

DIVING IN CORAL GARDENS

By ROY WALDO MINER

CURATOR OF LOWER INVERTEBRATES



A BAHAMAN CORAL GARDEN

GUIDE LEAFLET SERIES, No. 80

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AN UNDERWATER PARADISE IN AN ANDROS CHANNEL

A bluehead swims out into a sunlit submarine valley, its gay uniform of blue, green, black, and white, in vivid contrast to the soft colors of a bank of *Porites* finger corals, tinted with yellow, pink, and violet

Diving in Coral Gardens

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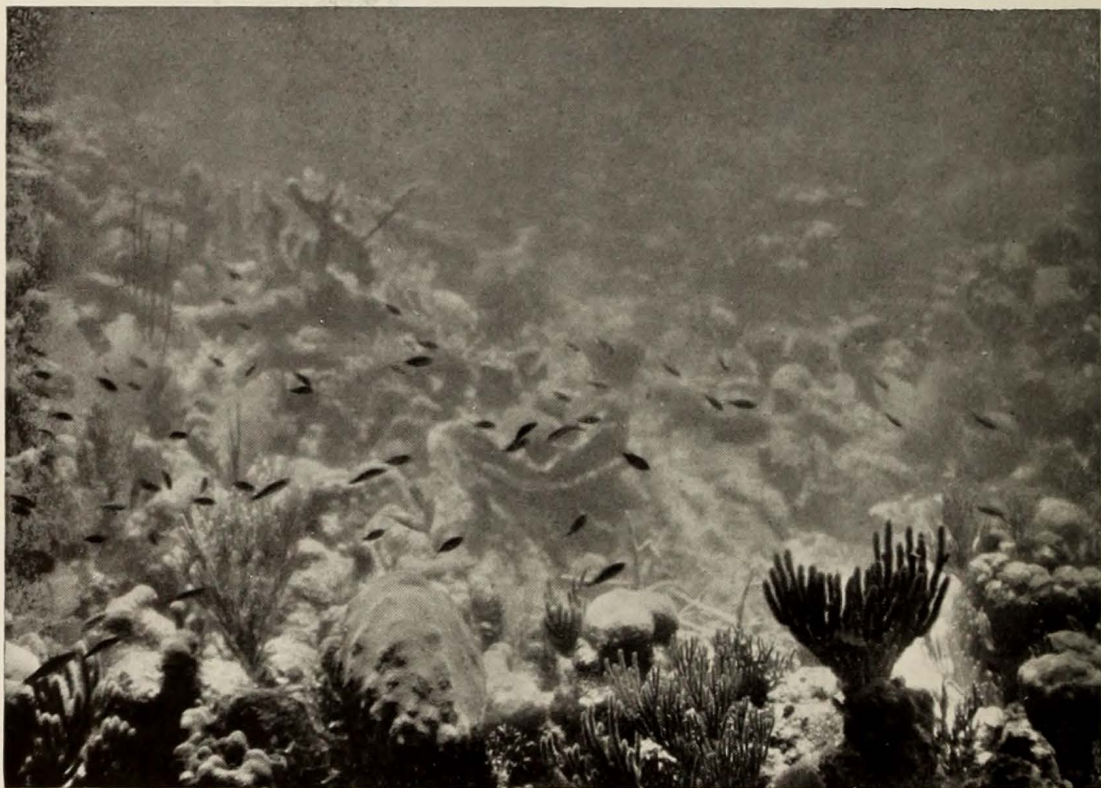
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A SUBMARINE VISTA ON THE ANDROS REEF

Sunlit aisles of the sea forest floor with reef fishes swimming among the fronds of the tree-like gorgonians

Steadying myself by grasping a ladder-rung, I looked about me. A short distance away rose the coral reef, tier on tier, to the surface. Clusters of mushroom-like coral growths capped with gray-green and pink *Orbicella* formed the bulk of the reef. Purple and yellow sea-fans swayed back and forth with the motion of the water, while sea-bushes of soft and varied hue rose from slender stocks, their waving branches, extending upward in widely expanding parallel ranks, starred with hosts of feathery polyps. Caverns and arches of eroded coral, fantastic in form, showed clearly through the unbelievably transparent water or melted into the pearly blue liquid mist in the distance.

I took a few steps forward leaning against the push of the current, and glanced up to see the keel and underside of the launch bulking above my head with propeller and rudder looking very formi-

dable from below. My air-hose floated coiling to the surface, while clouds of silvery bubbles, released momentarily from my shoulders, rose in expanding clouds. A disturbance of the water at the summit of the ladder attracted my attention. A pair of legs appeared weirdly on the rungs. The body was not visible, being concealed by the liquid mirror of the water surface. This was impenetrable to the view, but reflected an inverted image of the legs, giving the odd effect of a St. Andrew's cross! In a few minutes the rest of the figure and a helmeted head succeeded the legs, descended the ladder, and stood on the sea floor beside me. Looking through the window of the helmet, I perceived the smiling features of Roswell Miller, who, with Mrs. Miller and my artist, Chris Olsen, completed the personnel of my expedition for the American Museum of Natural History.

I motioned toward the reef and we advanced slowly in the direction of an outlying brain-coral that towered above us on a fantastically carved pedestal, with a cloud of bright yellow fishes flitting around its summit like canary birds. Rounding this mass, we entered a crooked passageway which led toward one of the great overhanging arches of coral rock. As we peered within, a moving form became visible in the watery shadows, then another.

Presently, a huge parrot fish, brilliantly blue, varied with deep violet, swam slowly out of the cavern, followed by two others in stately procession. Back and forth they sailed, staring toward us, occasionally nibbling at a bit of loose coral, portions of which they crushed with their white, parrot-like beaks, releasing powdery fragments which rose in clouds as they masticated them for the filmy nourishment they afforded. We signaled to each other and edged back toward the boat. The window of a water-glass penetrated the surface beside the bottom of a floating dinghy. We motioned with our arms, and the undersea tripod splashed down through the water to settle bottom side up at our feet, its legs extending upward from the square metal top. The heavy camera-box now came gliding down, hooked on the end of a cord. We slowly and painfully erected the tripod, carefully adjusting it in a favorable position. One must move with deliberation at the bottom of the sea. Attempts at rapid motion were futile and exhausting, but if we moved slowly, the water supported us in half floating fashion and we progressed easily with the effect of a slow-motion film. A little push with the foot and we glided over an obstruction to a considerable distance and settled down slowly and gently. After the tripod was erected satisfactorily, we returned for the camera-box. I reached for it but miscalculated the distance, and my hand

grasped empty water about two feet in advance of it. Distances under water are deceptive to the vision, because of the unaccustomed density. Groping forward, I felt the handle of the camera-box, and had no difficulty in lifting, with one extended hand, a weight that both hands could scarcely raise from the boat's deck, in the open air. We carried the box over to the tripod, placed it in position, and took turns pressing the lever that actuated the mechanism of the camera. Unfortunately, by this time the parrot fishes had disappeared, though swarms of blue-heads and schools of jacks swam into focus.

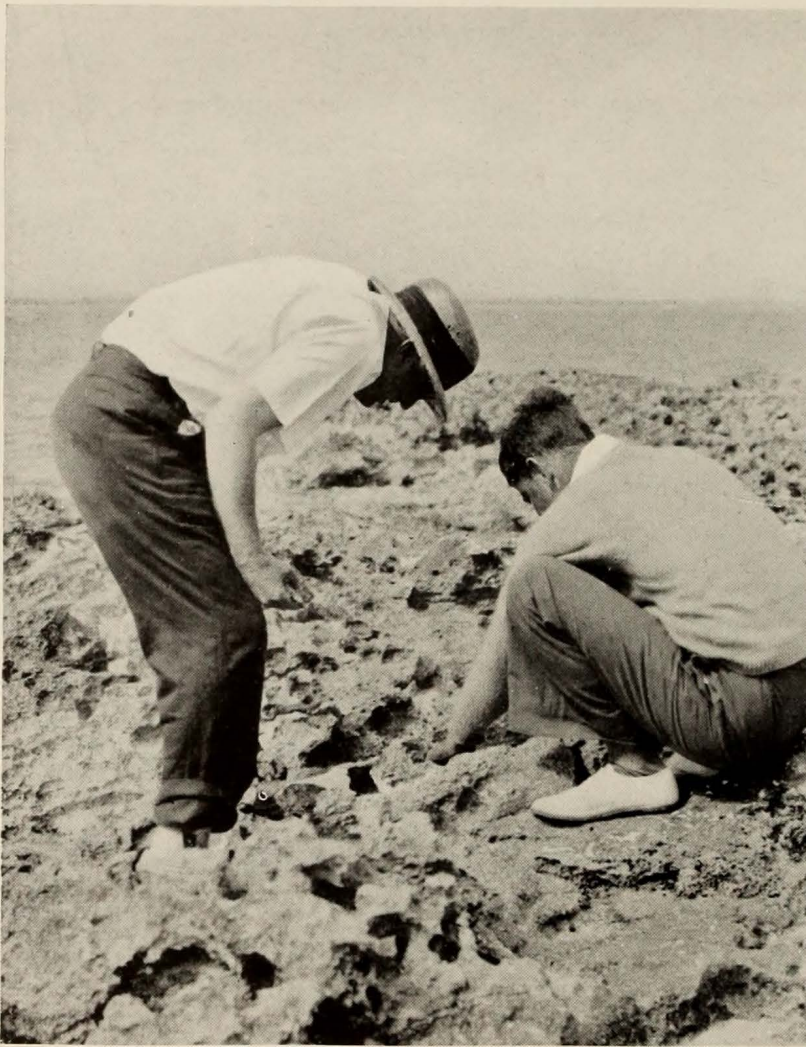
As the focus of the camera had to be set at a predetermined distance before sending it down, it was impossible to focus on a fish directly, and it was tantalizing to see beautiful queen triggers, blue angel fishes, and grotesque trumpet fishes come into plain view at a distance of twenty-five feet, when we had carefully arranged our focus at ten feet.

After fifty feet of motion picture film had been taken, we carried the box back to the cord which hung suspended from the launch and sent it up for Captain Bethell to rewind and return to us again. When the film had completely run out, it was sent up for Mrs. Miller to change, and a second undersea box containing color film was sent down. This was Roswell Miller's specialty, and through its means he obtained beautiful motion pictures depicting the soft colors of the living corals and gorgonians and the brilliant hues of the fishes which lived among them. After a time, Chris Olsen took his turn with the helmet, and we worked our way carefully through the tortuous aisles of this undersea fairyland to observe more intimately the multitudinous variety of the creatures composing the closely interlocked association of forms characteristic of the living coral reef.

Our attention was attracted by a

COLLECTING "HONEY-
COMB" ROCK ON SPRUCE
CAY

Many of the smaller cays of the Bahamas are composed of eroded limestone rock honey-combed with cavities and winding passages of fantastic form, resembling a petrified sponge



SCOUTING FOR A
FAVORABLE LOCATION
TO DIVE

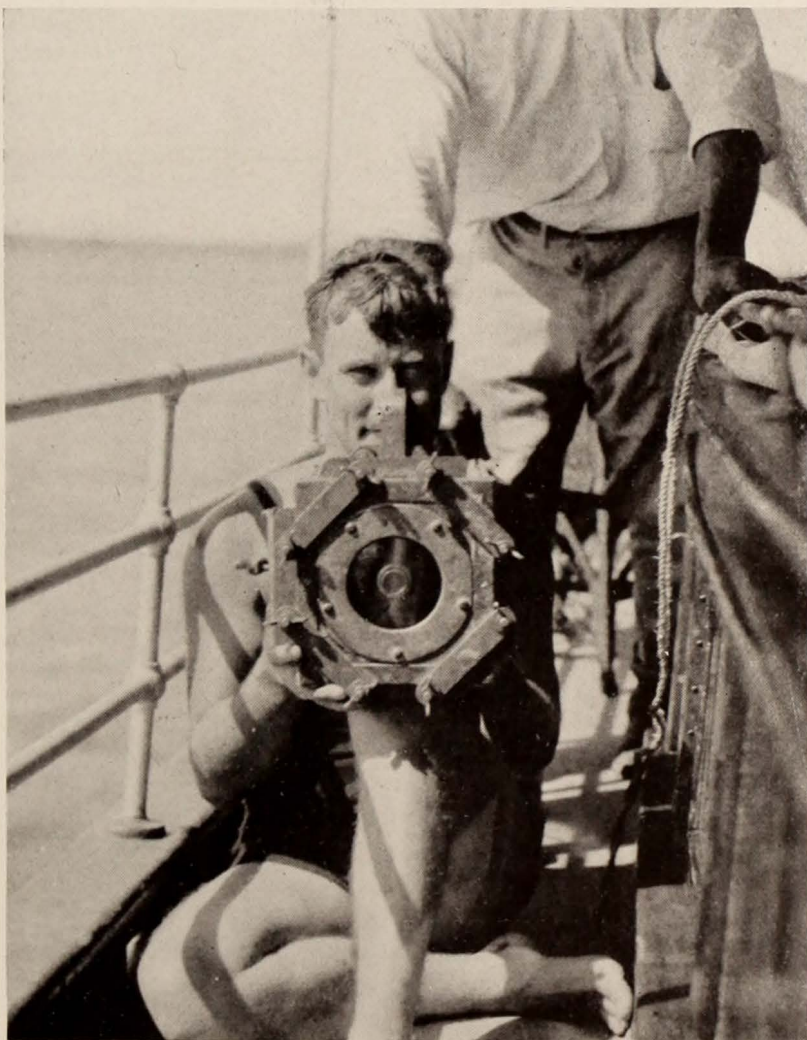
Members of the expedition using water-glasses to examine the sea-bottom for an advantageous position from which to study and photograph the coral reefs from the sea-floor





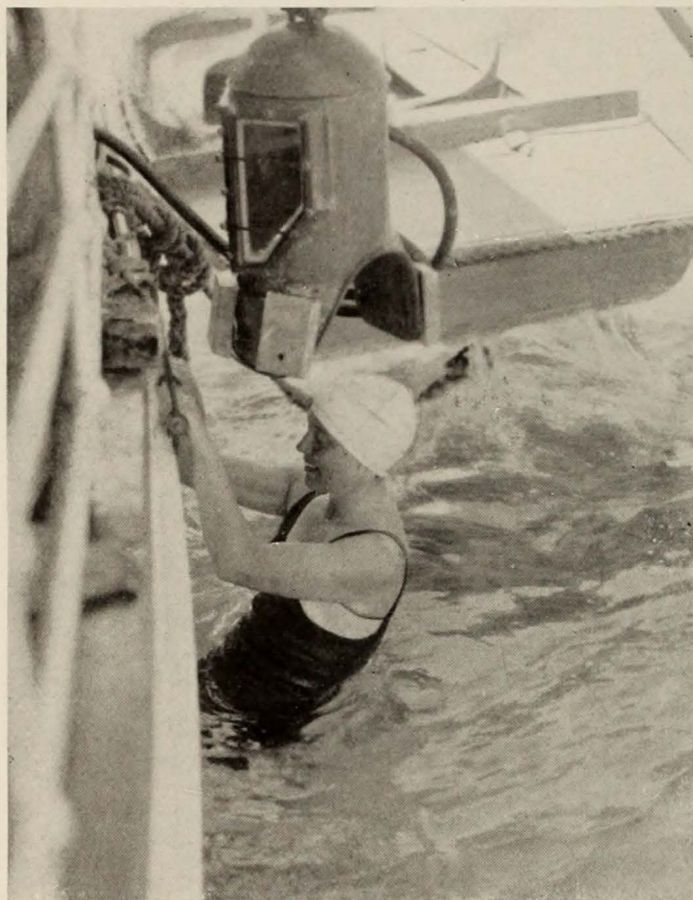
THE "STANDARD J." THE
FLOATING HEADQUARTERS
OF THE EXPEDITION

This forty-eight-foot gasoline launch, commanded by Captain Joe Bethell of Nassau, is well adapted for coral reef work. She has been used by Doctor Miner on two expeditions to obtain the material and observations for the American Museum's Coral Reef Group



ROSWELL MILLER AND
HIS UNDERSEA COLOR
CAMERA

The brass water-tight box contains a motion-picture camera adapted for Kodacolor. Mr. Miller succeeded in obtaining submarine color films of great beauty



MRS. ROSWELL MILLER DESCENDS
BENEATH THE SURFACE

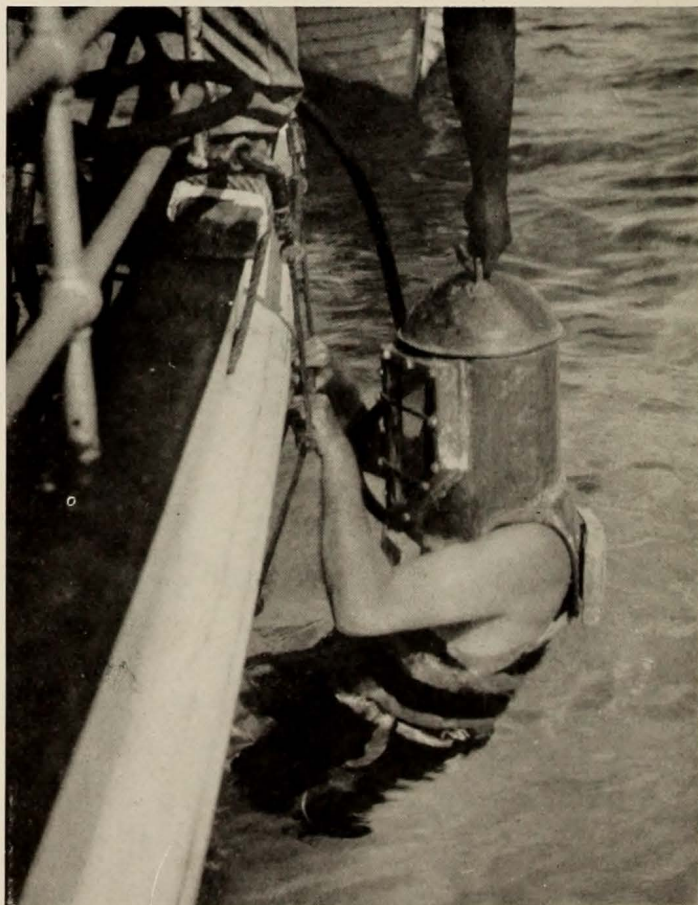
The heavily weighted helmet is being lowered over her head as she prepares to submerge

ridges exquisitely wrought with radiating star-shaped calices. Hues of delicate rosy pink shaded into cream-yellow tints, suffused at intervals with areas of orange and purple. We had brought with us specimens of this coral which had been colored artificially by our artists for use in the Coral Reef Group being constructed in the American Museum. We now took these with us down under the sea, and placed them beside the living specimens for comparison so as to test the accuracy of our colors. The result was very gratifying. At arm's length, they looked exactly like the real coral and blended with their living

wonderful cluster of golden yellow *Porites* coral which rose in an enormous dome above our heads. It was composed of a succession of expanded mushroom-like caps, completely covered with small conical mounds which gleamed in the sunlight flickering through the ripples overhead. Like most such growths, the caps were supported by eroded columns of dead coral limestone overgrown with encrusting sponges of scarlet, or green and yellow. Clusters of *Agaricia* coral grew vertically from the sides of the columns sculptured on both sides of their thin leaf-like expansions with close-set series of fine parallel

DOCTOR MINER ABOUT TO DIVE

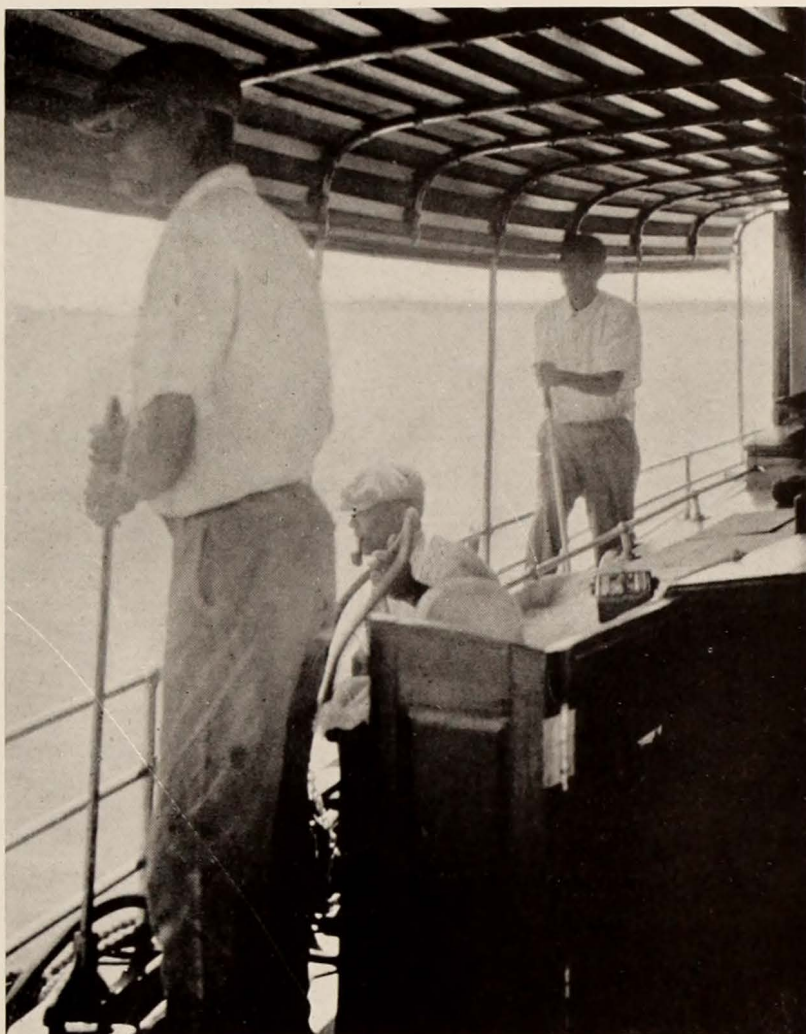
He stands on a rope ladder while the helmet is being adjusted. The rungs of the ladder are a foot apart, enabling him to measure his depth as he descends



neighbors so perfectly that they could not be told apart!

As we stood looking at the coral, we suddenly became aware of a beautiful sight. From the open ends of a cluster of little whitish tubes, soft tufts, for all the world like penciled color brushes, came into view, slowly unfolding until flower-like heads of violet and purple spread themselves wide open from every tiny aperture. Even while this transformation was taking place, another cluster began to expand, and then another, until the dead and eroded rocky shafts of coral became alive with the bursting bloom of animal flowers. For these were the heads of beautiful sabellid sea-worms which are crowned with circlets of delicate petal-like breathing organs expanding to receive through their thin, translucent walls life-giving oxygen from the watery flood in which they are bathed.

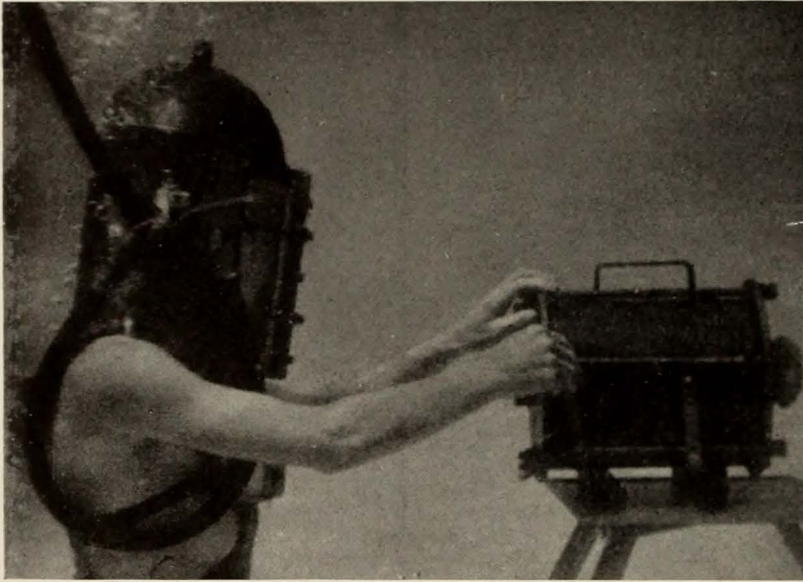
One stands amazed at the wealth of detail which gradually dawns upon the vision as the attention is directed to the multitudinous forms of which the reef is composed. Here, a magnificent purple sea-bush spreads its comblike fronds before us. Every branch is covered with thousands of transparent cream-colored polyps each spreading eight raylike tentacles around a tiny dot of a mouth, so small that it can be seen only upon close examination. The sunlight shining through their translucent crowded bodies outlines every twig of their waving,



MANNING THE PUMPS ABOARD THE "STANDARD J."
Moxie, in the center, acts as tender. It is his duty to watch the divers and to pay out and take in the air-hose as needed

treelike home with a multiple margin of glory.

A cluster of fluffy green clubs rises from a crevice between two rounded brain-corals. The starry blanket covering them seems to be very soft and deep. I touched it with a speculative finger. The soft clubs magically transformed themselves into a cluster of hard, finger-shaped projections of bright purple! Looking closely, I saw that the fingers were covered with thousands of pinholes, and, as I watched, one filmy form after another peered forth and gradually elongated until the purple surface of the fingers became clothed once more with fluffy green.



TWENTY-FIVE FEET
BELOW THE SEA SURFACE
The motion-picture camera is
enclosed in a water-tight box
and is actuated by a lever
from the outside

structure except that their cylindrical polyps are surmounted by many tentacles in multiples of six, and have the power of laying down a skeletal structure of carbonate of lime beneath and around their soft bodies. The concerted action of millions of coral polyps builds

The sea-clubs, sea-bushes, sea-whips, sea-feathers, and sea-fans are all grouped together by scientists under the name, *Gorgonia*. Unlike the corals, their tree-like skeletal support is flexible, being composed of a tough, horny substance invested with a crust of felted calcareous needles, irregularly shaped and of extremely small size. A labyrinth of canals penetrates this crust, opening frequently to the outside by means of circular or oval apertures about the size of a pinhole. The living substance of the polyps is tubular and invests the canals throughout, projecting through the pinholes, when expanded, as tiny tube-shaped creatures crowned by a circlet of eight threadlike tentacles surrounding the central mouth-opening. If touched, they contract and withdraw into their hollow retreats.

The reef-forming corals resemble the gorgonian polyps in appearance and

up the immense and complicated limestone structures which form the coral reef. The coral skeletons may form crusts over the sea bottom, or may rise in dome-shaped masses like the brain and star corals (*Mæandra* and *Siderastræa*), or postlike growths capped like mushrooms, as in the case of the orb corals (*Orbicella*). They may be leaf-shaped, as in *Agaricia*, or like rosettes, or sinuously petalled flower-like colonies, characteristic of *Isophyllia* and *Mussa*. Among the most beautiful and striking corals of the Bahaman reefs are three species of *Acropora*, which forms branching structures, the most delicate and fragile of which is the fan coral

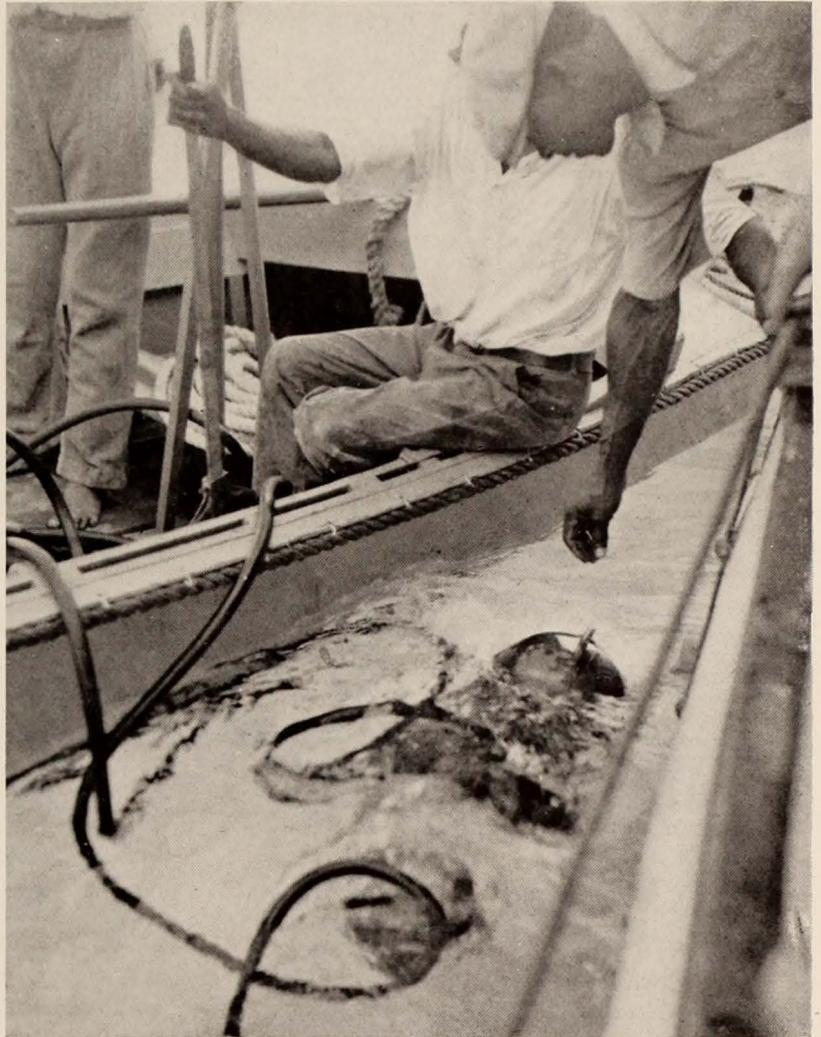


DOCTOR MINER FOUR
FATHOMS BELOW
THE SURFACE

His sixty-five-pound helmet rests lightly on his shoulders, because of the supporting power of the sea water

(*Acropora prolifera*). The staghorn coral (*Acropora cervicornis*) builds loosely branching many-tined skeletons reminding one of the antlers of a stag, from which its name is derived. The largest and most massive of the three is the great elkhorn, or palmate coral (*Acropora palmata*) which forms gigantic growths with branches like beams, expanding into broad, palmate tips, reminding one of the antlers of an elk. This species dominates the great Andros barrier reef, where the scene of the American Museum's Coral Reef Group is laid. All the other species of coral are found there, but are overshadowed by the great orchard-like groves of the elkhorn, which rise in tangled thickets of marble trees tinted with saffron.

Of the five expeditions I have led to obtain the material and observations for the Coral Reef Group, the first three centered around the Andros reef. The two latest, including that of the present year, concentrated on the beautiful reefs of Rose Island. Here, again, all the species characteristic of Andros are present, but the elkhorn coral is relatively rare, while the dome-shaped corals and the gorgonians are particularly abundant. The Rose Island reefs thus form a strongly contrasting association as compared with the Andros Barrier Reef. The latter is massive, wild, and grotesquely beautiful in its effect, as the coral growths run riot in protean variety and menacing grandeur.



COMING TO THE SURFACE AFTER A DIVE

Moxie reaches down to remove the helmet as the head of the diver appears above the water

The Rose Island reefs, on the other hand, are filled with soft and colorful beauties, due to the rising terraces of rounded species, cap beyond cap, dome beyond dome, their foundations columned and buttressed, pierced by caverns, arches, and winding passages. Their ethereal beauty is heightened by the multitude of waving gorgonians; sea-plumes, sea-feathers, and sea-bushes of many soft and varied hues—purple, violet, brown, tan, yellow, and lavender—waving back and forth in the sunlight which descends through the heavenly blue waters in beams of light. When the water surface is roughened, these sunbeams may be seen flickering and dancing



A PURPLE SEA-FAN WITH FULLY EXPANDED POLYPS
Waves back and forth in the sunlight glinting through the lacy openings of the delicate meshwork composing its flexible fan-shaped "skeleton"

the entire school were formed into a committee of the whole to inquire into the doings of their strange, helmeted visitors from the upper world.

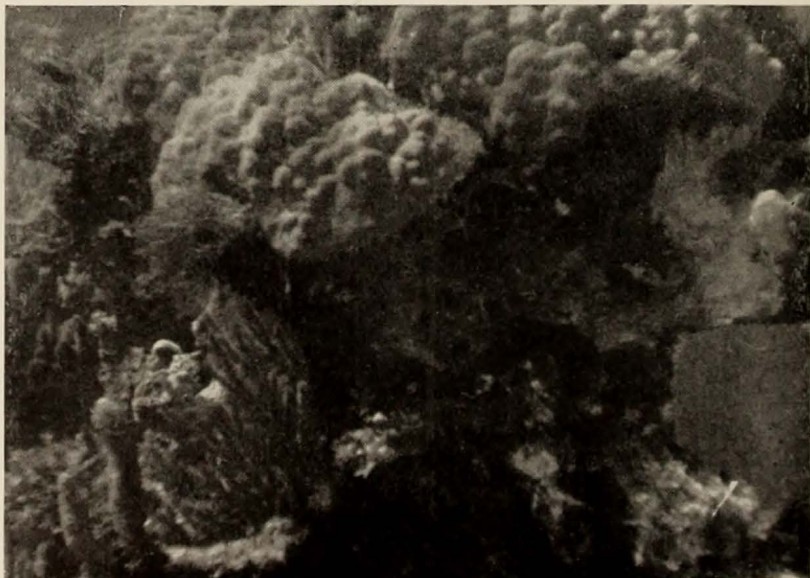
It is true that there are fish-serpents in this coral paradise of the fish world. Long and slinky

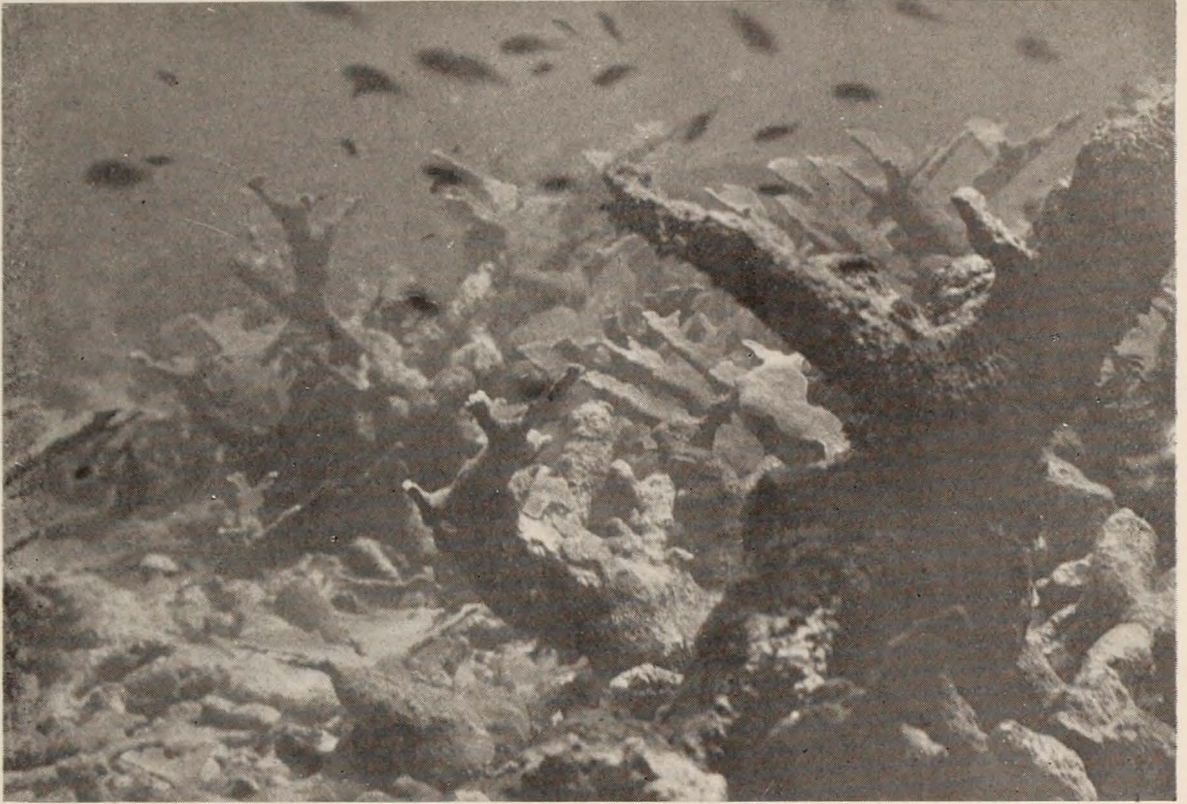
up and down, piercing the water in shining spear-shafts, advancing and retreating like Northern Lights. Out from behind the clustered domes dart fishes of every brilliant hue, in almost every unbelievable contrast of pattern and color, while from coral arch and deep, dark cavern, the bulky, bright-colored parrot fishes, the huge, somber jew-fish, and the variegated and changeable Nassau grouper, peer and nose and glide in slow and stately parade. Now and then a great school of silver-blue jacks with clean-cut bodies and small-peduncled, slender-finned tails will glide across the view and even surround us completely. Hundreds of them! All glide by, swimming in the same direction, passing out of sight, their silvery-blue bodies suddenly vanishing in the silvery-blue haze of the undersea. Suddenly they appear again out of nowhere and sail past in the opposite direction. This will happen several times, as if

green or spotted morays with small serpent-like heads and sharp needle-like teeth lurk among deep crevices of coral. But they are seldom seen, and if we are careful not to thrust hand or foot into an unexplored hiding place, there is little danger. Once, a barracuda, more to be dreaded than sharks, swam over my head while I was engaged with a camera; but I didn't know it till I came to the surface, when Captain Joe told me about it. However, it did not disturb me and went about its business elsewhere. As for sharks, one is occasionally seen about the reef, but both sharks and barracudas are open-water fishes. They seem to need

GOLDEN YELLOW PORITES CORALS

Like nuggets of gold, they are massed together in immense clusters, capping irregular columns of eroded limestone





A CORAL FOREST ON THE ANDROS REEF

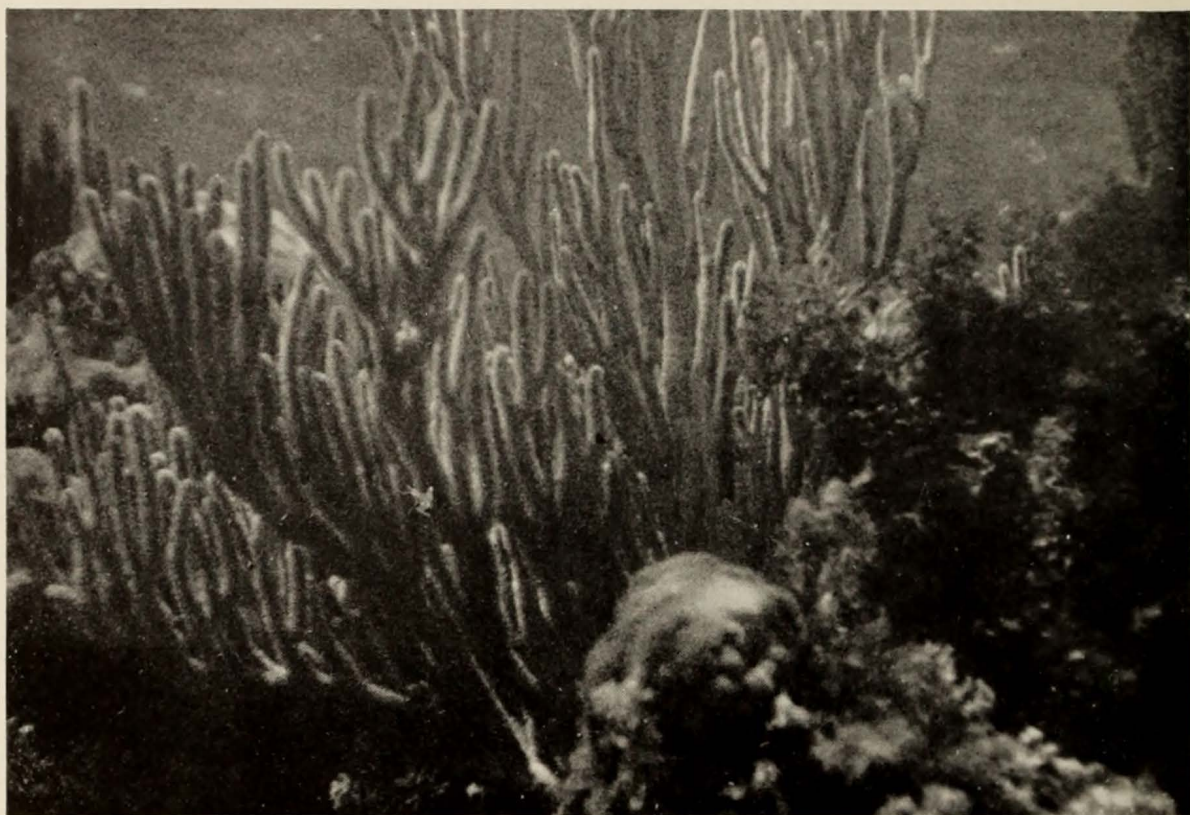
Stone trees, fifteen feet in height, with closely interlacing branches, present weird undersea prospects, in striking contrast to the dome-shaped coral growths characteristic of the Rose Island reef

sea-room, and do not usually bother with the serrated entanglements of coral reefs. So, if one is careful about crevices, and watches not to step on a sting-ray, and keeps one's ankles away from the needle-like spines of "sea-eggs," as the natives ironically call the big black sea-urchin (*Centrechinus antillarum*), there is not much to fear, not nearly so much as there is in crossing Broadway during the rush hour.

Day after day, whenever the weather permitted, the good launch "Standard J." took us from clump to clump of the reefs at Rose Island, Athol Island, and Long Shoal. We had three undersea cameras, two for black and white motion pictures, and one for color film. The latter and one of the former were the ingenious contrivances of Roswell Miller. There were also two helmets and pumps, which thus enabled two persons to get under the sea at a time. We could walk

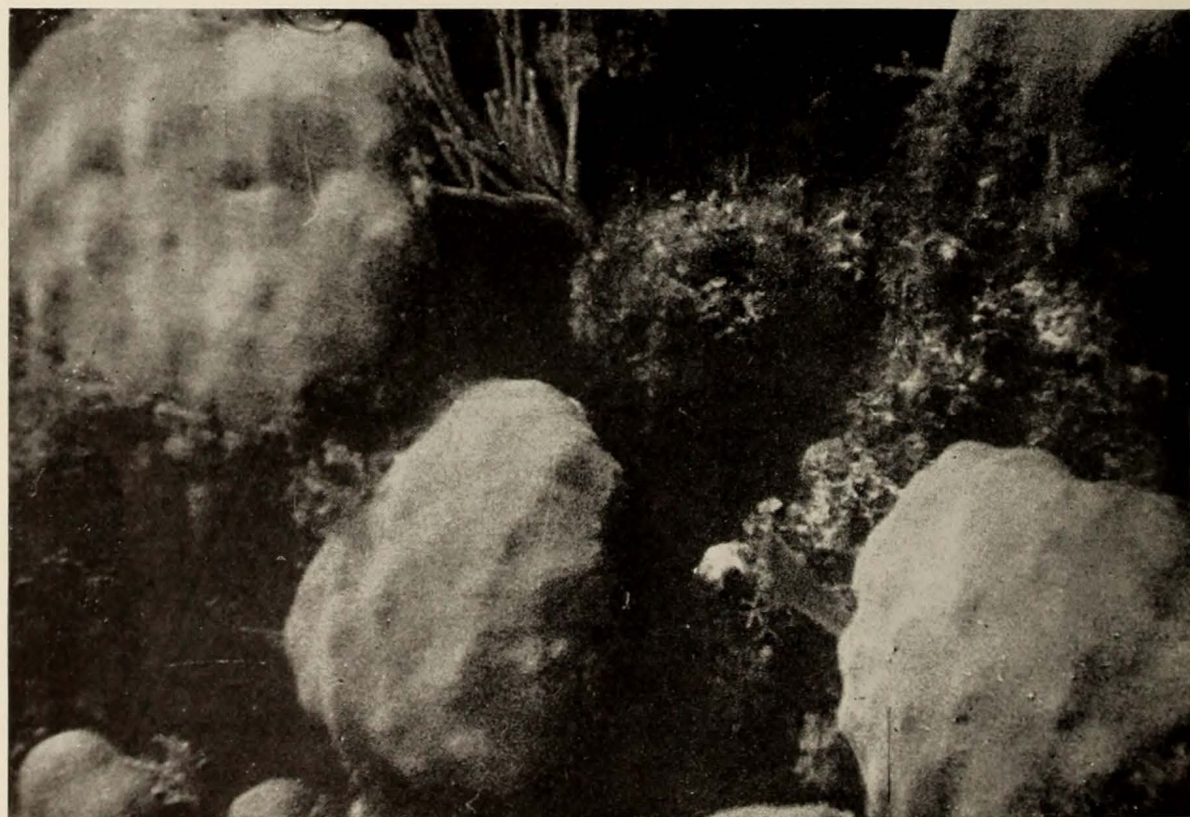
about together and converse simply, by means of predetermined signs which enabled us to compare notes for our work. At times Chris Olsen would go down with palette and easel constructed of non-corrosive metal. He would set up his easel on a convenient clump and fasten into it an oiled canvas securely mounted on a sheet of plate glass. Then he would actually make sketches with oil colors directly from nature, undersea, at a depth of fifteen or twenty feet. At first, he used the regulation artists' brushes with wooden handles, but whenever, inadvertently, he let go his hold on one, it would float to the surface and Moxie would have to row out with a dinghy to get it. Besides, in the wash of the tide, a brush is not steady enough for applying color. So Olsen finally used a palette knife instead, which was much easier to manage.

I succeeded in getting motion pictures



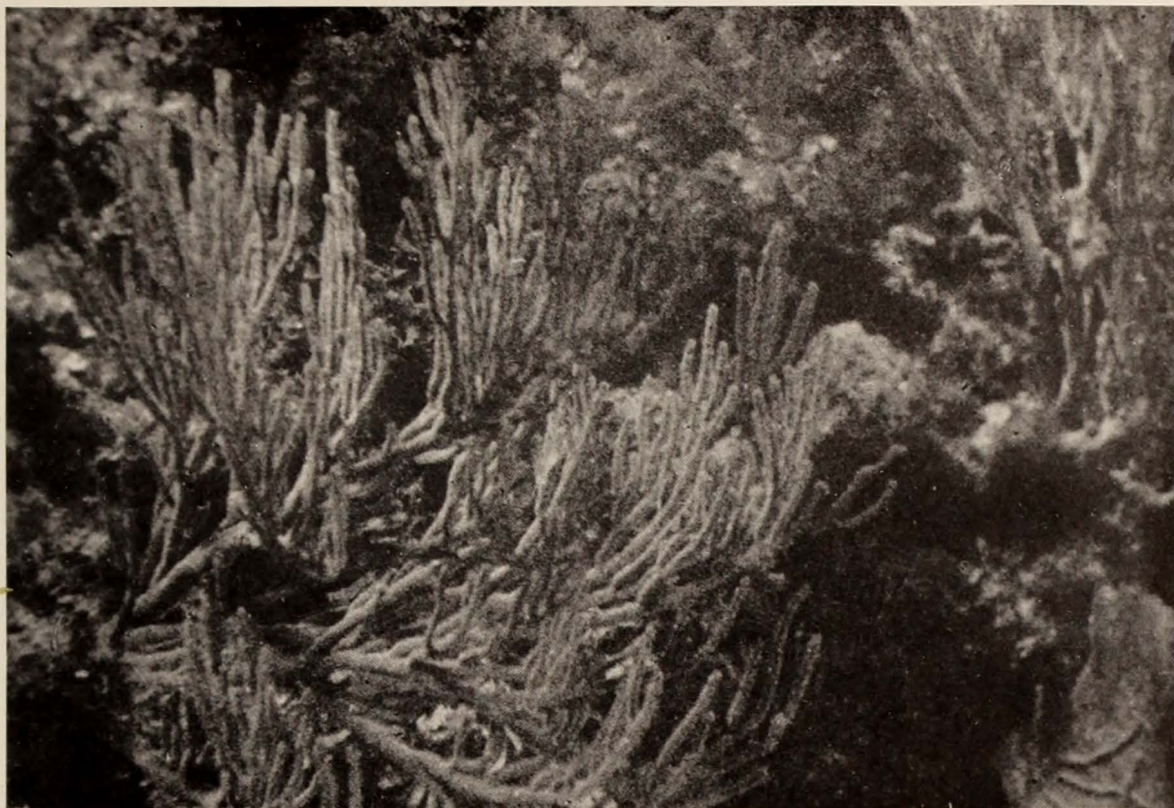
MANY-BRANCHED GORGONIAN SEA-BUSHES

Their vertical fingers, extending upward in closely parallel ranks, are covered with feathery white polyps, which outline the slender subdivisions like a halo of light as the sun shines through them



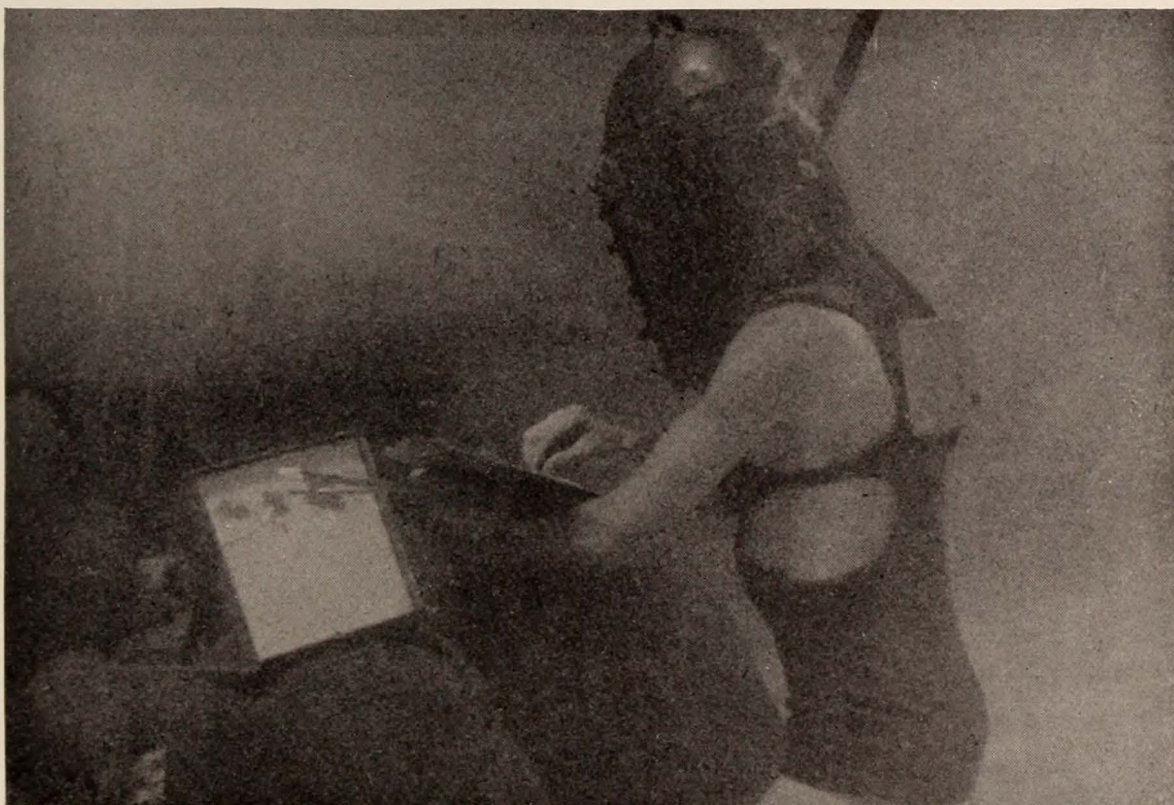
DETAIL OF A CORAL CLUSTER ON A ROSE ISLAND REEF

Huge dome-shaped masses of tawny or gray-green *Orbicella* corals, suffused with delicate pink, rise in towering clusters to the water surface, interspersed with patches of fluffy red and green algæ and branching gorgonia



NUMEROUS SPECIES OF GORGONIANS GROW AMONG THE CORALS

These are flexible coral trees each built up by thousands of tiny polyps, constructed by them of a horny substance, in contrast to the limestone "skeleton" built by stony coral polyps



CHRIS OLSEN PAINTING AT THE BOTTOM OF THE SEA

Equipped with diving helmet, monel metal palette and easel, the expeditionary artist made sketches of coral reefs twenty-five feet below the surface. He used oil-colors on an oiled canvas stretched over a sheet of glass



A GREAT ELK-HORN CORAL

High on the summit of the reef, close under the water surface. The spreading tips resemble the antlers of an elk

swam about the boat for long periods, looking down at Mr. Miller and myself as we worked, peering through a water-glass held in front of her.

At other times we had the pleasure of introducing His Excellency Sir Bede Clifford, the Governor of the Bahamas,

and Lady Clifford to the undersea world. They came down in turn, and explored the face of the reef, working their way through the crevices between the coral clumps, facing the inevitable camera at a depth of twenty feet. The Bahaman officials were all greatly interested in our work, both in this and in all the previous expeditions, and did everything in their power to assist us.

Of course, it was possible to make only the preliminary sketches undersea. The finished studies were made at our headquarters in Nassau, where our studio was established at the hospitable home of Mr. Edward S. Toothe.

Mr. and Mrs. Roswell Miller were splendid coworkers on this trip. They are excellent swimmers and occasionally, while both helmets were in use, I would sense a splash above my head and look up to see a graceful, red-clad figure break through the mirrored water-film, and Mrs. Miller would come diving down in a stream of silvery bubbles, or we could see her partly penetrating the surface as she

Occasionally, when the weather was too rough for diving, we went ashore on one of the rocky cays which abound in the waters near Nassau, and, by means of hammer and hatchet, hacked off huge fragments of the eroded "honeycomb

CORAL GROWTHS LIKE GIANT PETRIFIED MUSHROOMS

Rise above waving fronds of sea-fans and sea-bushes, melting into the luminous blue of the distant watery prospect



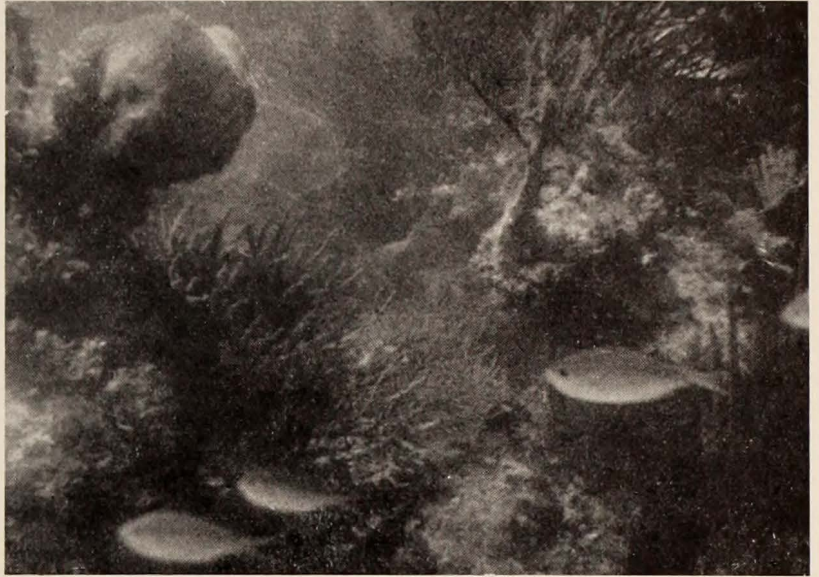
A SCHOOL OF SILVERY JACKS

They swam solemnly past the undersea workers, as if to examine the intruders into their submarine Paradise

rock" of which they are composed. This rock is wrought by wave and weather into most fantastic forms; in fact, the whole surface of the cays is full of holes and passages contorted and twisted and anastomosing like a petrified sponge. We obtained more than a ton

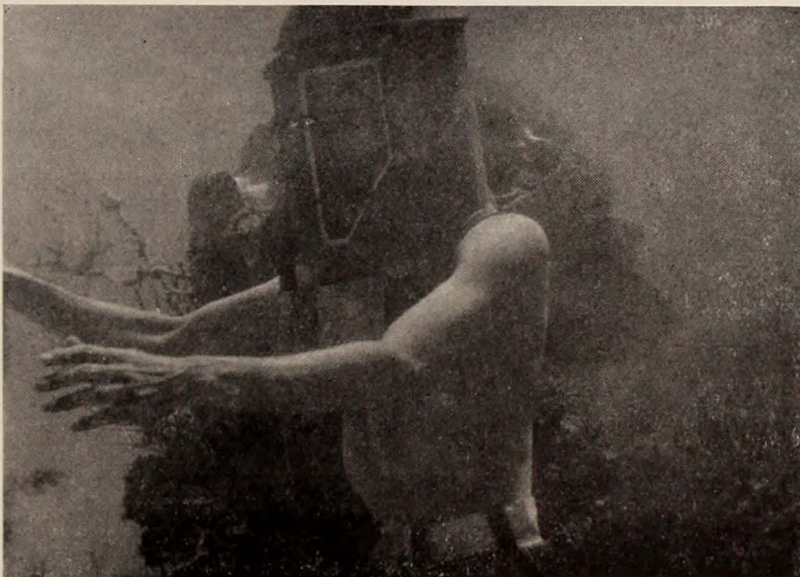
of this rock and shipped it to the Museum, where we are now reproducing a portion of such a rocky cay as a part of the foreground in the upper section of the group, using the original material in the process.

This group is now nearly finished. A few months more and the exhibit will be complete, after ten years of arduous work. During that time, five expeditions have been undertaken to the Bahamas, the first, in December, 1923, for preliminary observations and arrangements; the second, in 1924, secured forty tons of coral, many feet of undersea photographs and motion pictures of the Andros reef, and many water-color studies from



life, using the Williamson undersea tube and diving helmets for the purpose; the third, in 1926, obtained the casts and sketches of the fishes for the group, as well as sketches for the great cyclorama representing the scene of the coral lagoon above the water; the fourth, in 1930, procured the gorgonians needed, properly prepared, and additional undersea motion pictures and observations, utilizing diving helmets; the fifth, during the spring of the present year, also utilizing diving helmets, a check-up expedition, made final observations and additional motion pictures from the sea-bottom, and obtained rock for the coral island.

These five expeditions have been interpolated between long periods of work at the Museum, preparing and coloring corals, erecting the elaborate framework to support them in the group, consisting of more than seven tons of structural steel,



SIR BEDE CLIFFORD,
GOVERNOR OF THE
BAHAMAS

Inspecting the Rose Island gardens on the sea bottom. Governor and Lady Clifford were enthusiastic divers

modeling and coloring fishes and the other multitudinous forms of undersea life composing the coral reef association. The great upper and lower backgrounds had to be colored for this huge two-storied group which exhibits the above-water and under-water scene simultaneously. Eleven-foot plate-glass backgrounds had to be inserted and colored, and the under-water illusion

had to be worked out. Various items remain to be completed. When finished, it is estimated that the exhibit will be the equivalent of thirty ordinary Museum groups in size and difficulty of preparation. It will occupy one-third of the entire farther end of the great Hall of Ocean Life, probably the largest museum exhibition hall in the world.



LANDING THE "HONEY-COMB" ROCK
AT NASSAU

The expedition brought back more than a ton of this rock to build a rocky cay as a part of the Coral Reef Group in the American Museum

