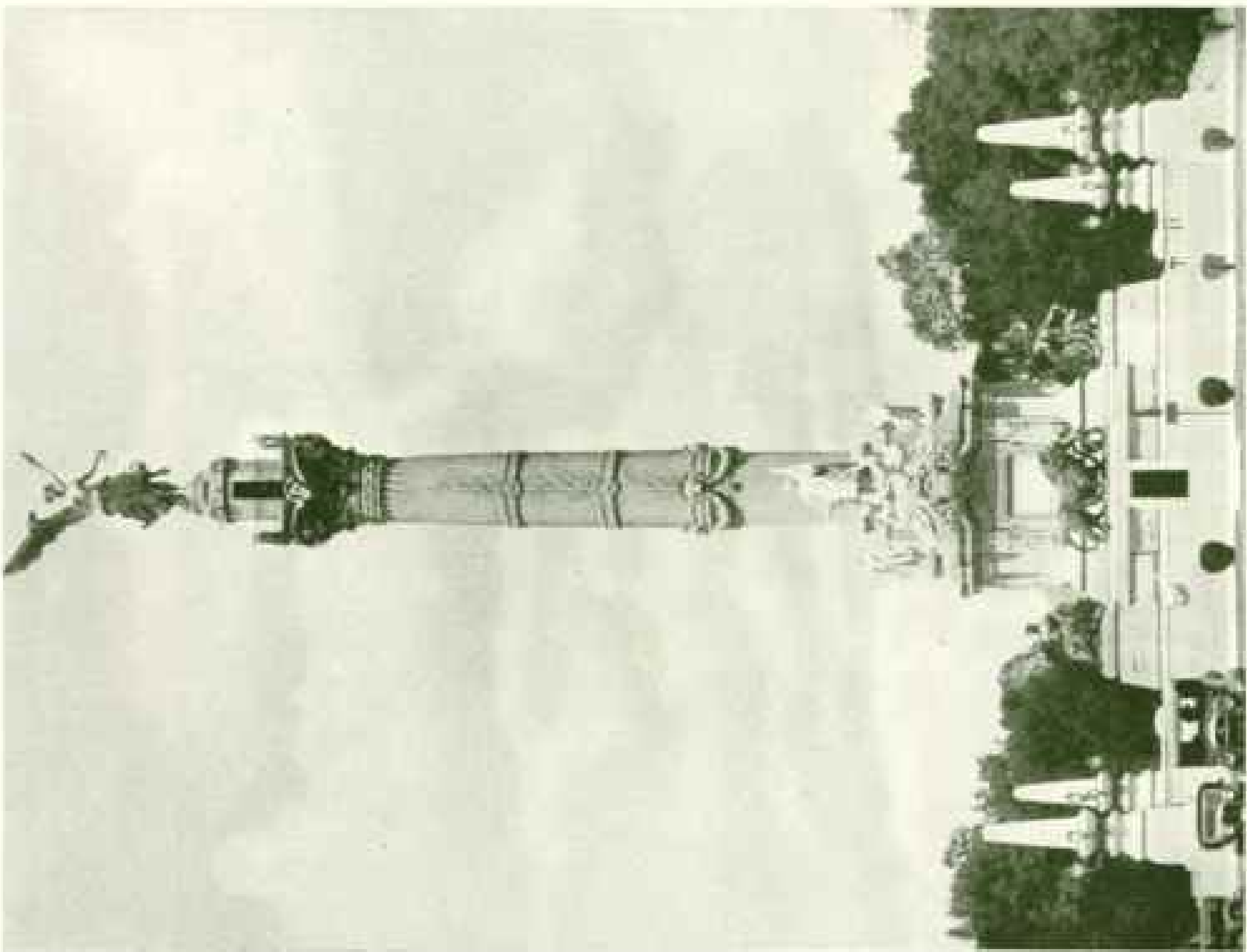
In September, 1934, Mexican and U. S. Army teams met at Potomac Park, Washington, in international contests witnessed by Government officials and other distinguished citizens. That they might quickly identify their mates, members of the team from the southern republic wore jerseys marked by broad horizontal bands of color. Their opponents wore vertical stripes. Shins of the horses have been bandaged to protect them from hard-bit balls and swinging mallets.



Compania Mexicana Airofoto

MEXICO'S "WHITE HOUSE" IS PULLED DEEP IN A BED OF AGE-OLD TREES

Chapultepec Castle, home of the President, was originally planned as a summer home for the Viceroy of Spain in 1783. In 1847 it was the scene of a desperate battle between Mexican and United States forces. Maximilian renovated it in the grand manner of an Italian villa. To the left of the lower end of the famous boulevard, Paseo de la Reforma (right), are buildings of the Department of Public Health. Across the left foreground spreads the Colonia Roma, exclusive residential district.



VICTORY BREAKS THE BONDS OF SERVITUDE

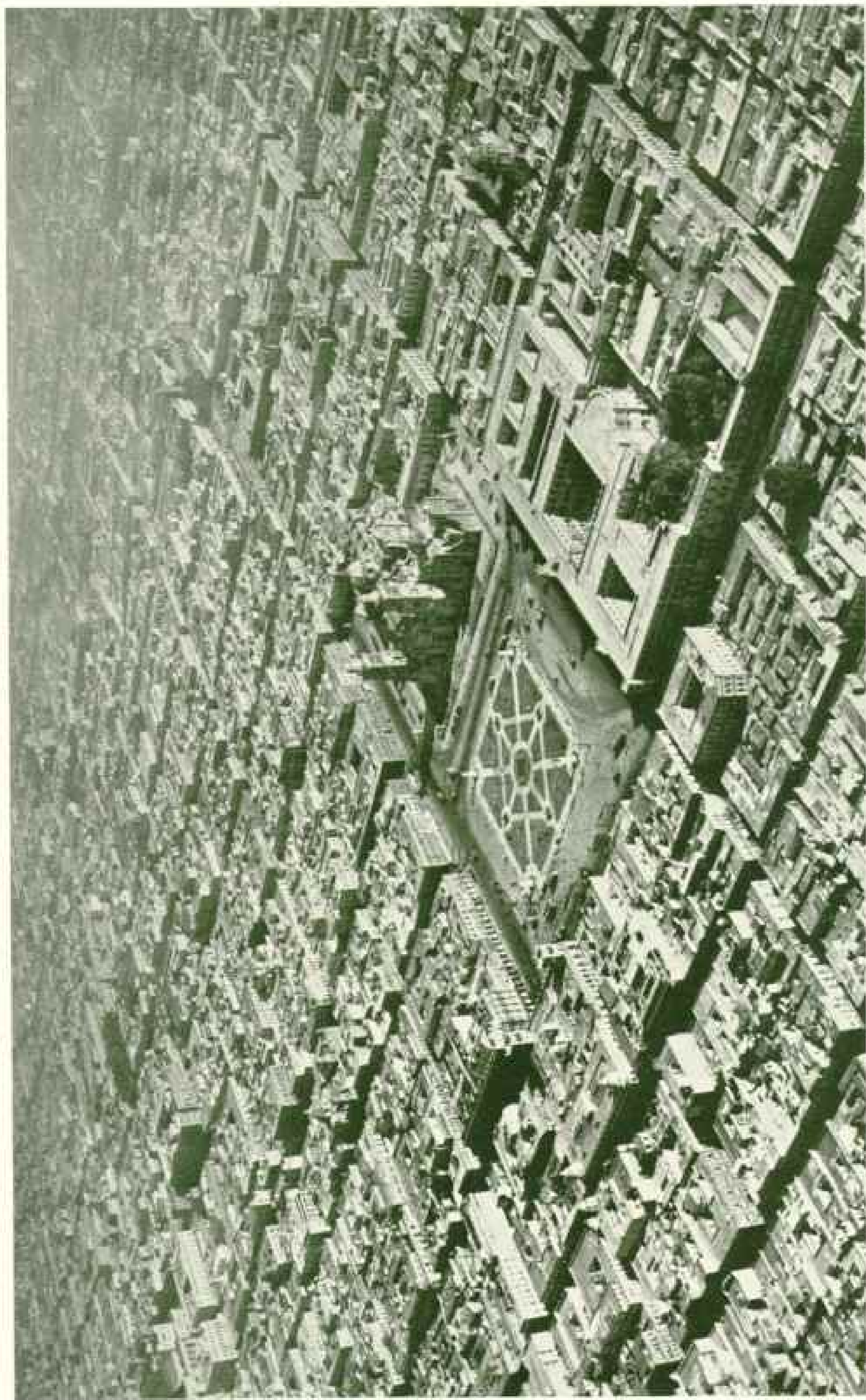
The Statue of the Independence, in Mexico City, is crowned by a winged figure holding in her left hand links of a broken chain, emblematic of her country's freedom from foreign rule; in her right hand the laurel wreath of triumph.



Photographs from George F. Paul

A FOUNTAIN WEEPS FOR A BELOVED STATESMAN

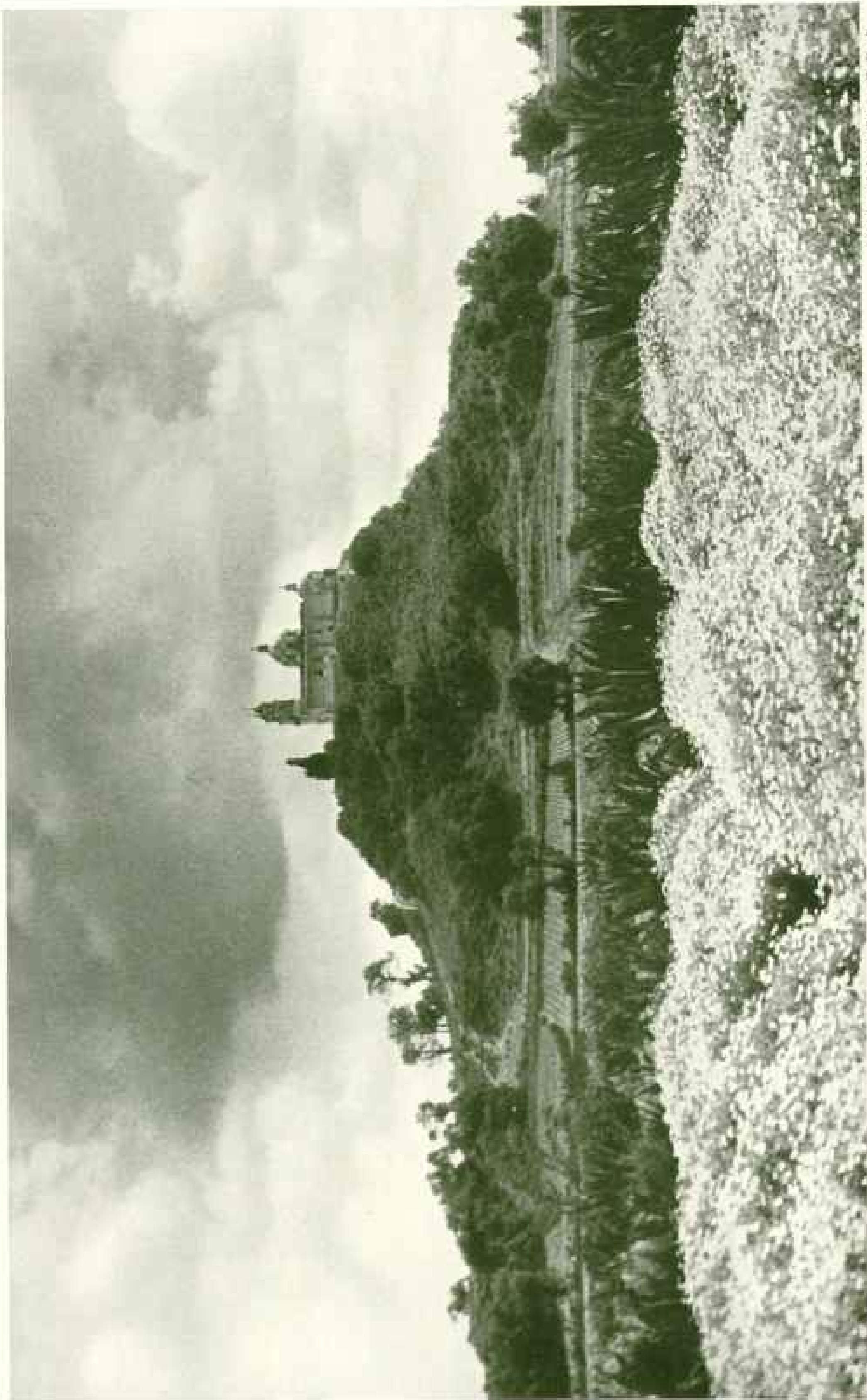
Beyond the graceful jets of spray in delightful Alameda Park, Mexico City, is the hermicycle commemorating a humanitarian President of the Republic, Benito Juárez, whom historians have compared with his contemporary, Abraham Lincoln.



Photograph by Fairchild Aerial Surveys

QUEEN ON A COMMERCIAL CHESSBOARD IS THE ANCIENT CATHEDRAL OF MEXICO CITY

Around the "St. Peter's of Mexico" swirls the busy life of the capital, many of its canyon streets leading into the cross-patched Plaza de la Constitución. One of the first great Christian temples built in North America, it rises near the site of a pagan Aztec sanctuary. On the right of the square is the National Palace. In the right background is the Church of Santo Domingo, remnant of the one-time Monastery of the Dominican Order.



Photograph from George E. Paul

CHOLULA'S ARTIFICIAL MOUND RIVALLS THE PYRAMIDS OF EGYPT

Raised by grateful natives in memory of the pagan god Quetzalcoatl, who, legend says, tutored them in the ways of life, this awe-inspiring pile is twice as long as its base as the great monument of Cheops. Tangled shrubs and wild verdure hide the truncated hill which to-day supports a glistening white church dedicated to Our Lady of Help.



Photograph by Blanton De Cam from Galhaway

MEXICAN "GONDOLAS" CARRY TOURISTS ON HOLIDAYS, VEGETABLES ON WORKDAYS

The famous Canal de la Viga is a gay waterway for pleasure-bent thousands traveling between Mexico City and Xochimilco ("The Place Where Flowers Are"). Lilies choke the water in places, making harder the work of the boatman ponting his flit-bottomed craft. Flowers wage a battle of color in early spring, and songbirds make music in the eucalyptus trees along the banks.



A CHARRO AND HIS HORSE AFFECT THE DANDY'S REGALIA

As he lavishly grooms his pony, so does the gentleman rider outfit himself in richly embroidered trappings. His fancy jacket, fringed trousers, and spurred heels are in keeping with the studded leather of his saddle.



Photographs by Hugo Bruhne

MEXICO REMEMBERS THE "PROTECTOR GENERAL OF THE INDIANS"

The statue of Frey Bartolomé de las Casas commemorates the heroic priest who spent his life trying to shield New World natives from the oppressive rule of conquerors. The unit of the Cathedral (see page 745) is the Sagrario Metropolitano, with its striking east façade.



THE OFFICE OF THE PRESIDENT OF MEXICO OCCUPIES AN ENTIRE BLOCK

In the National Palace are also the offices of the Secretariats of War and Navy and the Treasury. Its rose-and-maroon lava stone front extends along the east side of historic Plaza de la Constitución.



Photographs by Hugo Brehme

A MODERN SKYSCRAPER CASTS ITS SHADOW OVER MEXICO CITY

Tallest in the capital is the "set-back" building, La Nacional, housing business offices. The foreground structures, which might be mistaken for subway entrances, are pergolas of flower vendors, typical of the charming medley of old and new in the city.



Compañía Mexicana Aéreo-foto

MEXICO'S MAJESTIC "WOMAN IN WHITE" SLEEPS BESIDE A SEETHING FURNACE

Because its snow-covered summit rather closely resembles a recumbent female figure, volcanic Iztaccihuatl (foreground) bears a distinctive name. Beyond is its twin, Popocatepetl (see page 754), often called the Venus of America, so violent are its outbursts of lava. Only four North American mountains are higher than "Poppo." Cotton-puff clouds caress the time-weary slopes.



Photograph from George F. Punt

AN EXPERT HORSEWOMAN RECALLS GOLDEN DAYS OF MEXICO

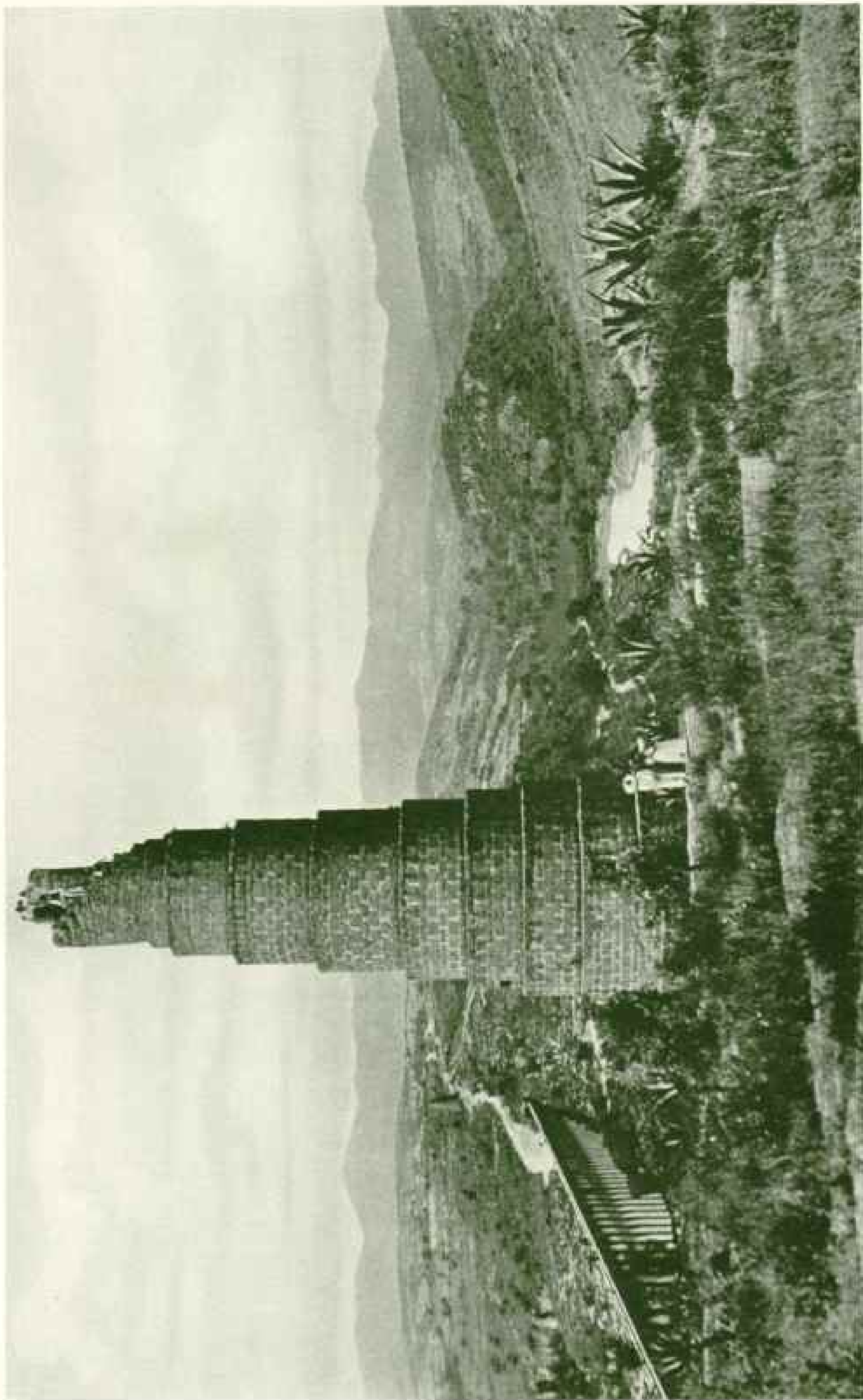
One of the remaining few who ride with the skill of their forbears, she wears a bright-colored "china pobliana" skirt—woolen, heavily beponged, and gay in reds and greens. Her blouse is richly embroidered, and around her throat hang several strings of brilliant beads.



Photograph by Hugo Brulize

THE PEON'S HERO STOPS TO HEAR A HUMBLE PLEA

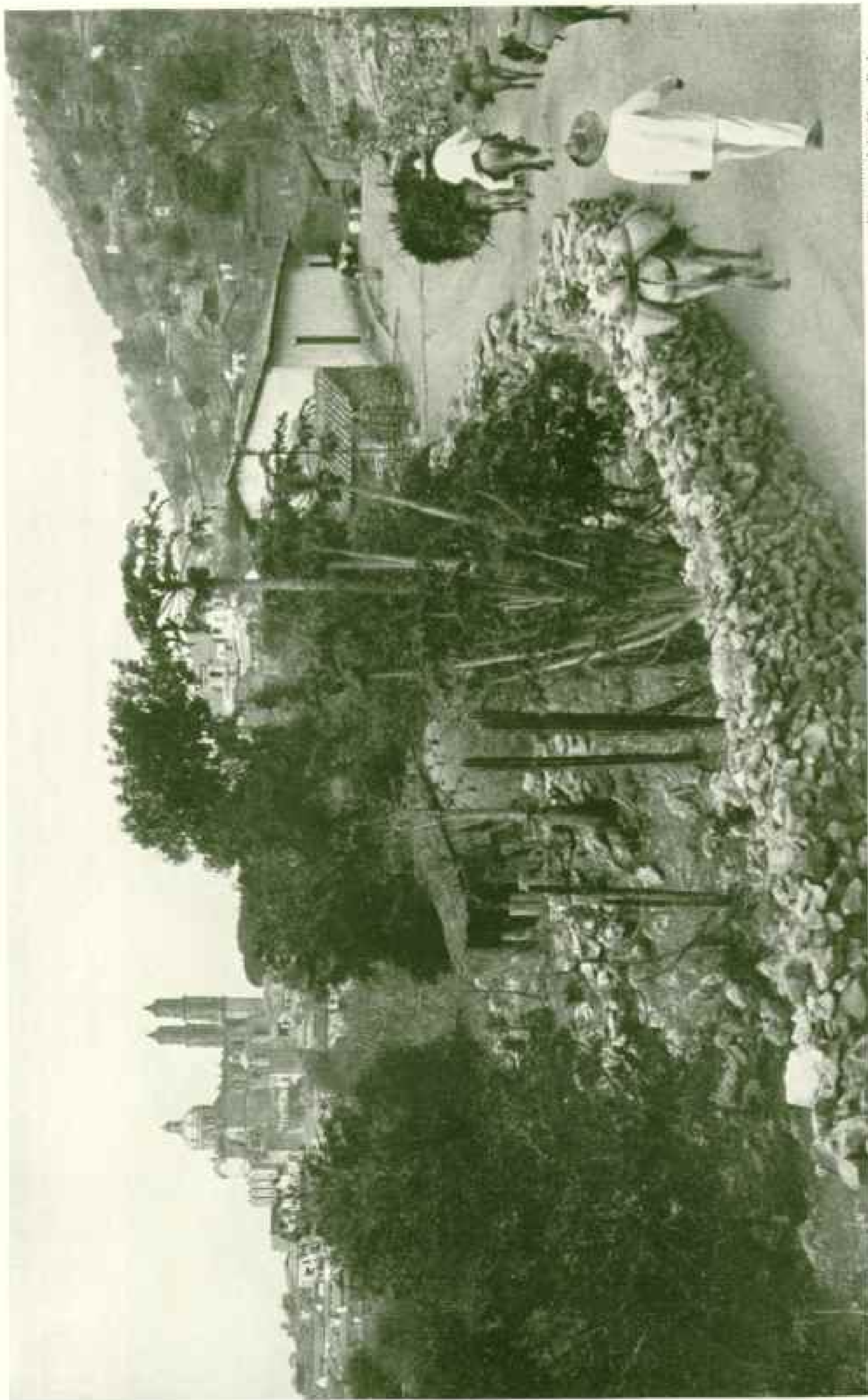
At Cuautla is the statue-crowned tomb of Emiliano Zapata, who led the march of a ragged army on Mexico City in 1910. The tempestuous political career of this cowboy-ranchman began with a vow to return the land to the peasants and ended by a bullet.



Photograph by Hugo Baschme

MEXICO WAS BUSY WITH WATER TOWERS WHEN THE PILGRIMS LANDED AT PLYMOUTH

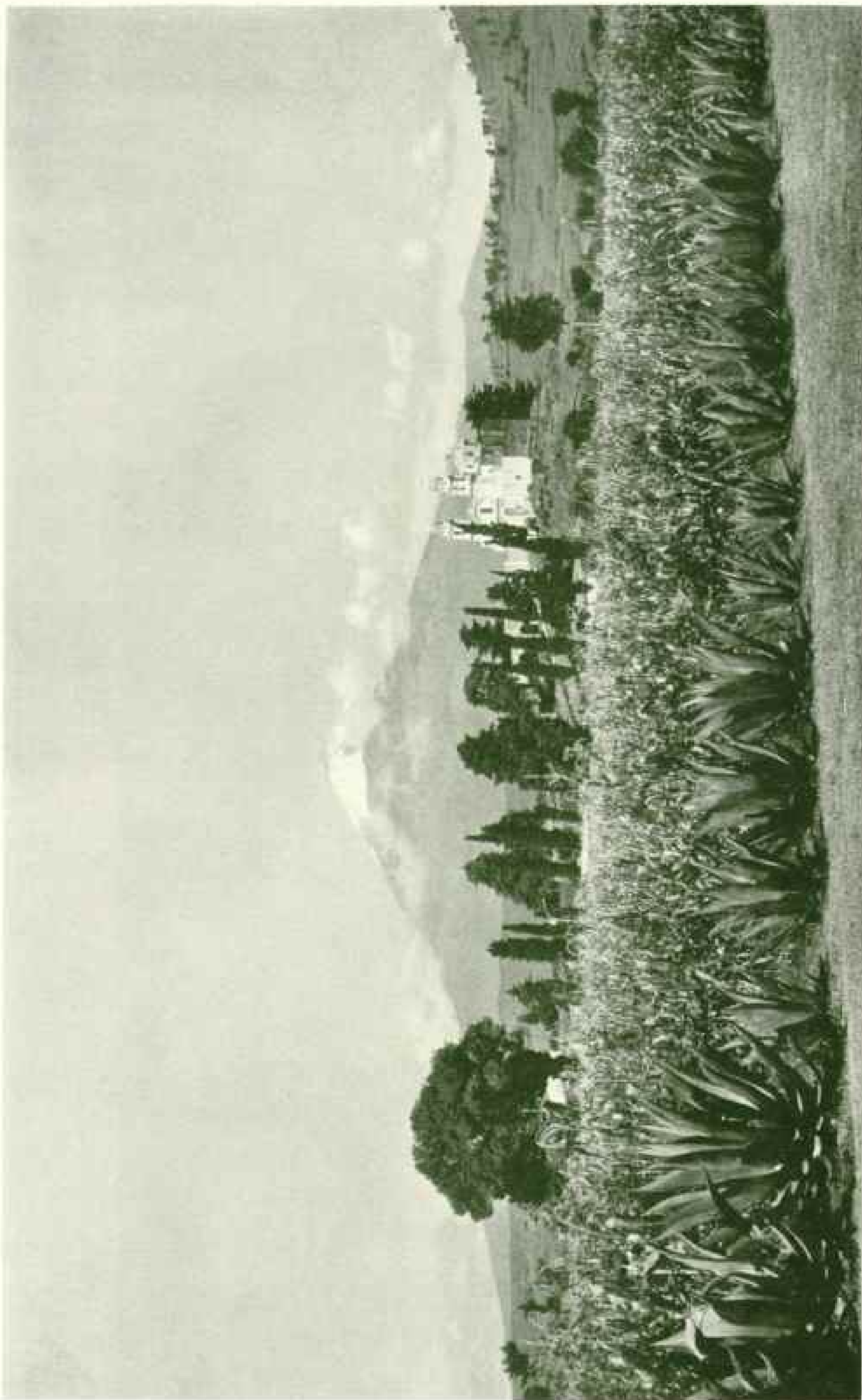
The curiously telescoped pile and its twin across the ravine were erected in 1620 to store water from a neighboring gorge. A modern aqueduct spans the valley to-day, near Nauculpan. The village is noted for its enshrined Virgin of Help, patroness of Spaniards in Mexico. After a Mexican victory a general issued an order that the image be cast out of the country, but relented when the Spaniards promised never to use it to influence politics.



Photograph by Hugo Brehner

A FRENCHMAN WHO DIED A PAUPER BUILT A SPANISH COLONIAL CHURCH IN A MEXICAN TOWN.

José de Laborde was once looked upon as the richest mine owner in the world, as a result of his search for gold and silver in the hills about this village of Tasco. Fortune frowned, but not until Europe had sent its best architects and Asia its rare objects of art to erect a memorial to his enduring fame. From the ore of Tasco Spauldard sent home their first shipment of silver. In the foreground are Mexican peons taking produce to market.



Photograph from George F. Paul

"POPO" PUSHES ITS SNOW-TIPPED SNOOT THROUGH A WREATH OF CLOUDS

Soldiers of Cortez, it is said, took excellent sulphur from the yawning lava pit of Popocatepetl to make gunpowder for their battles against Mexicans. Worshipers at the white church make their way thither past stately fir trees and through planted fields benumbed in by rows of manguy. From this plant is dipped the as-yet-unfermented juice that is made into pulque—pasty-white, quick-foaming, and sour-tasting.



Photograph by Hugo Bröhme

LIKE A PREHISTORIC MONSTER, THE AQUEDUCT CRAWLS ON A THOUSAND LEGS TO QUERÉTARO.

There, in 1867, Maximilian faced a firing squad. Escutcheons dating from colonial days mark many doors of the city, famous for delicious fruits and berries. Water carriers fill their pottery jars at a central fountain fed by this many-bridged conduit, construction of which was completed in the 18th century. A statue has been raised to the Marqués de la Villa del Villar del Aguila, who contributed thousands of dollars to the undertaking.



Photographs by Ewing Galloway

THREE LITTLE MEXICANS PRESENT BOTH SIDES OF THE PICTURE

It is a fiesta day dedicated to the poor. Each chubby-cheeked youngster has dressed as an Indian peon, or laborer. The boys, with their indispensable scrapes, carry tiny crates of pottery and live poultry, and an extra hat for sale. The girl, in wrap-around skirt and hand-woven sash, carries flowers.

TRAVELS WITH A DONKEY IN MEXICO

Three Adventurers Trudge from Oaxaca to Acapulco, 400 Miles, Through Back Country, Their Equipment Carried by Burros

BY BERNARD BEVAN

With Illustrations from Photographs by the Author

NOT until one has wandered about Mexico can one appreciate how incomplete was the Spanish Conquest. Only isolated Spaniards and occasional marauding expeditions ever penetrated to southern Oaxaca and Guerrero. No wealthy monasteries, sure sign of Spanish infiltration, were ever founded here, and the grandiose churches so striking elsewhere in the Republic are conspicuously absent. Since the coming of the Spaniards this region has remained commercially, culturally, and artistically a backwater (see map, page 760).

There are in Mexico nearly 500 tribes and more than 200 languages, some differing from others as much as French from Chinese.

FOUR RACES IN 400 MILES

In the 400 miles between Oaxaca and Acapulco, Maureen Herbert, James Sturken, and I, put afoot when our bus "decomposed" at Mitla (see illustration, page 759), walked across four racial and linguistic frontiers—the Zapotec, Chatino, Mixtec, and Negro. At Tlacolula we were close to yet another tribe, the Mixe, distantly related to the Mayas of Yucatán. Even so, we have omitted the Amusgos (Amishgos), Tlapanecos, and isolated colonies of Aztecs, all of whom retain "islands" in Mixtec territory.

The physical characteristics of Mexico are as varied as the civilizations. Vegetation and scenery change with almost every league, the enormous variations in altitude enabling one to pass from subarctic to tropical climate in a single day. Sometimes within a few hours we saw eagles from the high mountains and parrots from the tropical jungle.

Our route is unlikely to attract tourists. There is no railway, no road, no hotel, no bed, no butter or fresh vegetables, and the discomfort has recently increased since the

virtual destruction by earthquakes of nearly half the towns we passed.

The white man seldom travels in this region. He is not only excellent bait for the numerous bandits on wilder stretches of the road, but an object of suspicion among quite well-intentioned Indians, who imagine he is searching for gold. They have never forgotten the Spaniards' quest for treasure, and to say you are collecting beetles or studying architecture is to them absurd. They are victims, too, of even stranger traditions, notably that the white man desires to fatten Indians and boil them for lubricating oil, or to steal native babies for similar "reduction" as airplane fuel.

For many reasons we deemed it advisable to disguise ourselves and to travel as the poorest peon. We emerged from the market of Oaxaca in white and purple trousers, heavy leather sandals, and broad-brimmed straw hats. Over our shoulders, and chiefly for use at night, we carried large woolen Oaxaca blankets, or serapes—blue, white, and black. Our money we carried in stout leather belts, all of it in silver and copper coin, for bills are not accepted in villages where men cannot read their value.

Finally, we gathered machetes, a dagger, old flour sacks to contain food, and for water a glass *garrafón* neatly dressed in a straw jacket like a bottle of Chianti. All these "personal effects" we fitted into brilliantly colored string bags.

We set out for Tlacolula, the railhead, near Mitla, and there invested in two donkeys. Unfortunately, these proved too decrepit to carry both passengers and baggage—a fact we did not discover until we had footed the bill and hopefully baptized those pathetic animals "Pegasus" and "Pullman."

Chiefly for the donkeys' benefit, we engaged a donkey-driver, guide, or "porter." I doubt whether he had ever driven, directed, or counseled donkeys before, since



Photograph by Emma Reih

SOME MEXICAN POTTERY DESIGNS HAVE NOT CHANGED FOR CENTURIES

Like parts of China, Mexico is a land of handicraft industry. Here, at Ocotlán, the product is identical with that of Oaxaca, famous since time immemorial for its clay workers. Ceramic idols from the Spanish Conquest still mark ancient graves (see text, opposite page). There is not a village market without its display of the potters' wares.

by trade he was a sandal-maker; but he spoke Zapotec and rejoiced in a grandiloquent name, perhaps his chief claim to immortality. Under his auspices we loaded the donkeys with four tall cylindrical baskets for the baggage (see page 761).

SOME POMP ATTENDS THE START

As we dawdled out of the sleepy little town of Tlacolula, it was 4 o'clock in the afternoon, and afternoon was in the atmosphere. The market was deserted. Pigs and scraggy dogs of uncertain race and temper sprawled in the dust heaps. Only our grunting donkeys broke the stillness of siestatime.

Soon we were out in the plowed fields with the village behind us, a blue-green gem on the sunburnt plain. All around, the horizon was bounded by lofty turquoise mountains. Here and there on the lower slopes stood big white churches with red domes like toy rubber balls sliced in half. In the foreground were vast fields of magwey, in regular lines—an army on parade.

By 10 p. m. we heard distant barking, the canine concert which invariably precludes a Zapotec village, and that night we

slept on the earthen floor of a windowless adobe house, our companions a cat and three turkeys. At 4 a. m. we rose and set forth again into the dark. Sunrise found us at the top of a low mountain pass. Before us stretched a wide valley still deep in purple shadow, and in the distance blue mountains with serrated crests bathed in pale golden light. This was the Valley of Ocotlán, a branch of the great Valley of Oaxaca, center of Zapotec civilization.

By 8:30 we reached the town, dominated by a domed church, salmon pink and pale jade green. In the market place, beneath striped awnings—some white, some terracotta, like the sails of Venetian barges—all local produce is spread out. There is milk in plenty, coffee, chocolate, several kinds of bread, and dried fish brought up from the coast by mule and donkey. Oranges, bananas, and pineapples are piled in decorative heaps.

Even peanuts and beans, including special white beans, to be eaten on Fridays, are laid out in geometrical patterns, for the Mexican has an inborn sense of design, and nothing is too humble to be arranged with care and displayed as a work of art.



THE DRIVER EXPLAINED THAT HIS BUS HAD "DECOMPOSED"

Too many flour sacks caused the rear wheel to roll into a ditch somewhere between Oaxaca and Mitla. It is 25 miles between the two Mexican towns; the crippled vehicle made it in 14 hours. Three of the company procured donkeys and walked to Acapulco, 400 miles—and thereby hangs this tale (see text, page 757).

This innate artistic sense is specially evident in the hand- and home-made pottery (see opposite page). Almost every village retains its particular style in pottery, and towns such as Guadalajara* and Puebla have achieved a more than national reputation for their wares.

One of our party, suffering from headache, approached an herb stall. In a prominent position lay a red-crested woodpecker, which, as the chief cure for heart disease, is as obvious a professional sign to Indians as the barber's pole to us. Laid out on straw mats were starfish, sea shells, rattles from rattlesnakes, birds of brilliant plumage, and herbs to cure diseases both human and animal; but, curiously enough, for headache and heartache the cure was identical—two little patches of banana leaf affixed to the temples.

FEW VILLAGES ON THE TREELESS PLAIN

In the blazing noonday sun we set forth again across the treeless plain, its monotony relieved by giant candelabra cactus and many small artificial mounds, on one of

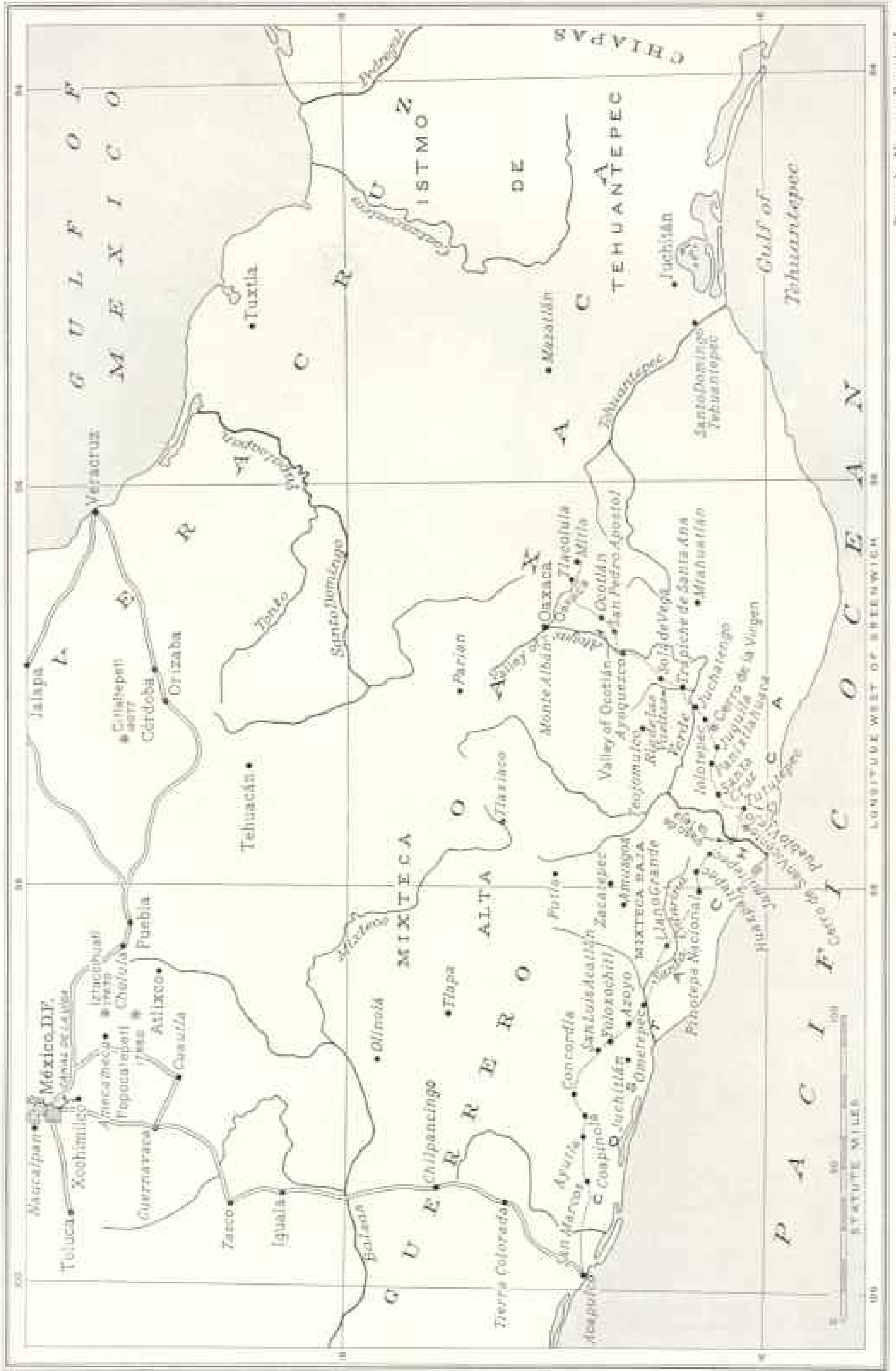
* See "Vignettes of Guadalajara," by Frederick Simpich, in the NATIONAL GEOGRAPHIC MAGAZINE for March, 1934.

which a man was actually sowing corn. Although this valley is still thickly populated, it is no center of civilization, as in the days when Mitla was built and pyramids or temples rose on nearly every hill. Though we trudged on all day and well into the night, we passed only one hamlet, San Pedro Apostol.

Typical of Zapotec villages were defiant walls of organ cactus lining the roadway and barricading every house—impenetrable barriers to all save the lean dogs who squeezed through to get a bark at our cavalcade. Characteristic, too, were the numerous pigs and turkeys, the former "dressed" in wooden triangles to prevent their prying into other people's business, and the latter resplendent with gorgeous blue throats and heads and dazzling white plumage. Turkeys are always to the fore in Mexico.

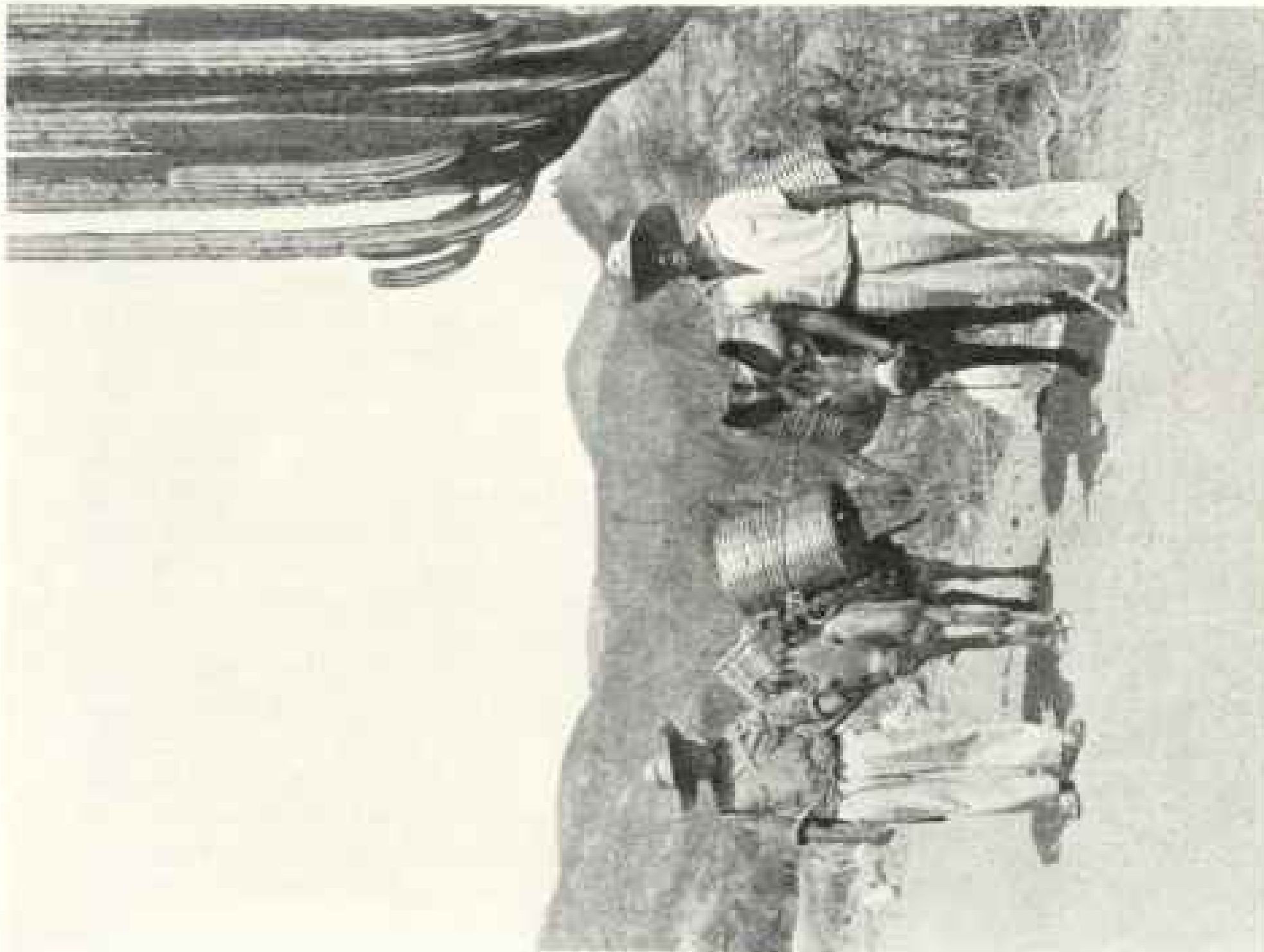
Our second night was passed at Ayoquezco, "The Place of Still Tortoises." Here we slept on the stone floor of a large earthquake-ruined hacienda along with 15 peons of both sexes, who, swathed in serapes and laid out in regular lines, resembled recumbent effigies of knights in an ancient church.

The following day we left the great Valley of Oaxaca, our trail keeping for a time to



Drawn by Newman Dummitt

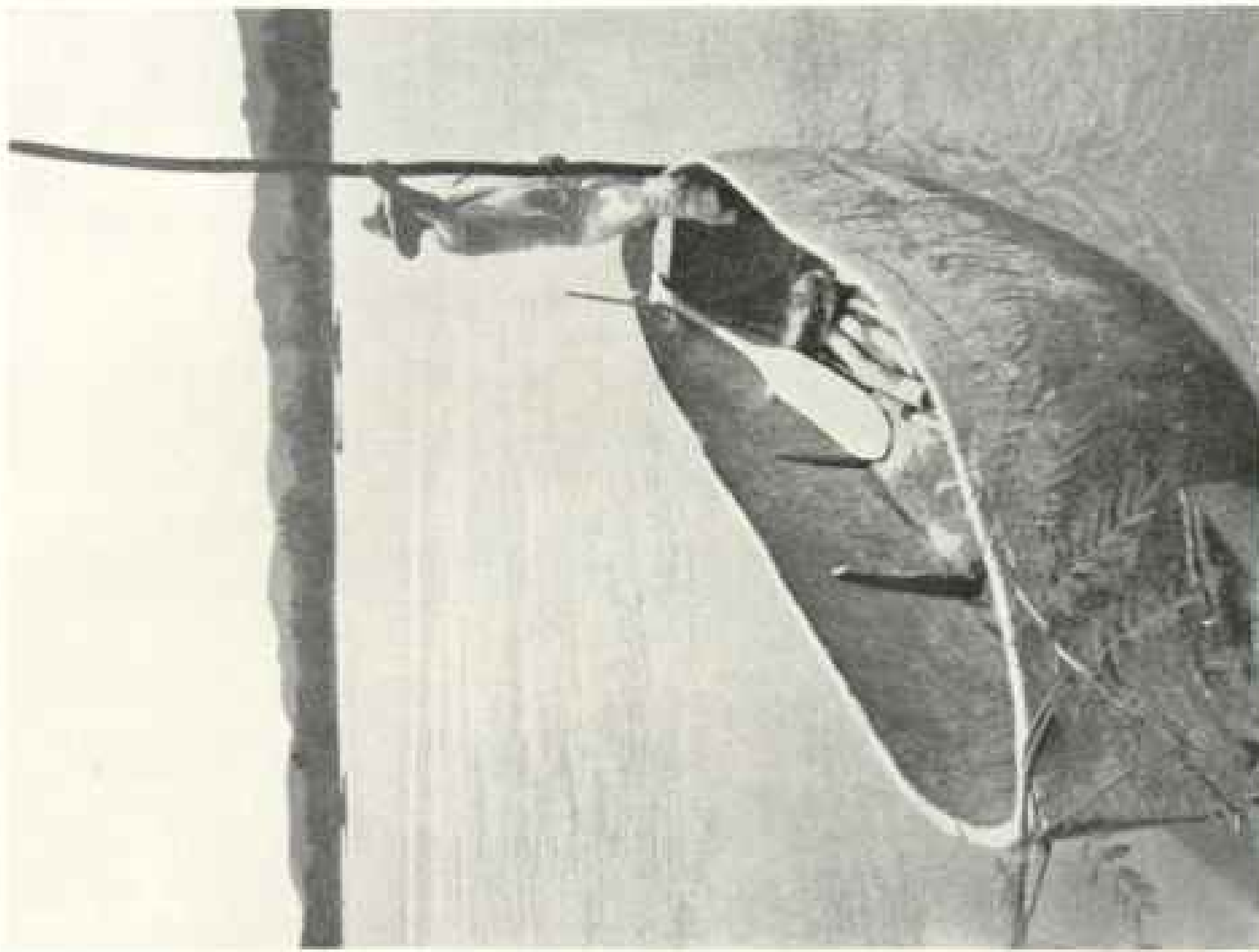
THE AUTHOR FOUND ANCIENT INDIAN CIVILIZATIONS ROOTED DEEP IN MEXICAN LIFE BETWEEN MITLA AND ACAPULCO



Photograph by M. Berliet

"PEGASUS" AND "PULLMAN" STOP BESIDE A CACTUS CANDELABRA

The bihthely named donkeys proved to be neither fast nor freightworthy. Tall, cylindrical baskets peculiar to the Oaxaca region were strapped on their backs. Sunrise found the travelers in the Valley of Coatlán, a branch of the Valley of Oaxaca, center of Zapotec civilization (see text, page 738).



STURDY TREES MAKE STOUT BOATS

Equipped with pole and paddle, the ferryman takes his boat across the Verde regardless of the season. With the nearest bridge 180 miles away, travelers have no choice but to accept transportation in these dugout craft, which, however, are amazingly seaworthy.



BOTH FISH AND FOWL LURE HIM

Large birds with loud cries like pneumatic road drills will be the target of the 70-year-old flintlock carried by this Negro-Indian hunter of the Verde River region. In shallow water he will kill fish with the machete hanging from his belt.

the Río Atoyac; but where this river bends round a mighty limestone bluff the path scales a mountain, then descends abruptly to Sola de Vega. In four hours we climbed this pass, famed for rattlesnakes and tarantula spiders. It was our first *subidita*, as the natives call any ascent, however large or small, so fearful are they of admitting the cold reality.

Beyond Sola neither an automobile nor even an oxcart can pass. The precipitous trail to Juquila ascends 2,800 feet, then drops nearly 7,700 feet, only to rise immediately another 8,000. These tremendous variations in altitude form a commercial,

racial, and linguistic barrier, beyond which the level of civilization falls considerably. Sola is nominally Zapotec. The next town is Chatino.

This high "frontier" pass has typical changes of vegetation. First we climbed through shaded banana groves and fields of sugar cane; then to a zone of cultivated maguey; then, at 6,000 feet, to a more temperate zone, with oaks and other trees. Finally, perhaps a thousand feet higher, we entered a cool forest of long-leaf pine, the trees resplendent with white orchids, like candles on a Christmas tree, and gorgeous crimson flowers perched high in the upper branches.

LOST IN THE FOREST

Near the summit two men were driving a wild bull. With stout ropes the animal would be temporarily tethered to a tree. Then, once it was quiet, the ropes were uncoiled, and with one mad rush the men and their charge hurtled down the mountain. Some 50 yards farther on the ropes were coiled round another tree, instantly upsetting the bull, which kicked wildly in the air till, with ropes entangled in its legs, it lay helpless in the middle of the path.

Bull and men then recovered breath and the game continued, but this time the animal outdistanced its captors, dived into the forest, and finally lay bleeding and bellowing in a tangled skein of rope some 30 feet below the trail.

The sun was already sinking behind a distant peak when we reached the summit. Before us rose in gaunt majesty the Cerro de la Virgen, swathed in heavy gray clouds, and in the foreground lay a multitude of red-brown hills cushioned like a quilt.

Twilight fell; not a house nor a light could be seen; only a vast and gloomy forest—a blue-green carpet stretching to eternity. Darkness closed in, but still we continued down the mountain into the inky black night. Both donkeys were exhausted, and finally, after numerous falls, collapsed simultaneously.

We had lost our way, and it was foolish to explore the *barrancas* and stream beds at that hour. We simply lay down in the woods and slept. That day we had climbed up and down mountains for more than 12 hours, and had had little rest since accomplishing 30 miles in 13 hours on our first day.

All next day was occupied with the 7,700-foot descent to Juchatengo, and we camped again in the forest just above the Rio Atoyac, only 150 feet above the sea. Half-way down, at Trapiche de Santa Ana, we found an oasis with shining banana groves and sugar cane, watered by the tiny Rio de las Vueltas, which we forded 17 times.

With proper irrigation, this land could be a Paradise. Without the life-giving water, it remains a wilderness.

EARTHQUAKES ALMOST DAILY

The Atoyac, crossed at Ayoquezco as an insignificant stream and in Oaxaca as a chain of pools, is perhaps a hundred yards wide at Juchatengo. Having fallen 5,000 feet in less than 65 miles, the current is swift and dangerous.

Lying in a gigantic trough, with mountains rising to nearly 9,000 feet on either hand, this village, because of its low elevation and torrid climate, grows some of the best fruit in the State; but, because of difficulties of communication, the fruit sells for almost nothing. We bought 10 bananas, a pineapple, and a stick of sugar cane, all for about four cents; and delicious oranges, three for a third of a cent.

Juchatengo has the unenviable reputation of an earthquake almost every day. A few years ago, we were informed, the parish priest was murdered, and God has visited the town with quakes ever since.

The terrible earthquake which destroyed part of Oaxaca city on January 14, 1931, laid waste a district 150 miles long and 125 miles broad, a triangular area of about 9,500 square miles, and until we reached Jamiltepec scarcely a stone or adobe house stood intact.

Not only had buildings been overthrown by the shock, but whole mountain sides had slipped (landslides are still feared at Juchatengo, Juquila, and Miahuatlán), and rivers filled with earth overran their banks and destroyed the crops.

Even beyond Jamiltepec the towns of the Costa Chica (see text, page 783) are still desolate from previous earthquakes. In the State of Oaxaca alone more than 60 centers of seismic disturbance have been located. There are another 25 such centers in Guerrero, and at least 70 others near by, on the floor of the Pacific Ocean.

The 8,000-foot climb from Juchatengo to the Cerro de la Virgen took us nearly 15 hours, with two nights in the mountains—



Photograph by James Starcken

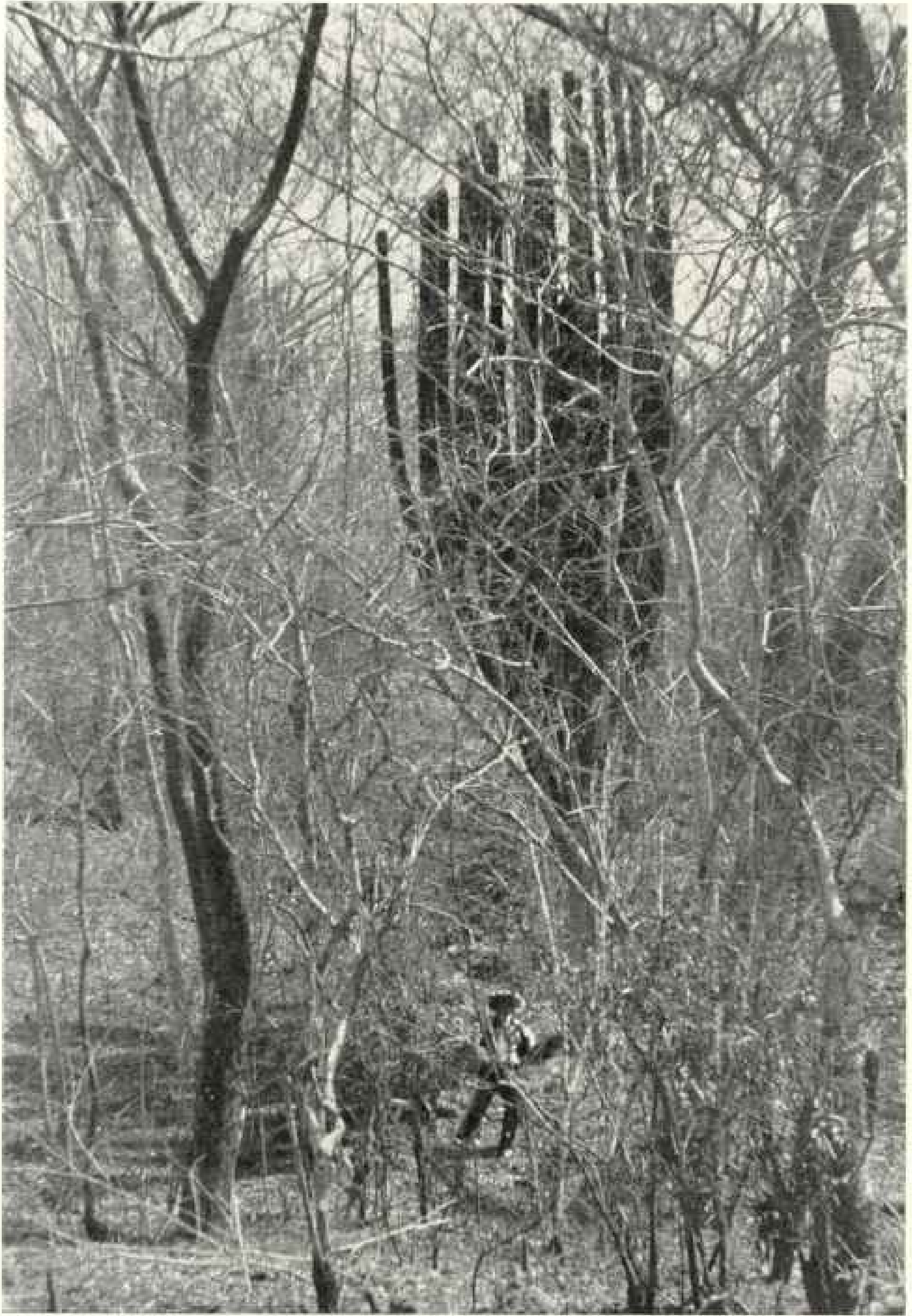
TWO PESOS A PIG

Fat sows are driven 150 miles overland, all the way from Juquila to Oaxaca. For the journey, which may take as long as three weeks, their tender feet are often wrapped in bandages or little shoes. The leg rope prevents escape.

one near a deserted village with old silver mines and the other near the top of the pass. Clouds drenched us while we slept at the latter place. In these 35 miles only one inhabited village lies on the trail, Iolotepec, a name meaning "In the Heart of the Mountains."

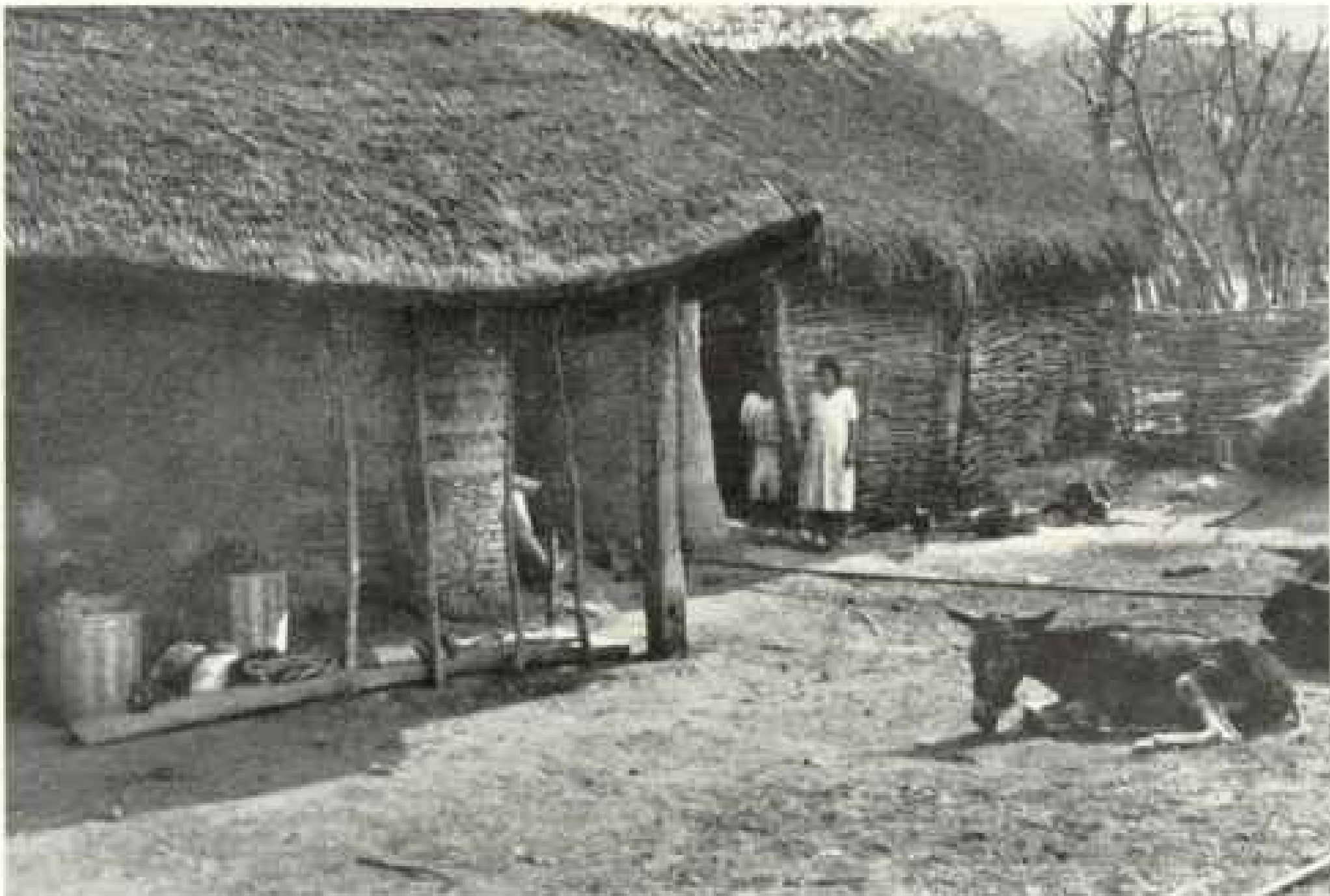
Here scarcely a soul spoke Spanish, and our porter's Zapotec made the peasants laugh. It was our first village wholly Chastino, a tribe which, numbering about 12,000, extends through most of the Juquila district.

On the eighth day of our march we reached Juquila (119 miles from Oaxaca), where we "took up residence" in the patio



GIANT CACTUS THRUSTS A BLACK HAND THROUGH THE FOREST OF JAMILTEPEC

Little green parrots, beautiful turquoise butterflies, winzid beetles, crimson dragonflies, humming birds, and magpies and golden calendar larks filled the air; scarab beetles, mud rollers, chameleons and lizards, iguanas and brilliant red ants crossed the paths; and the myriad crickets would sing in massed choirs like waves beating on the seashore, as the travelers passed through the twisted wood.



Photograph by James Starkon

SIESTA WAS INTERRUPTED BY AN EARTHQUAKE

While resting on the porch of a hut by the river bank at Juchatengo, the author received an unexpected shaking (see text, page 763). Even the donkey's extended ears seem to sense danger.



ONE MORE AND "PULLMAN'S" LEGS MAY FOLD UP

Loading the donkeys with their baggage baskets was drudgery for the three cross-Mexico hikers; and when the packs were in place, there began day-long anxiety that the beasts would collapse.



JAMILTEPEC'S ANCIENT CHURCH IS 150 MILES FROM ANY ROAD

Oxen drag a heavy log across a street undisturbed by wheeled traffic. Monumental sundials of Spanish architecture stand before the church, which is guarded all night lest unfriendly neighbors remove its miracle-working image. Such objects of religious veneration were found in many villages throughout the journey taken by the author and his two companions, but few were so elaborately housed.



A THOUSAND YARDS TO SWIM AND CROCODILES ALL AROUND!

Crossing the Verde, largest river in the State of Oaxaca, 14 miles from the sea, means peril for led animals; for the water is infested with vicious crocodiles, which may attain a length of 15 feet.



Photograph by James Sturken

AN OMETEPEC RESTAURANT TEMPTS MARKET TRADERS

Sweet delicacies cooked by Mixtecs from Tlaxiñco, straw hats fashioned by Triques from beyond Putla, beautiful trays, gourd vessels, and boxes of fragrant tropical woods made by Tlapanecos from the mountains of Guerrero and their neighbors from Olinolá—all are brought here for barter.



EACH BALANCES A BASKET OF BEANS.

Mixtec women bring their produce to the Ometepe market for disposal. Their hand-woven smocks are richly decorated in crimson and blue. Although they retain a distinctive language, they express by a hand raised in disgust more than by a hundred words.

of an old ruined convent and left our donkeys in a field outside the village. A few years ago, and before the great earthquake, Juquila was an important town of perhaps 5,000 inhabitants, but now it is a mere hamlet, although it still derives an almost nation-wide fame from its tiny wooden image, which attracts throngs of pilgrims to its festivals.

To this image, only eight inches high, thousands of Indians make an annual pilgrimage on December 8. Most come from Oaxaca and little towns in the Mixteca Alta,

or High Land of the Clouds, but some from more than two hundred miles away. We knew of one who had actually ridden from Ayutla, near Acapulco, 240 miles.

Those who come as a penance or because of a "promise" nearly always do so on foot, no matter what the distance, and for the last few miles some actually travel on their knees. Often they march in large groups, chanting as they go, carrying miniature shrines and forming torchlight processions as they wind up and down the hills by night.

Our trail from Sola is popularly known as the Road of the Virgin, and nearly every rock is associated with miracles. At the wayside shrines the Indians brush their aching limbs with flowers and beg the *virgen* to ease their pains. For ardent pilgrims she is said to make the road more laborious. Woe betide him who swears at the rocky, precipitous path; his portion shall be a broken ankle or leg, for this *virgen* prohibits swearing.

In the course of our stay two Government functionaries passed through Juquila, the Commissioner of Woods and Forests, and the Inspector of Licenses to sell alcoholic drinks. The dignity of the latter was enhanced by a giant Negro servant, who, arriving before his master, quickly discovered where alcohol was illegally sold. In due course fines were efficiently exacted.

Meanwhile the resentful populace took revenge on the Forest Commissioner by setting fire to a majestic pine on Government land in a vain attempt to set the forest ablaze.

If the first 120 miles of our journey were arduous because of the mountainous country traversed, the rest were difficult mainly because of the scarcity of food. The villages, few and very far between, could provide no luxuries, and for the next 17 days we lived almost exclusively on eggs, corn *tortillas*, bananas, and beans. Every day we each consumed ten or more eggs.

Bread was obtainable only in the larger towns, and even there was baked just once a week. Very rarely could we buy oranges or pineapples, but occasionally we had *panela*, a brown substance made from sugar cane and tasting like maple sugar. For drink we had coffee made with extract, and in the Hot Country coconut milk, sickly sweet, but a welcome change from the usually brackish water we drank from the streams.

DIFFICULTIES OF COMMISSARIAT

Since there were no village stores, procuring food entailed a house-to-house reconnaissance. From nearly every hut would come first a muttering in an unknown tongue, then the answer, "*No hay . . . No hay nada*," "There isn't any." The Indian women seemed to delight in repeating with seraphic smile those dismal words, which were used so often that we came to classify the villages as *Hay* and *No Hay*, "There is" and "There isn't."

Toward the end of our trek, wearied by sleepless nights and long distances covered despite the torrid heat, we developed a craving for milk, seldom satisfied, since the In-



Photograph by James Sturken

"HOW MUCH?"—"EH?"—"TOO MUCH!"

A tattered oldster haggles over the price of a Mexican water jar. Baskets and various pieces of pottery, for which his race is famous, clutter up the lanes of the market place. The old man's features are those reproduced countless times in ancient Zapotec grave figures.

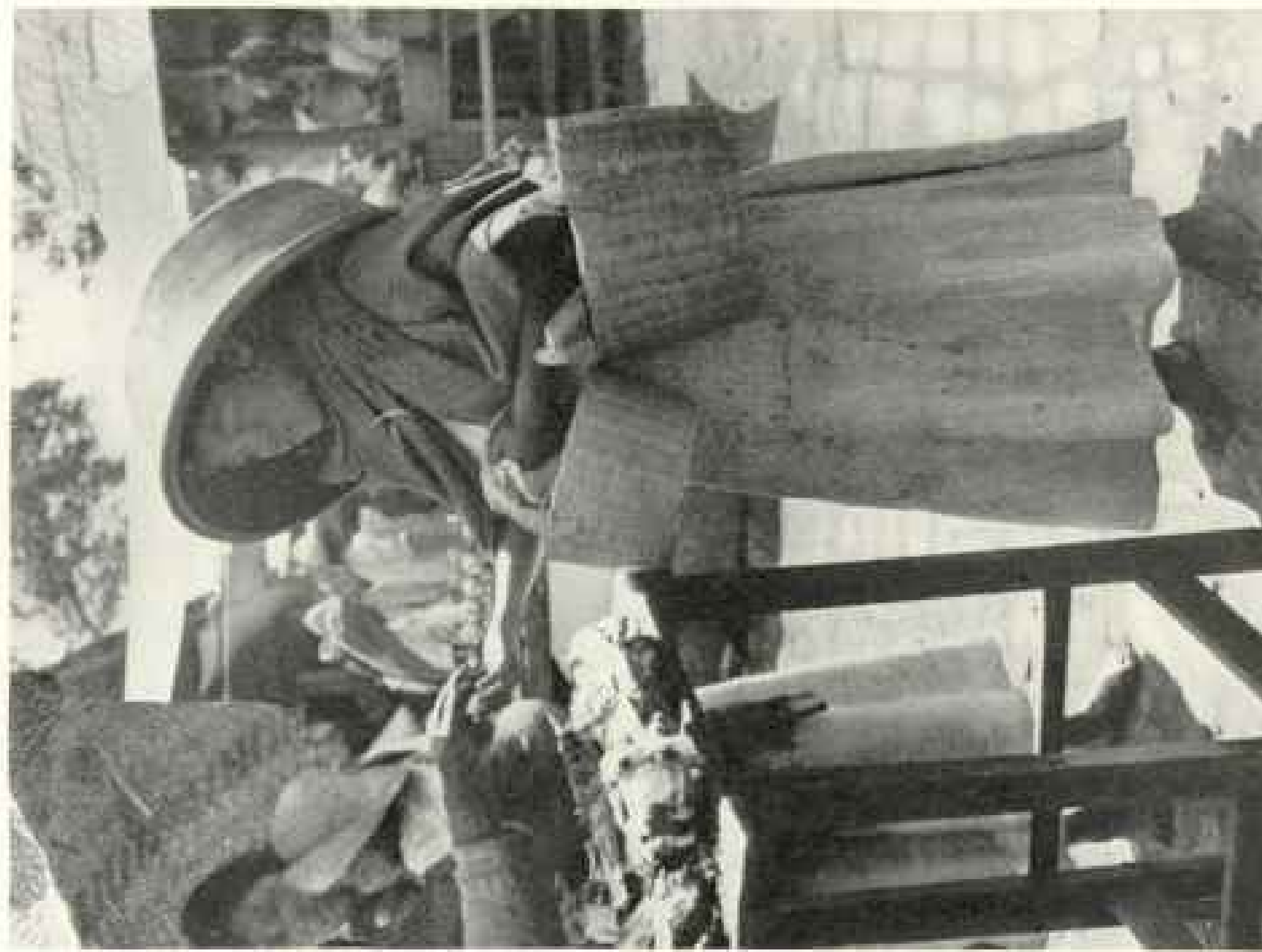
dians do not usually trouble to milk their cows. In large towns one can buy milk in the early morning, but we hardly ever reached a town before nightfall and usually left long before daybreak.

The country between Juquila (4,225 feet) and Tututepec (1,300 feet) is practically uninhabited. In the more than 50 miles between these towns we passed only two villages—Panixtlahuaca, the last in Chatino territory, and Santa Cruz, the first in Mixtec; and these lay 11 hours apart,



THE TUTUTITEPEC WEATHER MAN IS A HEAVYWEIGHT

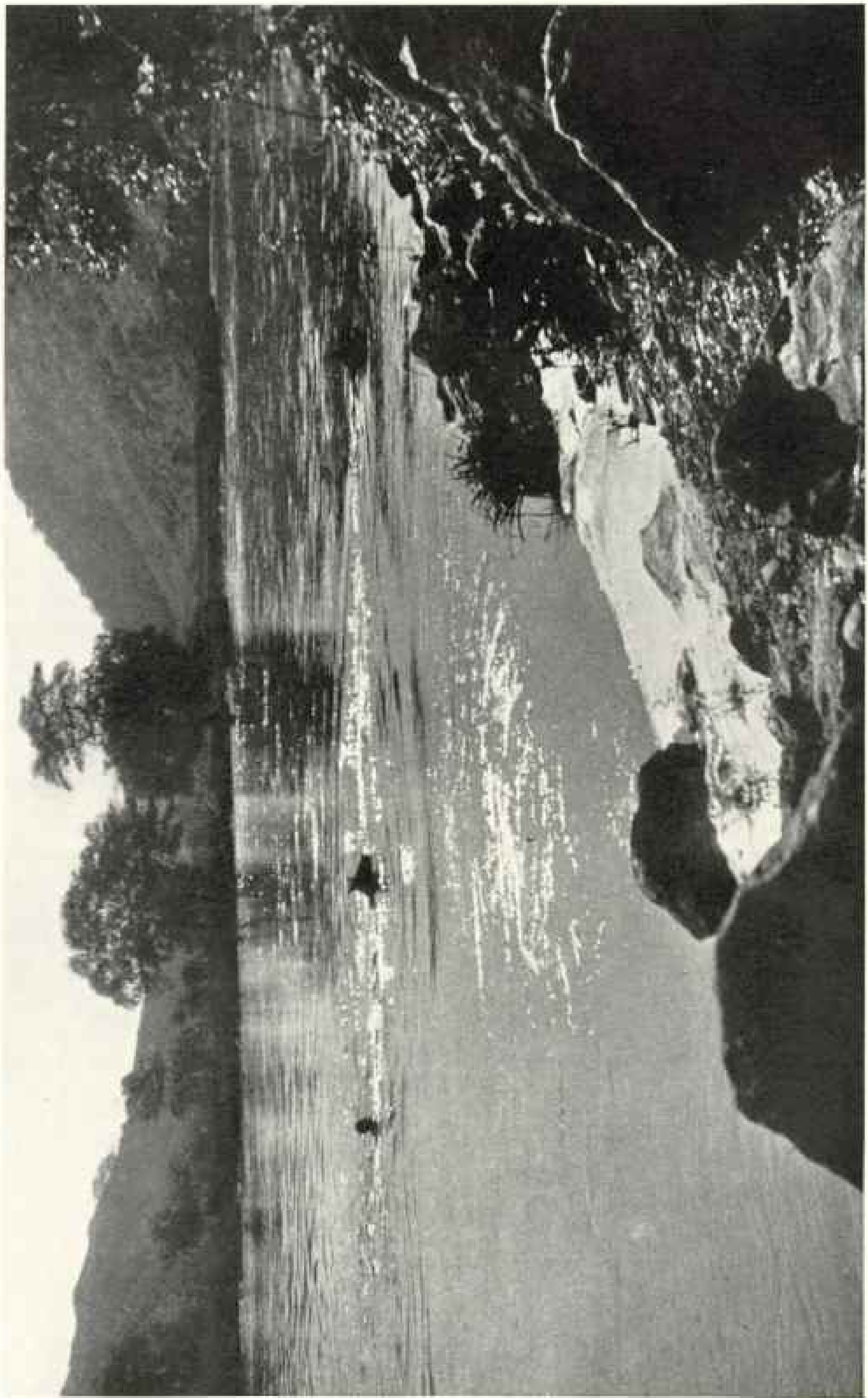
A granite idol six feet high, with twisted lips and large, almost round eyes, Tlaloc, the Rain God, wears ponderous earrings and necklace. The zig-zag patterns of the hem of his robe are said to signify lightning, and the curious features just below his hands, falling drops of water (see page 776).



HER ARMS ARE FULL; SO A BASKET IS HER HAT

A resourceful Mexican matron has stopped to buy meat on her way through the market on family business. The children have not been forgotten; in one of her baskets are three sticks of sugar cane. She is receiving her change in coins. Paper money means nothing in remote villages (page 757).

Photograph by James Starken



DONKEY AND MASTER SWIM THE SHIMMERING SANTA CATARINA

Near Omatepec the river unites with several streams tumbling down the mountains of the Mixteca Alta, or High Land of the Clouds, joins another below the village, and debouches into the Pacific through a lagoon famed for crocodiles. During the wet season it can rise to flood level and subside within four hours.



Photograph by James Sturken

MEXICAN TRADERS STOP TO GOSSIP UNDER PUBLIC SHELTERS

After carrying flour, fruit, and drink hundreds of miles to remote settlements, mule and donkey trains rest free of charge in resthouses like these seen in Panixtlahuaca and Santa Cruz. Every village in the district provides such thatch-roofed protection for travelers.

with no sign of life between, only lofty mountains and dense forests.

Panixtlahuaca, in its deep valley, more than 2,000 feet below Juquila, is an attractive and typical Chatino village. Water rushes everywhere. Bougainvillea, morning-glory, and convolvulus cluster in the trees. White turkeys strut up and down the cobbled lanes, and pigs run in and out of the houses, all of which are built of sticks and thatched with grass.

Inside the church some 20 Chatino women, kneeling on mats, recited the Ave Maria in high-pitched Indian tones. On their backs were fastened tiny babies swathed in scarves. One girl, stripped to the waist, beat herself with knotted rope, physical penance being common among these tribes. Indeed, it is not unusual to see both men and women walking in Good Friday procession with huge thorned cactuses tied to their backs and naked arms.

The church had no windows, no pews, no chairs, no organ, no priest; but 10 young men played lustily, though inharmoniously, a loud military march upon brass musical instruments and drums. When the din

ceased, two nimble-fingered fiddlers struck up an Indian tune which was not unlike an Irish jig.

Later the band paraded the image of the local saint round the village. It was a wooden jointed image of Michael the Archangel, with waxen face, real clothes, glass eyes, and human hair. Finally the procession halted in front of the municipal building, the band continuing its efforts before the *Presidente* and three councilors, who sat cross-legged beneath the porch. Meanwhile, behind the church, six rockets and two small bombs were fired as a mark of appreciation.

They were a gay sight, these Chatino musicians, in their clean white "pajamas," crimson or imitation tiger-skin serapes, and immense sombreros. Their painted drum and flashing trumpets lent just that touch of modernity which appears in even the most remote corners of Mexico.

INDIAN CARRIERS AND TIME SENSE

For the next three days we clambered up and down the cushioned hills; rushing streams sated our thirst and made music in our ears. The few persons we met were



PINOTEPA WOMEN PREPARE FESTIVAL FOOD OF WHICH THEY EAT LITTLE

In a South Sea island setting cooks in brilliant blue homespun skirts, horizontally striped in red and yellow, grind maize and slap tortillas for a religious feast. Women may attend the celebration, but their portion of the vianda is small (see text, page 782).

carriers, with mules or donkeys, transporting goods to and from the coast.

Among the characteristics of Indians thus encountered, most striking was their utter lack of time sense and their great physical endurance. With immense loads on their backs, they can walk 30 miles over mountains in a day, but never do they seem able to estimate time or distance.

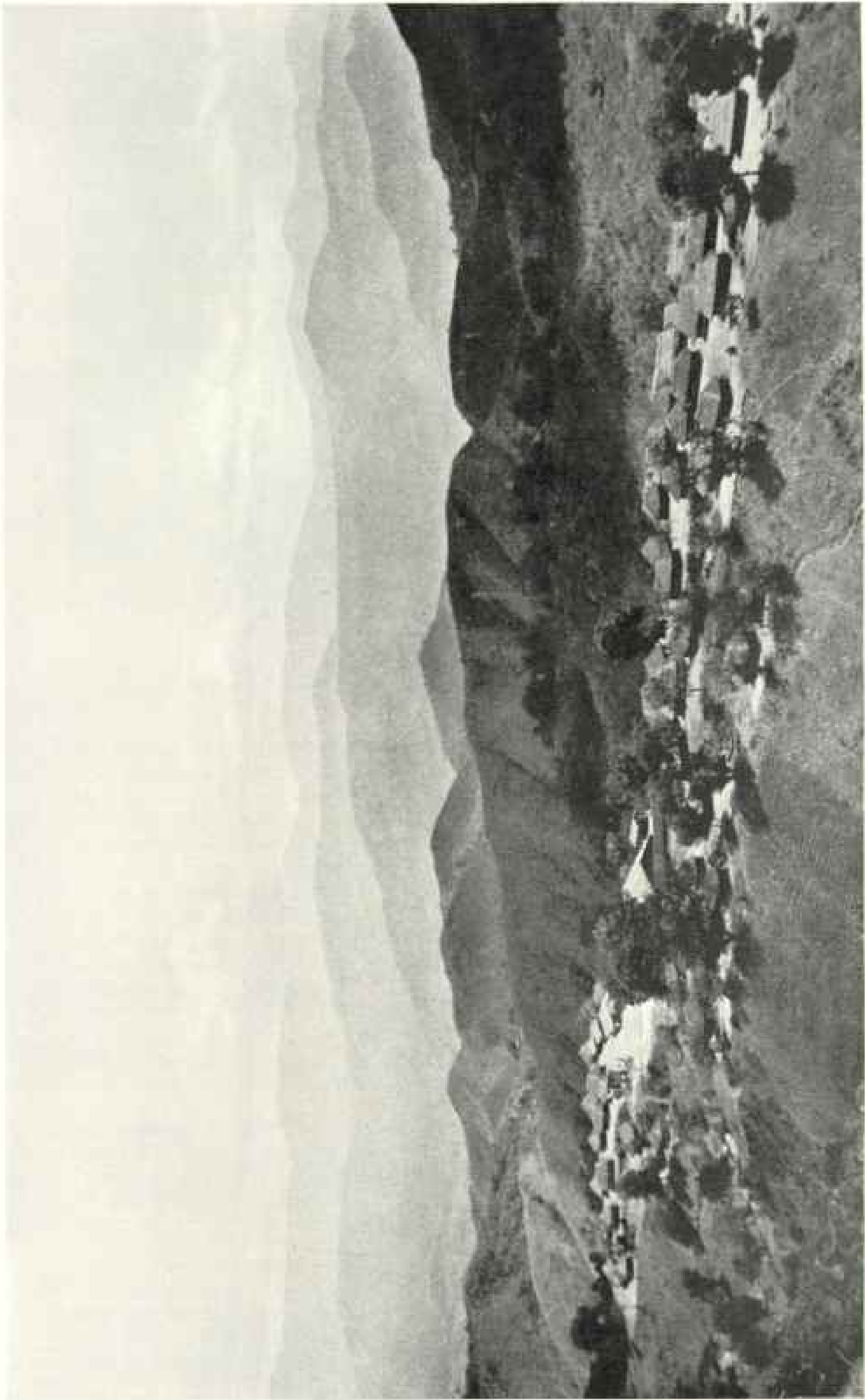
When asked how far lay the next village, they would wave a hand at the sun and answer paradoxically, "It is now 3 o'clock; you will get there in two hours—about 7 this evening."

"Fairly distant" might imply anything from an hour's walk to a long day's march, and "Quite near" might entail a 10-mile tramp. With watches hidden, we tested their accuracy in reading sun time, often to find them out by several hours; and the number of leagues would sometimes *increase* as we neared the hoped-for village. In desperation we concluded that to an Indian a league is the distance he can walk in what he thinks is an hour, and an hour is the time in which he can walk what he thinks is a league.

Tututepec (172 miles from Oaxaca) is an old and famous name in Mixtec history. Here some 500 years ago, on the "Hill of Birds," reigned, in almost Arabic magnificence, the so-called "kings" or "counts" of Tututepec, latterly vassals of the Aztecs.

One of these princelings, even after the Spaniards captured Oaxaca, refused to acknowledge Spanish supremacy and made war on the natives of Tehuantepec down on the Isthmus. Hearing of this insurrection, Cortez's formidable lieutenant, Don Pedro de Alvarado, made in 1522 a punitive expedition to Tututepec, and the story of this raid almost parallels that of Cortez upon Mexico City.

The *cacique*, or "king," received the Spaniards well and lodged them in his own palace, a spacious and beautiful building; but Alvarado feared the Indians would set fire to their town and destroy the Spaniards and their horses in one terrible holocaust—an easy matter, since all houses save the palace were of wood and thatched with grass, just as they are to-day. He therefore made a camp of his own near by, and to it the king came daily with presents of gold



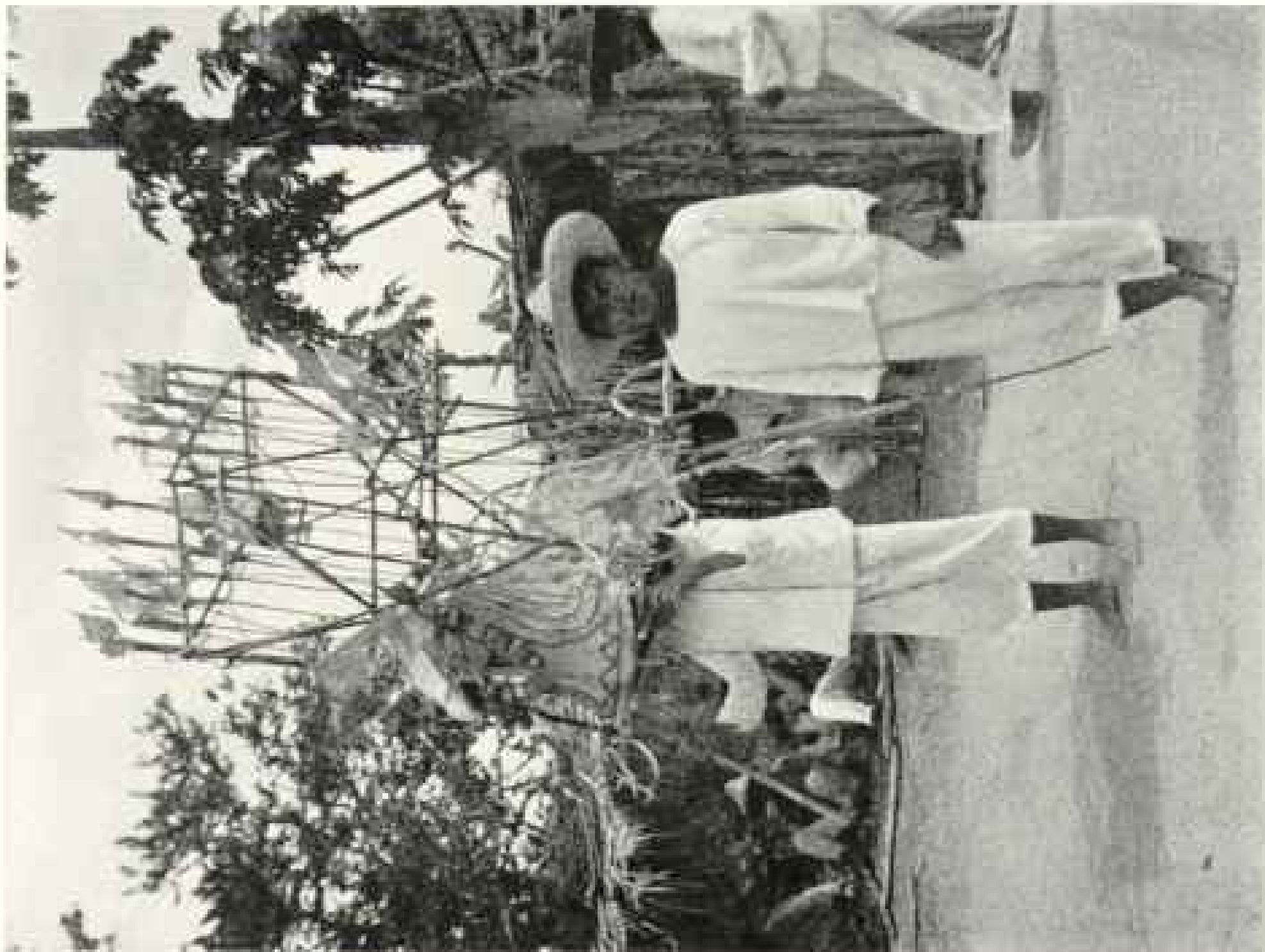
COMPINOLA COMMANDS A STRATEGIC POSITION

Between Ormitépec and Acapulco, this Indian village is tucked between folds of the mountains of southwest Mexico. Indian natives warned of Negro bandits along the Pacific passes, and the travelers chose this highland route inland rather than the coastal path. The town is characteristic, steps of a terraced field climbing up to the shelf supporting a string of thatched huts.



NO "MIDDLE MAN" PROFITS ON HER CLOTHES

In her hand this Mixtec woman holds the raw material; on her back she wears the finished cotton product. All her garments are woven at home. She is skilled in needlework and an adept at the loom, upon which she can fashion cloth showing curious and intricate patterns that look as if they had been embroidered (see illustration, page 783).



"THE LITTLE HULL" FLAMES GAILY AT THE FEAST

After a day of mighty eating and drinking, the crowd at the Pinotepa religious celebration hails at night the setting off of this fireworks effigy of the *torito* (see text, page 782). As the Catherine wheels spin and set pieces explode, the bearer of the contraption dances a sort of Highland jig. If a fuse fails, the price must be repaid to the master of ceremonies.



SUCH DITCHLIKE ROADS BECOME RIVERS IN RAINY SEASONS

Traveling is a tedious business in this region of the State of Guerrero where there are neither railroads nor good highways. To traverse such mountains, one must follow endless zigzags which wind their tortuous way up and down the slopes.

and silver. Just as when Montezuma lavished gifts on Cortez and was rewarded with imprisonment and death, generosity was the downfall of the Mixtec king. The Spaniards grew avaricious, ordered more and more gold to be brought, and when the supply failed imprisoned the king, who died soon afterward.

PYRAMIDS AND IDOLS

Comparatively little remains of the town where these events took place, though Tututepec still retains several lofty mounds which appear artificial and might well be the bases of pyramids or the pedestals of temples. It is significant that on one of

these stands the church, for the Spanish priests, wherever possible, set monuments of the new religion upon those of the old. A small stone goddess stands in front of the municipal building; near by sits a sphinxlike, headless animal; and beside the old ruined church, crowning the problematical pyramid, stands another far more imposing idol. A granite monolith six feet high, it represents Tlaloc, the Rain God (see illustration, page 770).

Archeologists, although relating Tlaloc to both Zapotec and Aztec sculpture, pronounce him Mixtec. He was originally an Aztec deity and is found in Zapotec and Mixtec territory only where Aztec influence had spread.

The whole region of Tututepec is teeming with unexplored relics of its former magnificence. Within three miles of the town lies another ancient city, the Pueblo Viejo.

One can see only vague traces of walls

and a few small mounds, one of them terraced. The site is far smaller than that on Monte Albán,* and the mounds are not spaced with that consummate sense of town planning which distinguishes most ancient American cities.

Near by, between the Pueblo Viejo and the Rio Verde, rises a hill, the Cerro de San Vicente, with a large cave containing rock-cut hieroglyphs and sculptured eagles. This cave is still held sacred by the natives, who make Holy Week pilgrimages to it. They believe it to contain the treasure of

* See "The Richest Archeological Find in America," by Dr. Alfonso Caso, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1932.



THE MACHETE IS AS HANDY AS A FARMER BOY'S JACKKNIFE

With his long, swordlike knife, the Mexican Indian harvests sugar cane, builds his home, kills fish, clears paths through tangled woods, cuts bananas, defends himself; in fact, there are few needs requiring a blade that it does not answer. Most of the sheathed weapons displayed for sale are manufactured in the United States or Germany.



CHILDREN OF RURAL DISTRICTS KNOW THEIR THREE R'S

In this new school of Yoloxochitl, a Mixtec village near San Luis Acatlán, a pure-blooded Indian lad of 12 knew the points of the compass, the biological peculiarities of the iguana, the population of his country, and the names of Aztec deities. The present Government has established excellent schools all over Mexico, many of them in remote districts (see text, page 788).



MAIL COMES BY BACK PACK AT 8- TO 10-DAY INTERVALS

Pinotepa, in the Costa Chica region of southwest Mexico, is 150 miles from the nearest railroad station, at Parian, and 210 miles from the nearest post road, at Tierra Colorada. Heavily laden postmen travel faster than horses or mules over the mountain passes of the Mixteca Alta (see text, page 768).

the Mixtec kings hidden before Alvarado's raid. The alleged gleam of buried gold is a feature of Indian as well as Negro lore.

Nearly every ancient Indian city of the hundreds in Mexico has its legend of hidden wealth or of royal tombs, and sometimes the natives let no white person approach. That there is truth in these stories is proved by finds like that at Monte Albán.

That the Indians know the value of archeological finds we quickly discovered. One we saw in Tututepec professed at first

entire ignorance concerning jade, but afterward displayed a strange familiarity with the subject.

The origin of Mexican jade is an enigma as baffling as the deciphering of Mixtec, Zapotec, or Mixe hieroglyphs. Before the Spanish Conquest, axes, masks, tiny gods, amulets, badges of authority, talismans, earrings, necklace beads, funeral and priestly ornaments were fashioned in huge quantities from this hard-as-quartz material, than which not even gold was more highly prized.

In some ways it actually took the place of gold. It was eagerly accepted by the Aztecs as tribute from vassal sovereigns. Teeth of persons signally honored were "filled" with it.

Jade was traded throughout the length and breadth of the land and highly valued by nearly all the pre-Columbian civilizations from Mexico to Peru. The Spaniards, however, did not appreciate its beauty. Philip II wore a Mexican jade bead not for ornament but as a cure for kidney trouble. Jade carving

has been a lost art on this continent for 400 years.

SOURCE OF MEXICAN JADE

Tradition asserts that jade was found in Mexico only in the Mixtec country and in Chiapas. Ancient tombs in the former district almost invariably contain jade objects; and it is highly significant that nearly all sculptured pieces discovered in Mexico—even those found in Querétaro, Vera Cruz, and Yucatán—bear definite signs of Mixtec

workmanship. However, no actual jade deposit, vein, quarry, or mine has ever been found here by white men.

The probable explanation of this is that no such mine or quarry ever existed. It is doubtful that there were gold or silver mines here before the Conquest; and, as with these precious metals, the famed green stone may have been simply picked out from the river beds.

There exist in fact carved jade pebbles with the marks of rippling streams still visible, but whence these pebbles came is again a mystery. It is said the streams of Teojomulco, near Sola de Vega, and other places in the Mixtec country, contain stones capable of a high polish. We found some near Tututepec similar to the ordinary stones often carved in place of jade.

Our Indian friend, by recalling an old tradition, threw new light on the subject. He said that jade cannot be distinguished from the outside, but is found only in the core or heart of the pebble. Later I discovered that in Burma jade is still obtained from the heart of pebbles and boulders, where the rich color and quality are found. The Indian tradition is thus substantiated.

It was at Tututepec that we entered the *Tierra Caliente*, or Hot Country, where the mountains sink into the coastal plain and the sea glistens on the horizon. For a hundred miles we traveled through dense tropical forest or thorny scrub—not a luxuriant forest like that on the Atlantic coast, where rainfall is heavier, but a maze of tangled undergrowth beneath occasional majestic trees. Through this virgin forest on the plain our path had carved a low, narrow tunnel into which the sun scarcely penetrated.

WILDERNESS TRAVEL BY NIGHT

The most nearly impenetrable forest lay between Tututepec and Jamiltepec, and much of this we traversed in the night, our route illumined by flaming pinewood torches. It was uncanny to see a troop of white-robed Indians hurrying down the mountains or threading the forest in the utter darkness of tropical night, each equipped with a blazing torch and long, unsheathed machete.

From their appearance these men would be judged a robber band; but though rough looking, with "penwiper" hair falling over eyes and faces that would scarcely grace Neanderthal man, they were friendly. We often joined them for safety.

Once, however, when we were suddenly surrounded in a thicket by a menacing-looking band of seven, we felt sure it was time to hand over our belts full of silver. We smiled sheepishly and expressed the wish that God would watch over them. Quietly they returned our salutation and asked if we had seen their wild bull. They were just cowboys! Of the real danger, the bull, we had been blissfully unaware!

We learned we need seldom fear Indians we actually saw. The Mexican brigand lies concealed, attacks from behind, and shoots before the victim is aware of his presence. Nevertheless, we seldom felt really secure until dawn broke and that ratchet-voiced bird, the *chachalaca*, had made the sunrise hideous with a call like the noise of a pneumatic road drill.

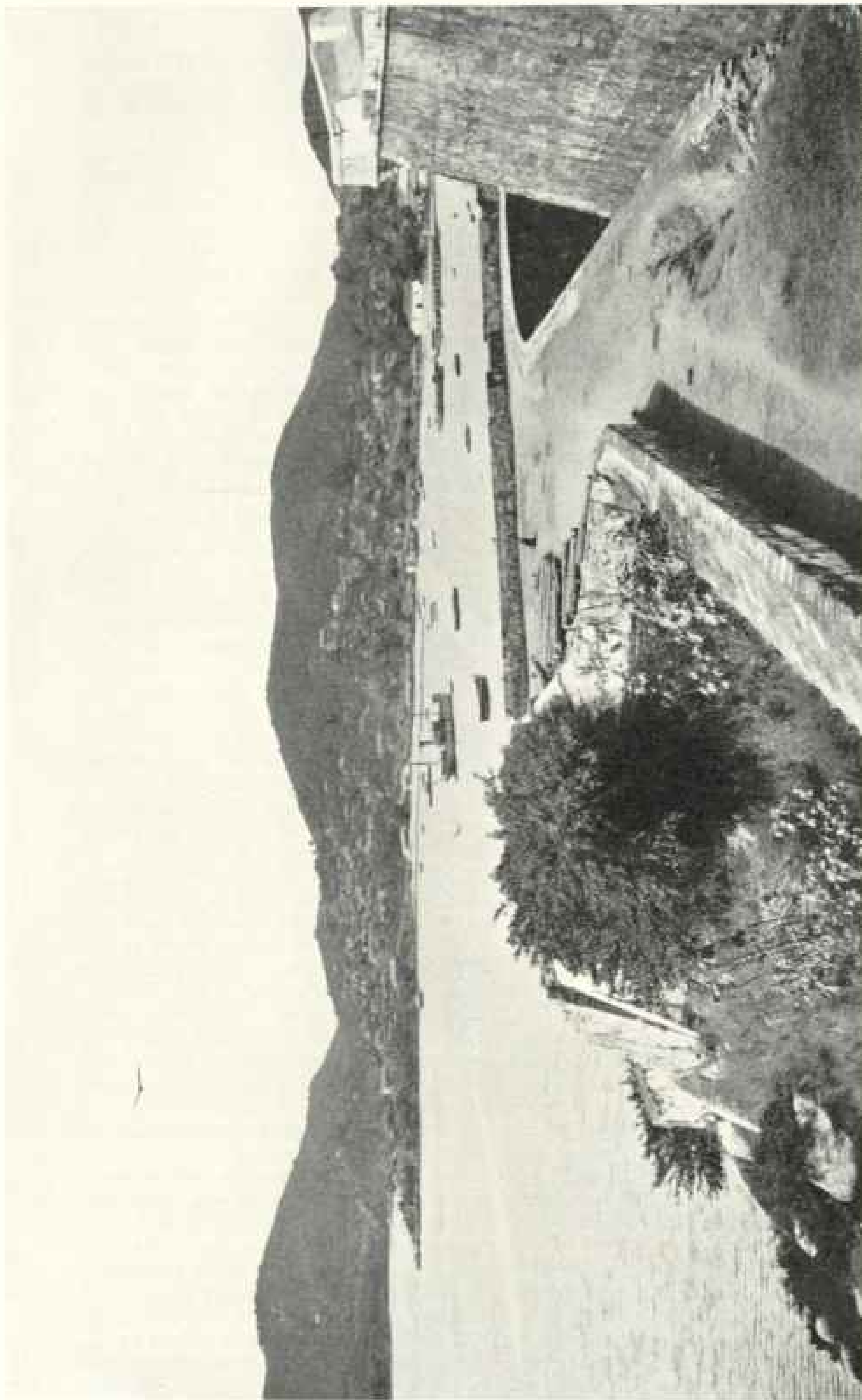
STRANGERS ARE NOT WANTED

Palm-encircled Jamiltepec, a day's march from Tututepec, is one of the most striking villages of the *Mixteca Baja*, or Low Country. It has a handsome white church and a spacious plaza with monumental sundials.

The local costumes are particularly attractive. Above a white cotton skirt, held by a blue cummerbund, the women wear a white shirt. This is thrown loosely over the shoulders and sometimes the head, so that the richly embroidered neckpiece forms a kind of headdress—very striking as well as practical in this sultry climate, and giving the effect of an oriental veil.

Immediately on arrival we heard the sound of rolling drums. The occasion was a religious feast, not, however, in a church, but in a small adobe house, where an Indian owned, as private property, an image of great local fame in curing skin diseases. Approaching, we found a large native gathering, but our presence caused such a stir that we surmised we were not wanted near the shrine. This suspicion became a certainty when, it being plainly obvious the *fiesta* was in full swing, we were told no *fiesta* would take place.

Almost throughout our trek Indians would inform us the next village was dangerous. On reaching it we were equally certain of congratulations on having passed the first village without mishap. As at Jamiltepec, the Indians were usually more afraid of us than we of them; but that the coastal region is none too peaceable is proved by the extraordinary number of wayside crosses set up, not as votive offerings, but as marks



Photograph by Albert F. Lindseth

GALLEONS FROM MANILA ONCE TRADED SPICES FOR SHAWLS IN ACAPULCO HARBOR

Under the menacing guns of the ancient Port of San Diego (right foreground), East met West to exchange merchandise. Legend tells of a Chinese princess, once sold into slavery here, who, on becoming a Christian, was beloved by all when she gave away her silks and jewels. The red skirt with a green border, white-embroidered blouse, and jauntily draped shawl that she wore became, with innovations, the local costume. The city offered soft beds and green vegetables to the foot-weary author and his two companions.



THE GUN DATES FROM 1861, BUT IT STILL SHOOTS

No modern repeating rifle, but an ancient muzzle-loader equipped with flint-lock, is this Chatino Indian's weapon for killing coyotes near Juquila, and his aim is deadly. How such firearms came into the country is not definitely known, but it seems probable that they were connected with some long-forgotten filibuster.



THE BELLE OF AMUSCOS PROVED SHY

She refused to be photographed alone and insisted that the girl in white stand with her. From the cotton her father had planted and her mother had spun she wove her pretty dress with its rich decoration. She did not embroider the pattern, but wrought it into the cloth on the loom by a difficult and painstaking art inherited from her ancestors.



ZACATEPECANS CLING TO TRADITIONAL COSTUMES

The cotton homespun garments of these three municipal councilors of the village are embroidered with figures representing birds and beasts. In the pouches of their trousers they carry provisions for long journeys, for Ometepec, the nearest town, is from two to three days distant.

for the sites of murders. I remember 12 such crosses in a stretch of five miles and 19 in another of 10 miles.

In Pinotepa Nacional, the next "large" town, we were able to watch a Mixtec festival without hindrance. A master of ceremonies (elected annually) has collected money to pay for the entertainment. For the actual feast no invitations are sent out, but all are welcome. If the year's contributions have been small, the male guests pay about 5 cents on arrival, after which they may eat and drink during the entire day and ensuing night. Ladies pay no subscription, but are allowed to eat only three tortillas (see illustration, page 773).

Early in the morning a long-drawn rolling

of drums opens the feast, and the natives hasten to the majordomo's house, where, beneath a porch, sit musicians with harp, trumpet, fiddle, drums, and guitar made from armadillo shell. Before them men dance with *toritos* on their heads (see illustration, page 775), while round the yard the guests sit or stand clapping their hands in time to the music. The *torito*, apart from its slight resemblance to a bull, is an ingenious contraption—a bamboo framework to which rockets and fireworks of all kinds are fixed. It is set alight at night.

The journey from Pinotepa to Ometepec held in store for us a series of adventures attendant upon the crossing of a "frontier" far more important than those between In-



"WHAT NEWS ON THE RIALTO?"

The Mexican Indian's interest in the market place is keen. Here weaver and farmer exchange products, produce, and gossip of the village, while pigs scuttle about looking for morsels of food. Ayutla's white church holds high its clock that none may forget the hour of worship.

dian tribes. This part of Mexico, the Costa Chica (Little Coast), is occupied almost wholly by African Negroes.

They are descended from slaves imported by the Spaniards to cultivate sugar cane at Acapulco and Mazatlán. Most of their ancestors were brought from West Africa and from the Philippines (hence a few Negro types survive) in the Manila galleons that called twice a year at Acapulco with cargoes of spices, silks, etc., to be sent across Mexico for transshipment to Europe.

For centuries the Negroes have dwelt and increased in numbers beside the Pacific, with the result that much of the coastal plain, at some points 30 miles wide, has become "a corner of Africa."

They speak no Indian or African language like that preserved in parts of Cuba and British Honduras, but rely on a peculiar dialect of Spanish.

Their small but very picturesque villages are composed either of round wattle huts patched with mud inside and out, or of huts walled and thatched with palm leaves. If the Mixtec festival at Pinotepa brought visions of the South Sea islands, the Negro villages near by recalled the Belgian Congo.

In temper and temperament we found the blacks very different from the Indians, usually sullen and discourteous. When we searched their villages for food, the invariable "There isn't any" would be reiterated with no seraphic and disarming smile, and



IT COST HIM SIX DOLLARS TO BUILD HIS HOME

No housing problem exists in San Luis Acatlán (see text, page 788). One family told the author that as soon as their son reached school age they would tear down their abode, pack it on a donkey's back, and move in "near town." Map makers find it difficult to keep up with villages that rise and disappear in two or three years. This dwelling has an open detached kitchen and sun porch.

we could well believe them to be the "bad people" with which the Indians stigmatize their name.

The Indians here cautioned us never to march at night, never to light a cigarette in open country after sunset, and never to sleep in a black village. No doubt their fears were greatly exaggerated. However, being unarmed, we heeded this latter warning, though it cost us several excessively long marches.

We covered the 60 miles to Ometepec, all of it through "black country," in two days. From Pinotepa we actually set out at 3 a. m., walked for 10 hours without a halt, and after a brief respite continued for another four hours.

A STRANGE FUNERAL

That night we reached a large village named Llano Grande, half Indian, half Negro, and despite doleful prophecies of robbery, we slept in a street porch. As it turned out, we were robbed, not by men, but by marauding dogs, which carried off all our provisions for the coming day.

Collecting food at 4 a. m. is a difficult task anywhere, and with deep misgivings I searched the village. From one hut strange music floated gently into the night. Peeping in, I saw four peasants, Negro-Indians, seated at a wooden bench—two with harps, one with a guitar, one with a drum. To a soft accompaniment they were singing a pretty little repetitive air of pre-Spanish type.

In the center of the hut, upon a table draped with hangings and with lighted candles at each corner, lay what seemed to be a small image. It was dressed entirely in blue and white paper and wore a crown painted gold and silver. At the back of the hut hung a white curtain with bunches of pink fruit blossoms.

Outside, several persons lay dozing, while an old woman stirred a caldron of boiling corn called *pozole*. "Is this a funeral? Who is dead?" I asked cautiously. One of the harp players pointed to the "image" on the table. "This little angel," he replied softly. Only then did I realize that the figure dressed in colored paper was a baby.



POTTERY SERVES MANY PURPOSES

The utensil the man holds is for cooking; the deep-bowled vessels are water jars. Most Negroes of the Costa Chica region (see page 783) do little work. Bananas, coconuts, and iguanas are their chief food, though shallow-stream fish are killed with machetes.



Photograph by James Sturken

STRIKING BLANKETS BRIGHTENED THE SQUALOR OF AYUTLA

Serapes, baskets, and sombreros immediately identify the Mexican locale. Outside the open door a bird cage rests on the arm of a wooden cross.



THE REPTILES CLIMBING THE TREE ARE STUFFED

Turtles, alligators, and iguanas lure the passer-by in many of Mexico's west-coast cities. Here they provide ornamentation for the fish dealer's stand, which is laden with parrotfish, sunfish, sea leeches, and horseshoe crabs. Lumps of coral and a variety of shells are on the table.

"It died from a fever of 'black cough,'" explained the old woman, handing me a gourd bowl of pozole and a cup of chocolate. I accepted the former, but not the latter; for only the day before we had been informed of a strange custom, idyllic in concept, but barbarous in practice and only one step removed from cannibalism.

Happily this terrible practice is confined to the Negro and Negro-Indian region, but all through Mexico the Indian child is dressed, as here, to resemble the Virgin, and lies in state through the night, while musicians play to it and sing little verses. Official mourners, replaced every few hours, are elected to watch the dead while a cook is hired to distribute food.

In the black villages health conditions are worse than elsewhere, though many of the neighboring Indians suffer from *pinto*, or "Mexican leprosy," which covers the hands with white spots and the face with black or dark-blue blotches. Normally not contagious, it often passes from parents to children, but does not seem to affect the sufferer's energy, mental or physical. There are villages where every one is thus afflicted.

As "people with reason" (the popular and pathetic Indian name for all white persons), we were often asked to prescribe remedies for dysentery and malaria, since native cures are extremely crude and these maladies work havoc on the Costa Chica. We heard that sea shells, ground to powder and mixed with linseed oil, should be applied to smallpox sores; that coral, ground and drunk in wine, cures heart attacks, and that armadillo shell, boiled in water and taken at night, is instant cure for a cold.

A Negress told us sorrowfully she had visited the shrines of both Juquila and Huaxpaltepec and *still* her baby had spots. She was now covering them with green slime from the Santa Catarina River, but hailed with delight our more orthodox application of an antiseptic because of its gorgeous color. Doctors seem scarce and the natives prefer to rely on miraculous cures from local saints or on herbalists who deal also in magic. They had suffered much from renegade whites.

On our 17th day of actual traveling we reached the State of Guerrero and Ometepec, a comparatively large town, bright



MONSTERS OF THE LAGOONS REACH JOURNEY'S END

Scale-backed, ugly-jawed crocodiles, some of them 12 feet long, are captured and killed in the shallow channels near Acapulco. Some are caught by means of coconuts thrown on the ends of ropes. Once the bait is in their jaws, the reptiles can neither swallow it nor let go.

and cheerful, with its clean streets and two-storied buildings—the first we had seen since leaving Oaxaca.

Ometepec is chiefly interesting as the trading place of many Indian tribes (see illustrations, pages 767, 768). The painted designs on trays, gourd vessels, and wooden boxes offered for sale suggest that the Indians have never forgotten the taste for chinoiseries imported by the Spaniards nearly 200 years ago. Their special lacquer finish is so hard—it is the work of weeks of polishing by hand—that some Americans recently traveled to Olinolá to learn the secret process, hoping to apply it to automobile painting.

Many of these tribes retain their distinctive dress, that of the Mixtecs of Zacatepec being the most curious (782), and all have retained their distinctive languages.

AMUSGO SOUNDS LIKE CHINESE

The Aztecs overran this territory shortly before the Spanish Conquest and are still represented near Ometepec by two small villages speaking Aztec, or Mexicano. For a language thus to survive some 500 years

in complete isolation is convincing proof of Indian conservatism. But far older and most astonishing of all the linguistic survivals in this region is the language of Amusgo, spoken in six villages in Guerrero and three in Oaxaca, but nowhere else.

Unlike the Mixtec spoken all around, it has few agglutinative words, most being of only two syllables, with many labials and nasal sounds almost impossible to render in Latin characters. Nearly every word begins with a consonant and ends with a vowel, and the precise pitch or accent of this vowel determines the meaning.

To the uninitiated this extraordinary tongue sounds exactly like Chinese. Those few Amusgos who can talk Spanish speak it with what might easily pass for a Chinese accent, both as to the vowel sounds and even to the substitution of L's for R's. The latter consonant does not exist in Amusgo.

It would be foolish to guess at the history of this minute tribe—at the most 2,000 persons. Perhaps it is the last remnant of a civilization far older than the Mixtec. On the other hand, the language may be equally well descended from a dialect of Mixtec

or Zapotec or Chatino, or from the parent of these.

Although this "island" tribe is an archaism and its history a riddle, there is present the inevitable anachronism or paradox. At Amusgos village, where centuries of Spanish rule have failed to implant the Spanish language or to replace the ancient native costumes (see page 781), basketball is played with enthusiasm and children whistle modern dance tunes from Mexico City.

From Ometepec two roads lead to Acapulco. We had no wish to test the accuracy of stories about the dangers of the one along the coast, and for another eight days we toiled over the mountain-forest trail, glad to be again with Indians. However, the Indians hereabouts were not so friendly as we had anticipated. We arrived at a village named Azoyo just in time to witness the funeral of a schoolmaster murdered the night before. We beat a hasty if undignified retreat.

The Indians of another village, San Luis Acatlán, told us their neighbors of Azoyo were bad people, and that there was constant "warfare" between the villages, interrupted only on important saints' days, when both peoples visited the same shrine.

Don Pedro, head of the family which befriended us here, was justly proud of his newly built house, which had cost him less than six dollars (see illustration, page 784). The speed with which such houses of sticks, mud, and grass are erected renders the rural population of Mexico almost nomadic.

In the matter of education, Don Pedro's 12-year-old son was something of a prodigy. Bitterly he complained that the Government had not dispatched protractors for his studies in geometry!

GOOD SCHOOLS IN REMOTE VILLAGES

Throughout our trek in the most remote districts we were amazed by the number and excellence of schools which the present Government has planted all over the country—amazed, too, by the Indian children's bright mentality and their eagerness to learn. These schools, built not with State or Federal money, but by the little communities, all able-bodied men cooperating freely, are the just pride of the Nation.

But, since these schools have existed a very short time, one often finds them in

strangely close juxtaposition with ancient customs still observed by the older generation. At Concordia, between San Luis Acatlán and Ayutla, there came for the Feast of the Virgin, on July 16, veritable hordes of primitive Mixtecs, who to this day sacrifice turkeys at the foot of an iron cross beside the church.

On the death last year of a cacique in this same village, the chief's favorite horse carried his hat and spurs in the funeral procession; the cacique was buried in full *charro* costume; chickens were slaughtered, and food, drink, and money were deposited in the grave.

MIXTEC FOR "FEAR" MEANS "AUTO"!

Though education is rapidly killing such interesting survivals as well as the pre-Cortez languages, Mixtec is still preferred by the grown-ups, and curiously enough it keeps pace with innovations. There are now genuine local Mixtec words for buttons, sewing machines, and even automobiles, the last named being appropriately associated with the word *fear*!

The last town of any size before Acapulco is Ayutla, a thriving little place of 3,000 souls, with an active market, situated in a wide valley, with the sea visible 15 miles away. Unfortunately, Ayutla was not for us the Paradise it looked. Every kind of noxious vermin seemed to flourish in this place. Winged cockroaches more than three inches long buzzed around our candle, and when all was quiet scorpions dropped from the rafters over our heads.

Our last 75 to 80 miles—Ayutla to Acapulco—we traveled once more on the coastal plain, part Indian, part Negro, with one or two villages famed for their charmingly polite inhabitants, who with gun held nonchalantly in the hand "beg for the loan" of five or ten pesos.

Cortez's first glimpse of the Pacific could not have been more enthralling to him than to us our first view of Acapulco, lying serenely in its sheltered bay. In 25 days of actual marching we had covered more than 400 miles. We had slept seven nights in the forest, seven nights on the earthen floors of Indian villages, six nights beneath wooden porches on village streets, and one night in the middle of the road. To us, more appealing than its natural beauties were the hot baths, real beds, fresh milk, and green vegetables of Acapulco.

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WATCH "C"	28	3
WATCH "D"	56	5.2
WATCH "E"	11	1
MISC.*	69	6.5
WATCH "F"	21	2
WATCH "G"	20	2
WATCH "H"	15	1.4
LOW PRICES	15	1

* "Miscellaneous" includes 6000-60000 watches which received but a few votes each.

An "Inquiring Reporter" in Chicago interviews a family in front of that city's famous Field Museum. He is asking, "If you were to get a new watch, which make would you prefer?" (The chronometer carried over his shoulder was used to check the accuracy of watches encountered. In the accuracy survey too, Hamilton was victorious—winning the title of "Most Accurate Watch" by a wide margin.)

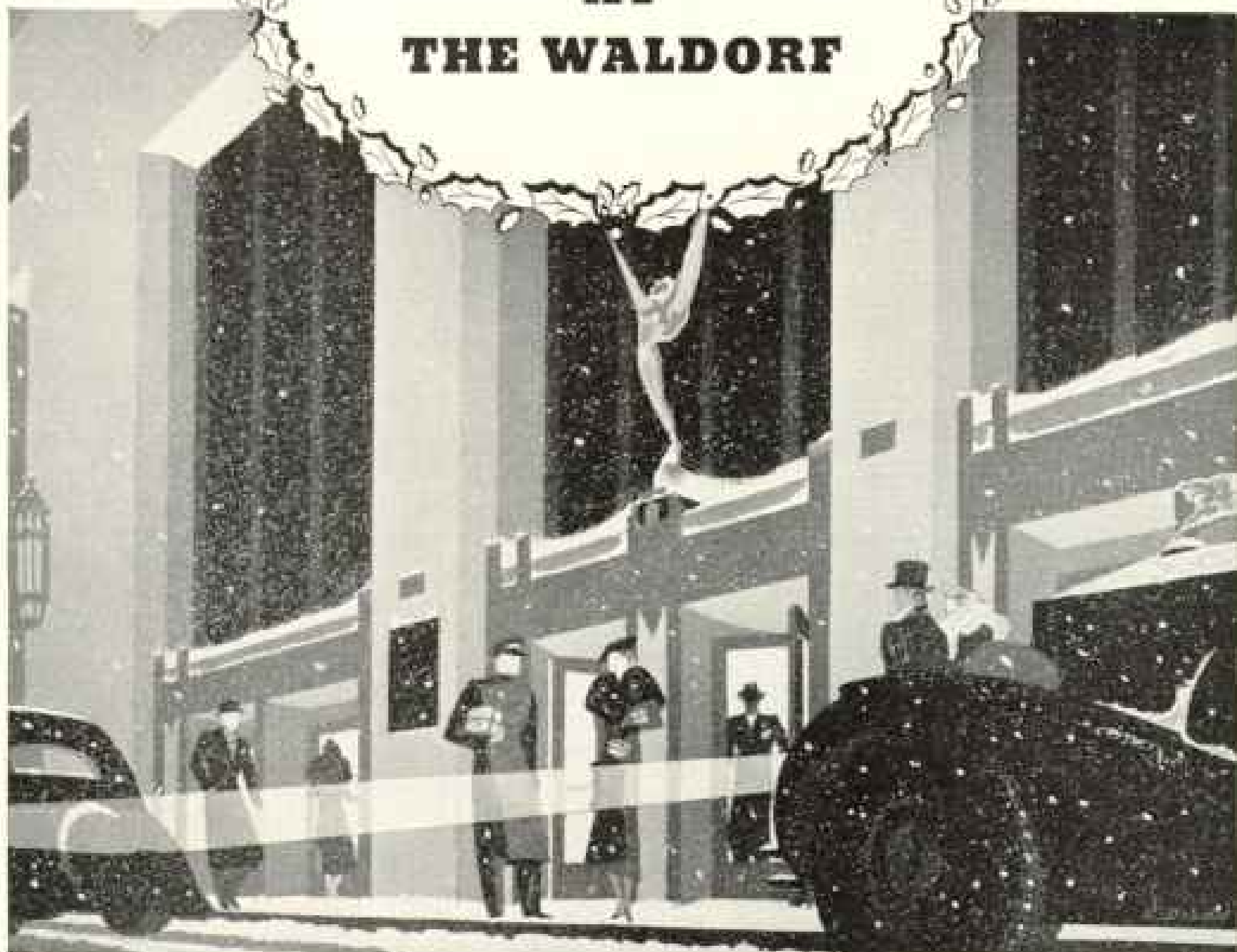
(Left to right) CAMOUZEN, 17 jewels, 14K filled gold, white or natural yellow. With filled gold chain (shown), \$54. With silk cord, \$32.50. GAIL, 17 jewels, 10K filled gold, white or natural yellow. With filled gold bracelet (shown), \$42.50. With ribbon, \$40. DUANE, 17 jewels, 10K filled gold, white or natural yellow. With black figure dial (shown) or luminous dial, \$37.50. With raised gold figure dial, \$40. Other Hamilton Watches for both men and women are priced from \$35.00 to \$500.00.

HAMILTON

the Watch of Railroad Accuracy



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In these days young men who will own the big life insurance estates of the future are proceeding in the same manner. In their minds is the plan of a well-rounded insurance program which shall meet all obligations—permanent income for family, education of children, the home free of mortgage—as well as provision for their own retirement years. But the fact that they cannot afford this complete coverage all at once does not discourage them. They are buying income, a little at a time!

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For the young man, Salary Continuance stands for assured income during the trying time of readjustment when his family would need it most. But many older men, whose estates have grown to sizable proportions, utilize Salary Continuance to provide income during the year or two consumed ordinarily in the settlement of estates.

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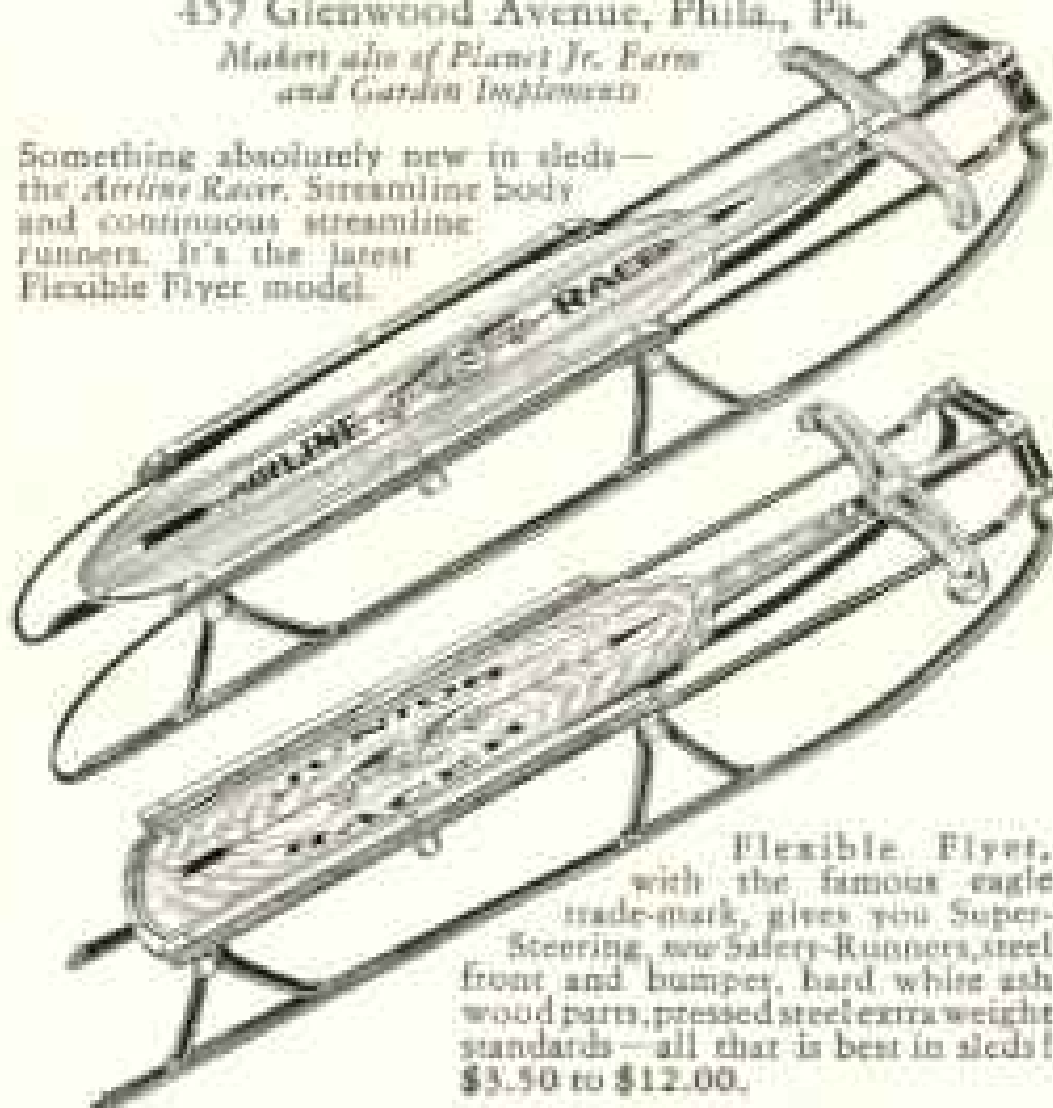
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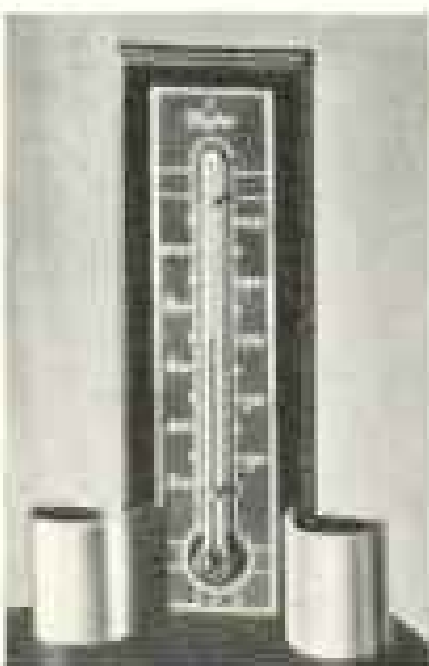
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Los Angeles is nearer to New York than New York is to Los Angeles. (You gain 3 hours on the sun going West.) ★

Both the highest (Mt. Whitney) and the lowest (Death Valley) points in the U. S. are in Southern California. ★

California has been under Spanish, English, Russian, Buenos Aires, Mexican, Bear, and U. S. flags. ★

Southern California's geographic extremes prevent climatic extremes. Barriers of ocean, mountains and desert keep temperatures even. ★

Papayas, sapotes, mangoes, cherimoyas, passiflora, feijoas, jujube, litchi, ceriman are among the tropical fruits growing here. ★

National radio programs are moving from New York to Hollywood because of greater supply of talent and celebrities. ★

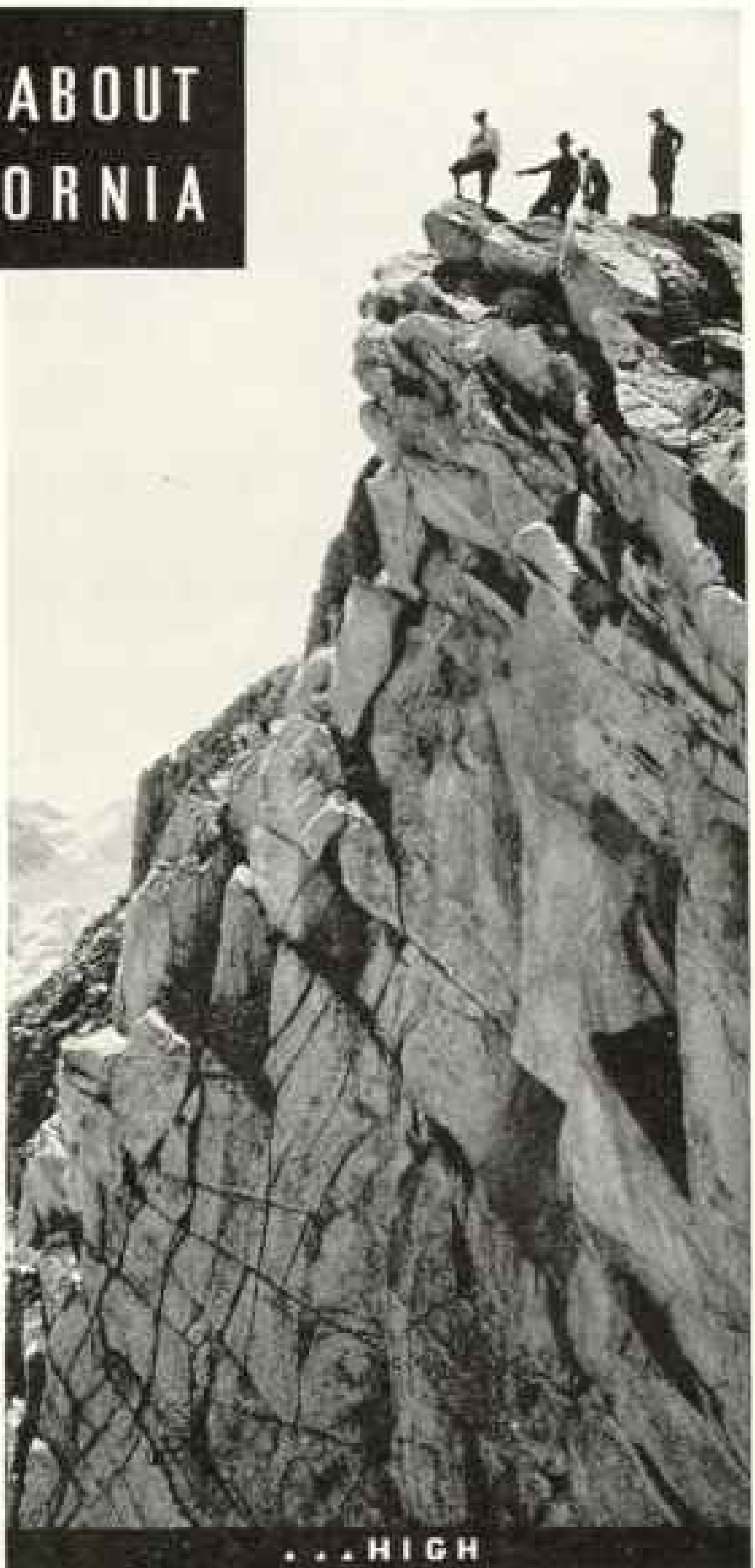
Despite the presence of 11 cities, including Los Angeles, Hollywood, Long Beach, Pasadena, Santa Monica, Glendale, Beverly Hills and Pomona, Los Angeles County leads all U. S. counties in value of agricultural products. ★

Living costs in Southern California are 18% under the average for the U. S. (less than half the costs in many winter resorts.) ★

Southern California has 270 miles of ocean beach, more than 1000 mountain lakes, 100 streams, but is tapping the Colorado River for still more water. ★

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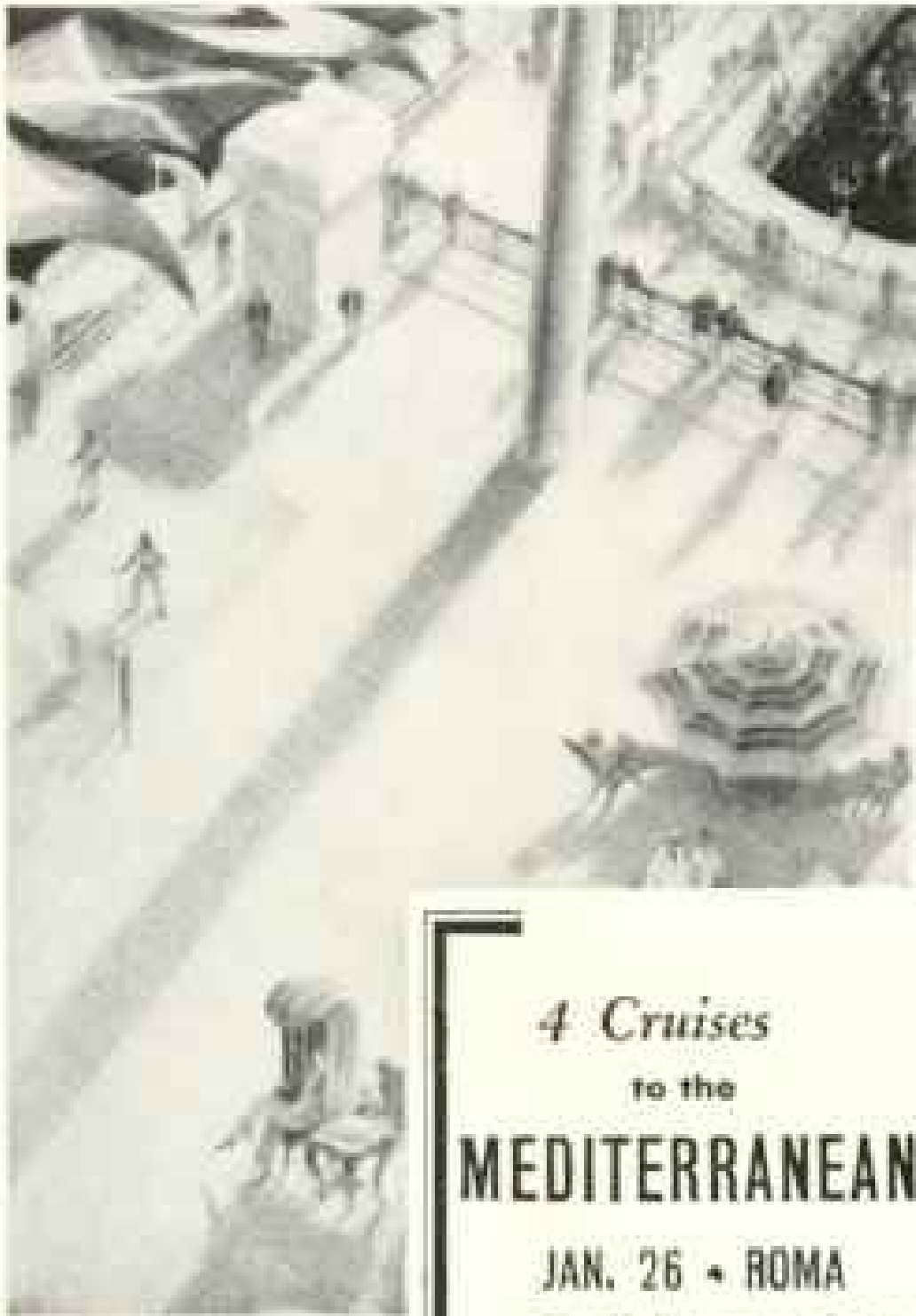
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The Visiting Nurse Service is one of America's distinguished contributions to the health movement of the world and has been adopted in other countries. Here it is supported by patients whose payments are supplemented by those of organizations that recognize the vast importance of this work which includes education in health. The Visiting Nurse whole-heartedly extends to each patient the benefit of her expert training.

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The Inclination, the Time, the Money

ABOARD this ship, seeing the world, is a young couple in the sixties. Neither came from a rich family. Nor did they get rich in the market, strike a mining bonanza, reap a fortune in real estate, or stake a successful invention. But they have the time and the money, as well as the inclination, to travel.

Forty years ago they returned from a brief honeymoon and established a home where modesty reigned jointly with happiness.

As the husband's income grew so did the cost of living. Also the scale of living. So, too, did his responsibilities. As he looked these responsibilities in the face, he wondered. He saw a few men seeking to meet similar situations by scrimping themselves and their families—saving until it hurt. He saw others taking speculative chances, winning, losing. He saw others who thought not of the morrow.

But he found a method of meeting his responsibilities that seemed satisfactory in every way. It

promised no extravagant returns and required that the family live on a little less than he earned. It promised, however, that they would not want if he did not live to see them through.

He lived. The three children are grown, self-supporting, parents themselves now.

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Moral: Insure in The Travelers.

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Some want to be intelligent.
But everybody wants to be
buoyant. And tingling buoy-
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when you pause at a soda foun-
tain for an ice-cold Coca-Cola
—a sense of refreshment...more
get-up-and-go. An ice-cold
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Old Santa, be buoyant.



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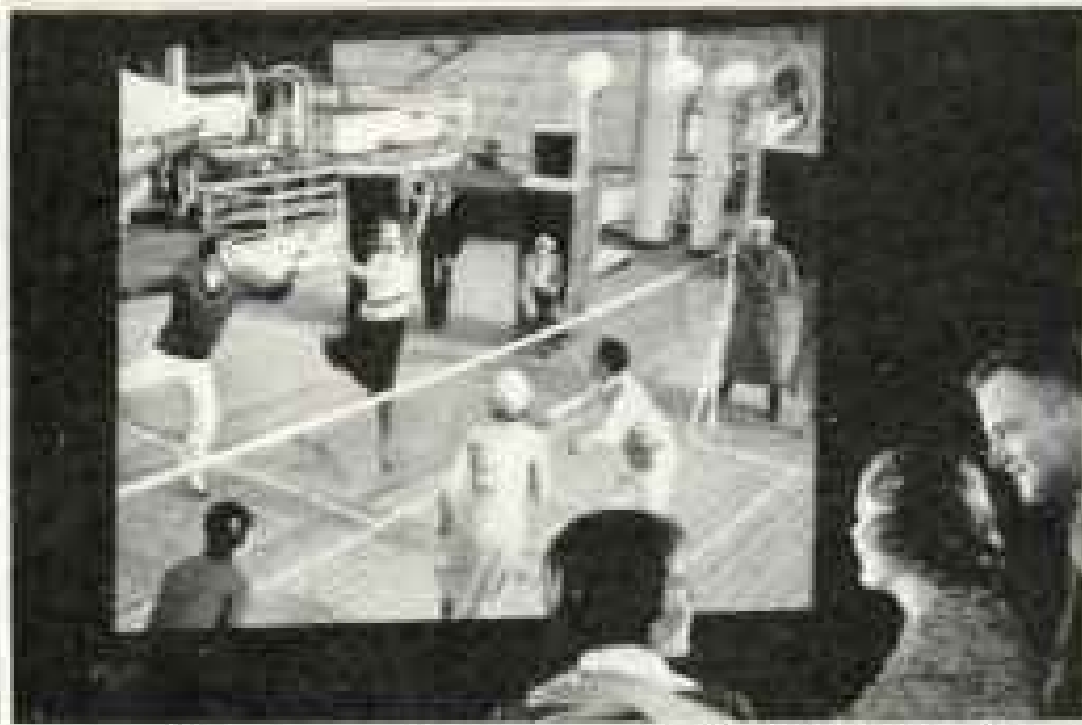
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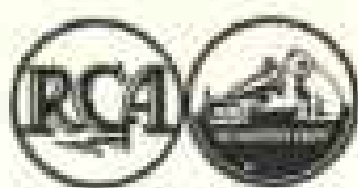
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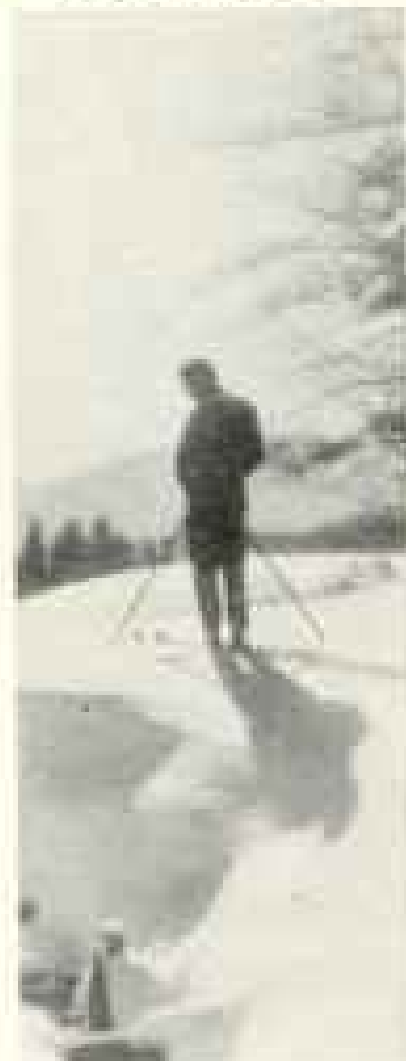
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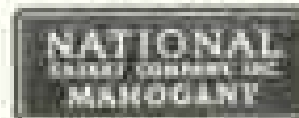
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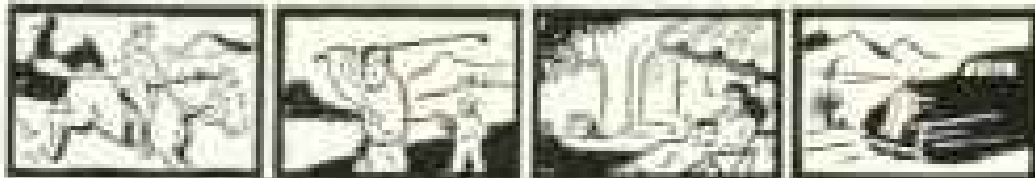
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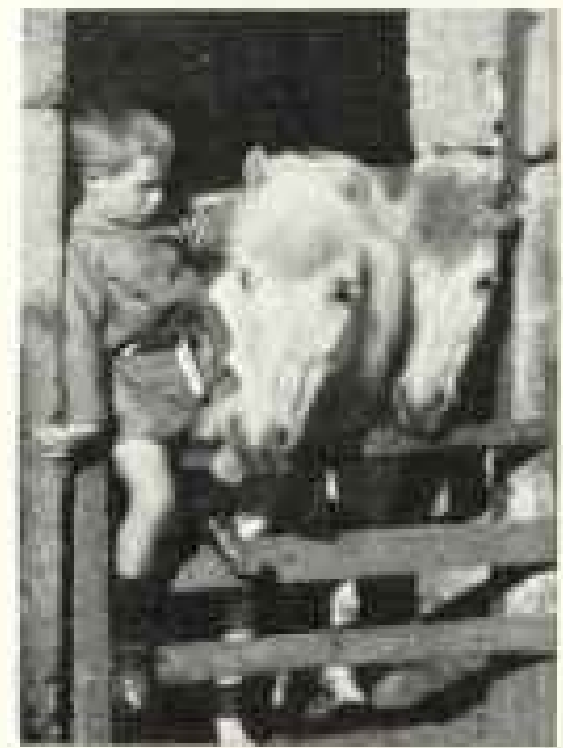


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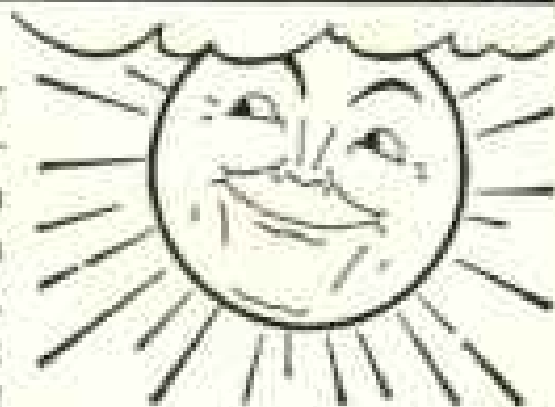
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