VOL. IX NO. 3 MARCH. 1963

OCEANUS

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Published quarterly and distributed to the Associates, to Marine libraries and universities around the world, to other educational institutions, to major city public libraries and to other organizations and publications.

Library of Congress Catalogue Card Number: 59-34518

The Woods Hole Oceanographic Institution · Woods Hole, Massachusetts

VOL. IX, No. 3, March 1963

ὠκηανος

THE God and personification of the stream Oceanus. He was the eldest Titan and married his sister Thetys; their children being the Oceanids and the rivers of the earth. Oceanus also was the great outer sea, the stream believed to encircle the earth.

THESE magnificent heads of our namesake appeared as two of many beautiful color reproductions in: "Tunisia, ancient mosaics," by C. Caputo and A. Driss, published in September 1962 by the New York Graphic Society as one of the UNESCO World Art Series.

On the cover: Head of Oceanus, from Boutrie, (Acholla). Second Century A.D. National Museum, Le Bardo.

On this page: Head of Oceanus, from Susa. Second Century A.D., Susa Museum.

Editorial

VOL. IX, No. 3, March 1963

Our circulation

WE must admit to a sense of satisfaction and pleasure caused by the many letters received after the December issue. This revealed once again that Oceanus is read by far more people than our modest circulation of 4,000 copies indicates. Apparently, the periodical is passed from hand to hand. We certainly hope that Oceanus may obtain the status of the "National Geographic". No one ever throws a copy away and the attics of the nation are groaning under the weight of years of accumulation of that periodical.

Where does Oceanus go and by whom is it read? There are the Associates, individual and corporative; our own staff, but also the staff of the Indo-Pacific Fisheries Council in Bangkok, and our friends at the Department of Geophysics, Cambridge University; the readers in the library of the Russian Academy of Sciences and so forth, in 65 countries!

There are marine libraries and university libraries in all states of the Union; the major public libraries; many Foundations; industries interested in oceanography; Navy organizations and projects; ships, editors, science writers; all Senators, many Congressmen; in short the circulation encompasses almost all branches of our society. Some day soon we hope to be able to print far more copies per issue and supply the demand that exists particularly among the individual laymen and in education below the college level.

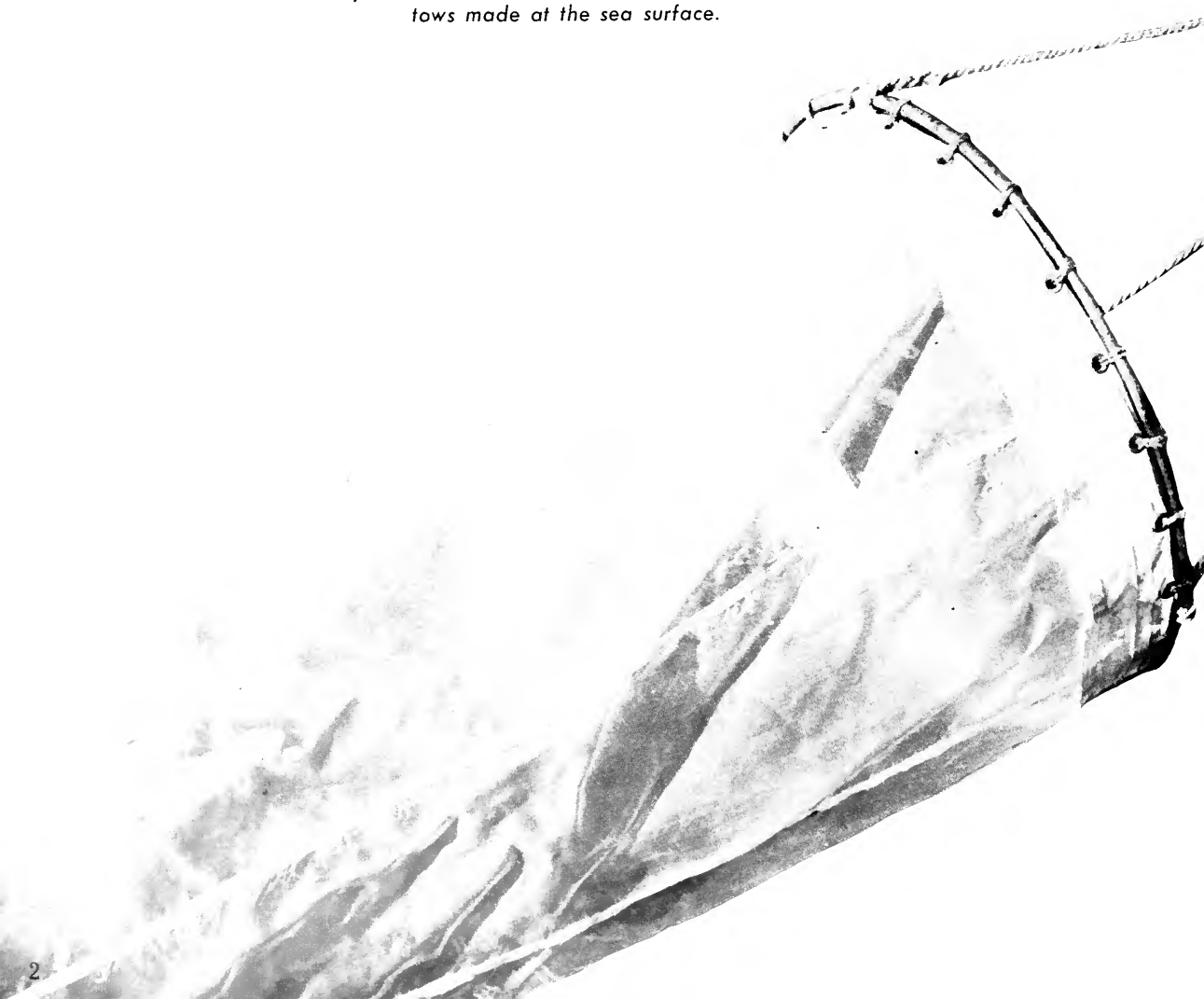
Larvae

in the

Open Sea

by R. S. SCHELTEMA

Many questions of identification and of mere survival are raised by the larvae of bottom dwellers found in plankton tows made at the sea surface.



DURING the 19th century naturalists discovered zooplankton in the sea. By towing conical, fine-meshed nets through the surface of the ocean they were able to strain minute organisms from large volumes of water. Among the animal life they found were the free-swimming larvae of sessile and bottom-dwelling organisms.

At first most of these animals were not recognized as larvae and many were given names derived from the

Greek and Roman. Our more classically oriented predecessors called the animals: zoea, megalops, cypris, pluteus. But as the nature of these larvae became known it was soon evident that each kind of bottom or attached animal was associated with a particular type of larva. A pluteus larva is always a stage in the life of a sea-urchin, and at the end of its free-swimming life metamorphoses into a sea-urchin; a megalops, into a crab; a cypris, into a barnacle.

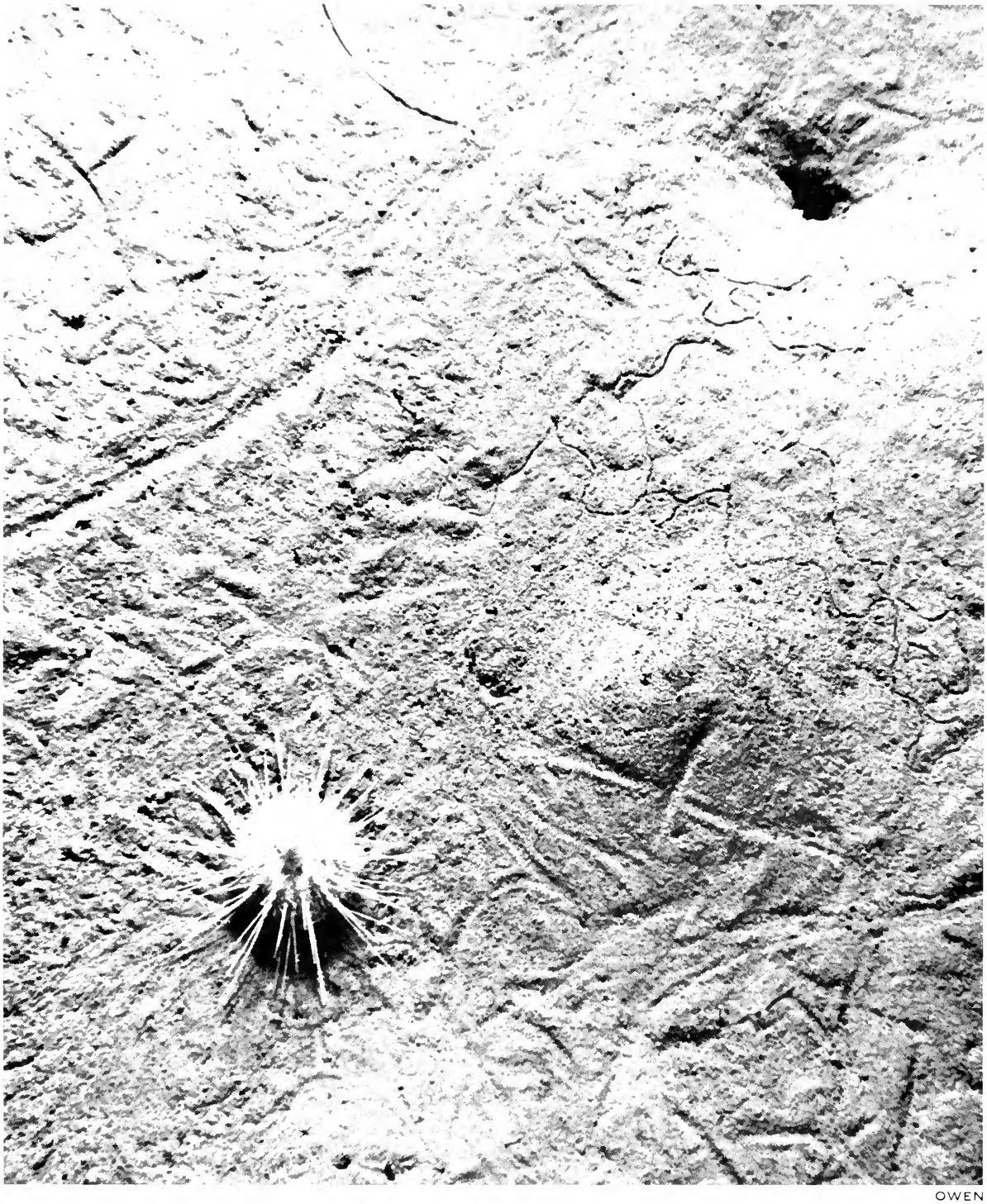
What species?

It was therefore possible to predict, from the form of the larva, the nature of the adult to which it would give rise. But knowing this presented an entirely new problem. It now became necessary to recognize each kind, or species, of the many pluteus larvae in order to know the exact species of sea-urchin which would result after metamorphosis. The situation is somewhat similar to associating the various caterpillars which one's child finds in the garden to the butterflies which will result if they are kept in jars in the kitchen. However, the problem in the sea is more complex because not only are there different species of sea-urchin larvae, but also different species of bivalve and snail larvae, called veligers; early worm larvae, or trochophores; the larvae of sea moss or bryozoans, called cyphonautes; and so forth. Further, many types of marine organisms have more than one type of larva during their planktonic development, and these larvae are totally different and bear little resemblance to one another. Crabs have an early stage known as a zoea, differing in each species, followed by the next stage known as a megalops, also different from one species to the next. There appears no certain method by which to associate the zoea stage of a crab to its megalops stage which in turn is not readily associated with one of the many adult crab forms.

Grow them

The answer may seem obvious. Grow them in the laboratory from the egg to the adult! This should reveal all the intervening stages. While this solution seems straightforward and simple this method did not have even moderate success until quite recently; for in order to grow the larvae, one must first have the food to feed them. Only by using the new techniques for growing phytoplankton in the laboratory has it been possible to raise larvae with a fair degree of success.

An assemblage of deep-sea urchins, taken by the 'Atlantis' in the Straits of Messina.



OWEN

Do larvae of deep bottom dwellers come to the surface? *In this bottom photograph taken at a depth of 1115 fathoms, a sea urchin is shown amidst tracks and holes made by other bottom animals. Photo taken at 39° 42′ North and 70° 39′ West.*

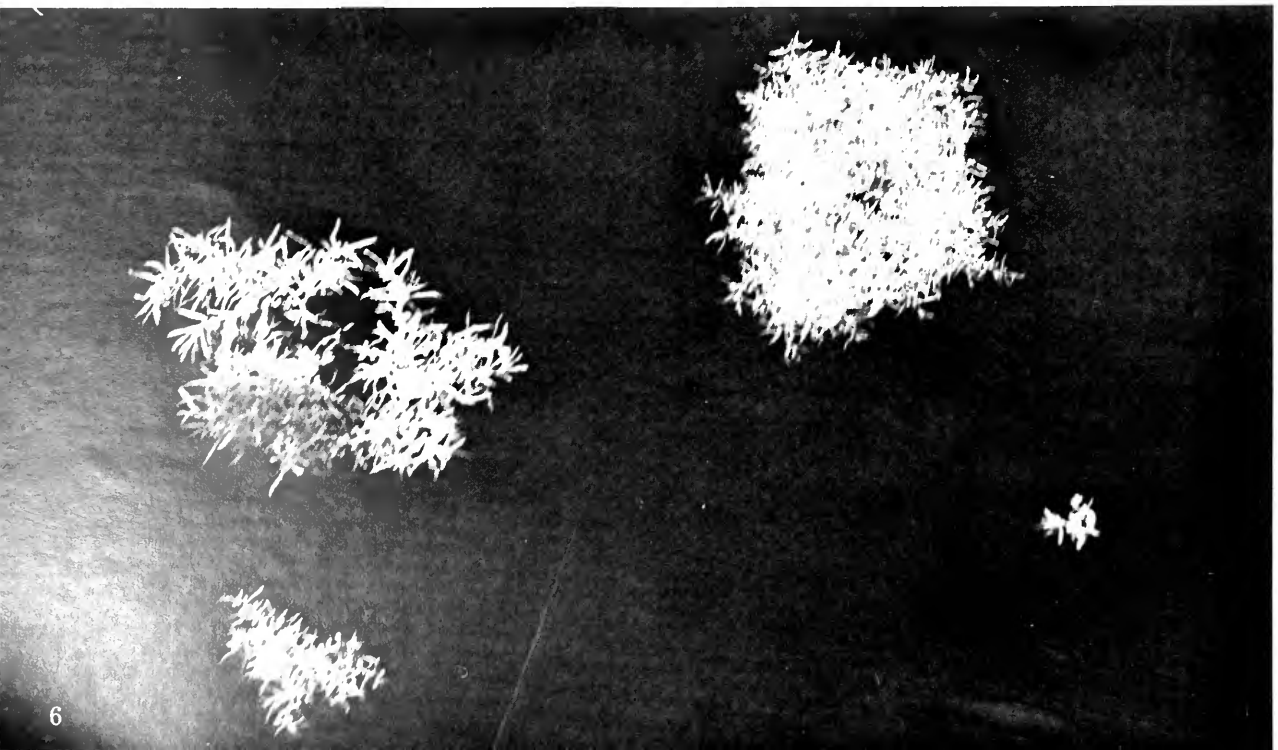
Larvae —

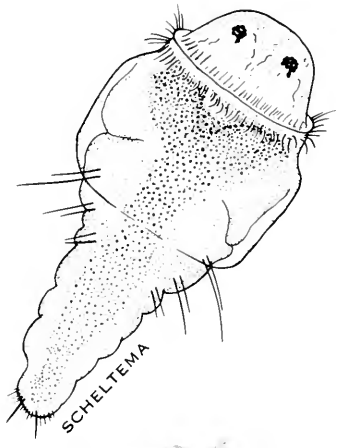
The larvae of the open sea are the least known. While most larvae taken in plankton nets on the high seas may be placed into a particular type, relatively few may be associated with specific species. Yet they offer some intriguing question which were asked first by the naturalists at the end of the last century and which still are almost completely unanswered. Where do these larvae come from? Do many come from the large numbers of organisms found attached to the sargassum weeds or are they carried by currents from the shallow waters of the coast? Do any larvae originate from the bottom of the ocean several miles below the surface of the sea?

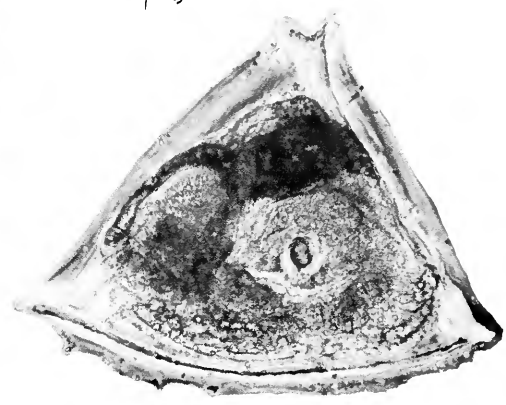
Sargassum life

A very characteristic fauna is found among the fronds of sargassum drifting in the Atlantic. Much of it is small and readily overlooked. Fairly conspicuous is the encrusting, calcareous form of bryozoa or "moss animal", an inappropriate name in this instance because the form found on the sargassum bears no resemblance to moss. Rather it consists of colonies of individuals formed from small, more or less rectangular boxes, and somewhat reminiscent of a honeycomb. Each box contains a single member of the colony, and an individual can extend itself from a small opening in the top of the box in order to feed. The colony increases in size by a division of individuals and their boxes and by the subsequent growth of the resulting two individuals. At certain times sexual reproduction occurs resulting in a larva known as the cyphonautes. The encrusting bryozoa found on the drifting sargassum is apparently restricted to one species, **Membranipora tuberculata.** It is, therefore, highly probable that the cyphonautes larvae taken in nets in the open sea are of this species. In order to fulfill its mission the larva must at the proper time find a new Sargassum frond to metamorphose upon, thereby starting a new colony. In the closely related inshore forms it has recently been shown that the larvae are attracted to the preferred algae by the polysaccharides (sugars) which are liberated from them.

Sargassum weed floating in the Gulf Stream area.







DE PUNTE

A greatly enlarged view of a portion of Sargassum shows coiled tube worms and a honey-combed colony of Bryozoa. The author's drawings show a larva of a tube worm ***Spirorbis borealis,*** *closely related to the species found on Sargassum and a larva which is probably from the species of bryozoa shown on the weed.*

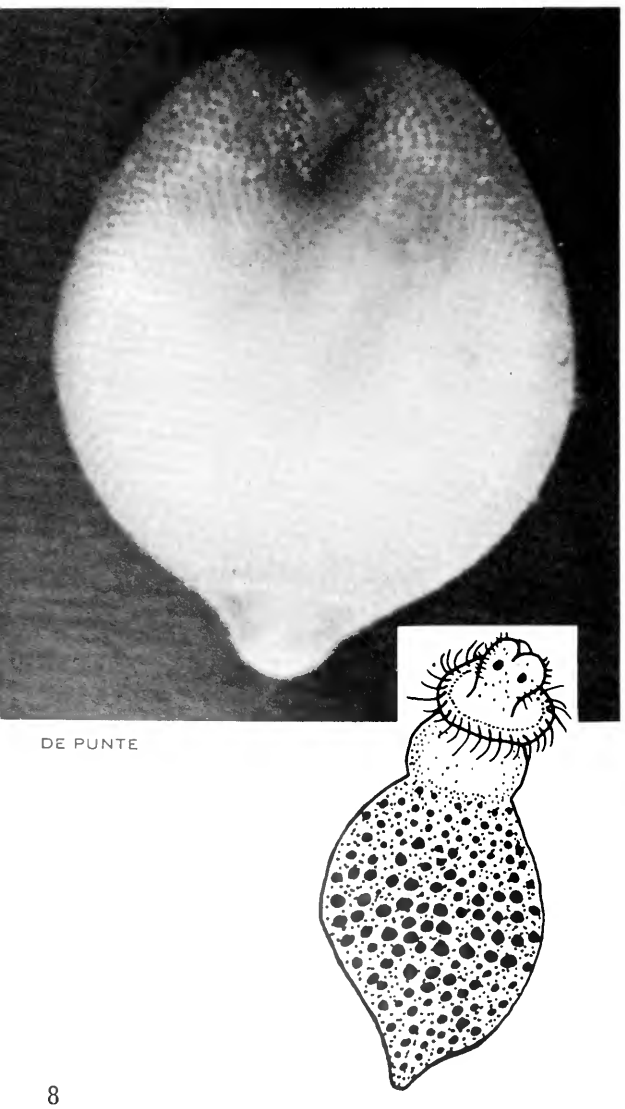
The worm **Spirorbis** lives in a small, tightly coiled, calcareous tube which it constructs for itself. From the opening it extends its tentacles for food. When alarmed it withdraws within the tube and plugs the small circular opening. The young worms start development inside the parent tube, from which the completed larvae emerge to swim free. Since they do not feed, and since they carry but relatively little yolk material for sustenance, they must find a place to settle and metamorphose almost immediately. Experimentally, larvae from closely related intertidal species have been shown to metamorphose near other individuals of the same species. This effect has been called "aggregation". Perhaps a similar event occurs in the life of the sargasso form.

The veliger larvae of the brown sargassum snail, **Litiopa melanostoma,** is commonly found in the plankton tows made during summer months in the surface of the Sargasso Sea. This snail is not difficult to relate to its parent because of the "top shell" or larval shell found preserved in the apex of the adult. It is here simply a matter of comparing the tip of the adult shell with the shell of the larva.

Whereas an examination of the inhabitants of the sargassum weed can account for many of the larvae found in the surface of the open sea, there remain many which cannot be so readily explained.

One of the more remarkable of these is the occasionally encountered larvae of the brachiopod or lantern-

shell. Two very transparent circular valves contain within them a pair of arms bearing tentacles for feeding. Another, the beautiful transparent auricularia larvae with its shimmering small inclusions, appears like a lady in formal evening dress. This belongs to an unprepossessing adult, the bottom dwelling sea-cucumber. The larvae of the lantern-shell and the sea-cucumber must surely come from the shallower coastal water. Indeed it seems likely that their origin is the coast of Florida or the West Indies. They are no doubt travellers who will never reach their destination. Or will some by chance reach the European shore?



DE PUNTE

And what about the deep sea? Are there actually larvae which can perform the phenomenal feat of swimming several miles from the bottom of the ocean to the surface?* It seems unlikely for such a larva at best would require three weeks to make the upward excursion. At present this question remains unanswered for too little is known concerning the breeding habits of deep sea bottom dwelling animals or even of the larvae found on the surface of the sea.

Dr. SCHELTEMA came to the Institution as a Summer Fellow in 1956, '57, and '58, prior to obtaining a Ph.D. at the University of North Carolina in 1960. He was appointed Research Associate in Marine Biology on our staff in 1961.

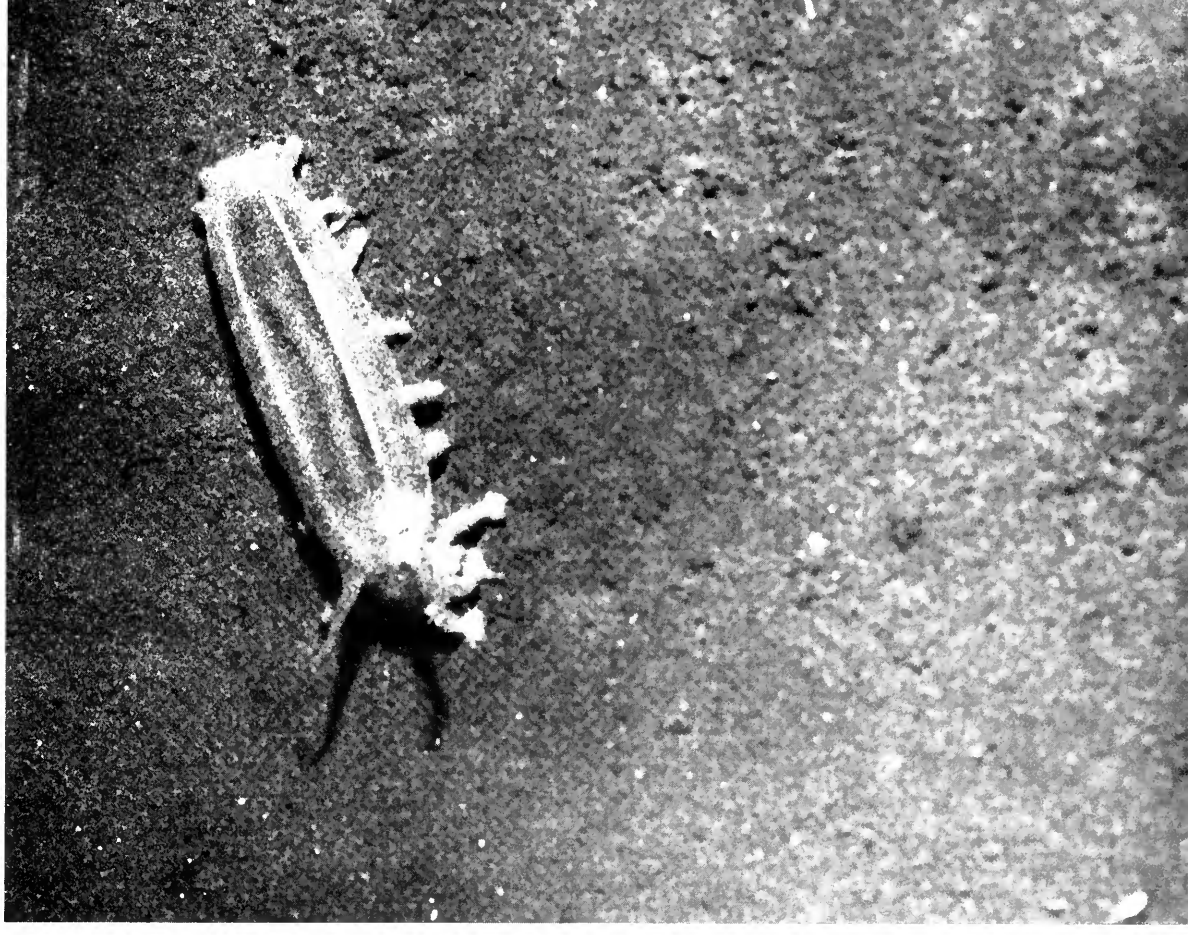
A new, old, find

As so often happens in scientific research much depends upon someone's interest and upon library research. This larva was not uncommonly found in plankton tows made last summer by the 'Atlantis' to the east of the Gulf Stream. Yet, none of the planktonologists at the Institution was able to recognize it. Dr. Scheltema hit upon its identity while browsing through an 1889 edition of the account of the German plankton expedition of the Humboldt Foundation.

The specific identity of the adult remains unknown, although the larva is a member of a group of bottom dwelling worms, the sipunculids. As is obvious, the larva was tentatively given the name **"Baccaria citronella"** (lemon berry).

The sketch was made from life by the author while on cruise #1 of the 'Atlantis II'. Apparently, the larvae are common throughout the year in the warm waters of the Gulf Stream and the Sargasso Sea. It is able to swim by means of cilia shown around the head region, when this is extended as shown in the drawing.

*See: "Deep Teredo", Vol. VIII, No. 2, December '61.

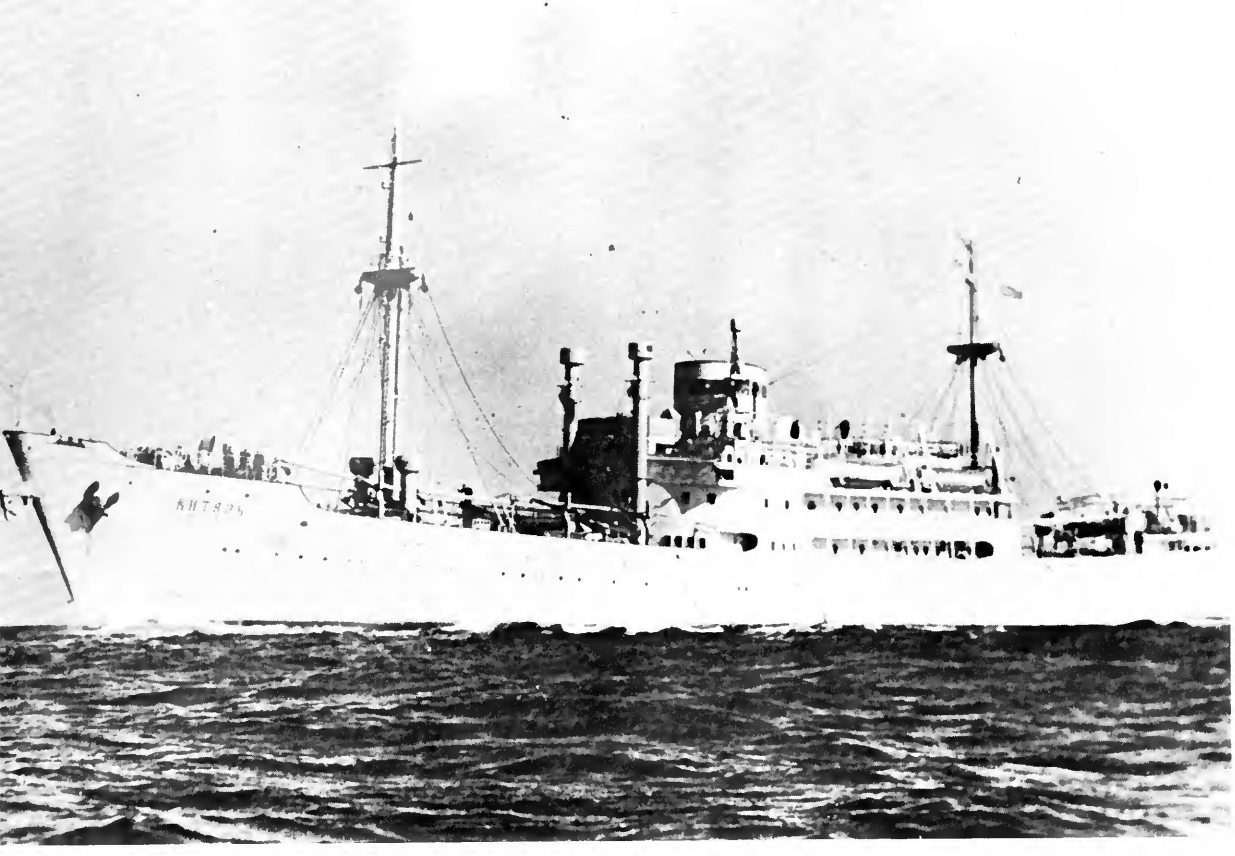


ARENDS

How does this sea cucumber photographed at a depth of about 25,000 feet reproduce? Are some of the larvae found at the sea surface from deep bottom dwelling creatures?

One of the few cases in which the adult and the larvae can easily be recognized. The tip of this adult snail shows the axial ribs of the larval shell. After metamorphosis there is an abrupt change and the whorls on the shell become smooth. This *is the Brown Sargassum snail,* ***Litiopa melanostoma,*** *about ¼" long.*

DE PUNTE



A Cruise with the Vityaz

BY D. A. McGILL

UNDER the sponsorship of UNESCO, and in preparation for the International Indian Ocean Expedition, the chemistry department of the Institution has participated in various seminars to compare analytical methods and techniques. The Russians were unable to attend the meeting held in Honolulu in 1961, so that a second meeting was scheduled in the summer of 1962 when Australian, Japanese and American oceanographers gathered to await the arrival of the Russian ship 'Vityaz' in Perth, West Australia on the third and last of its Indian Ocean surveys. I was offered the unique opportunity of spending ten days at sea with the Russians on the flagship of their oceanographic fleet.

The 'Vityaz' is a former Baltic Sea Liner, taken over from the Germans after World War II. Vestiges of her former glory remain in the grand stairway from the bridge and promenade decks to the dining salon on the main deck level, although the only decoration now is a large oil painting of Lenin. Officers and scientists use the main salon as their dining room. As guests of the Soviets, the visiting scientists were given comfortable suites on the promenade deck with twin beds and a sizable sitting room and desk. Naturally, there is more space than that available on our vessels.

The ship has a total of fourteen laboratories, each with specialized equipment. A complement of about seventy scientists staff these laboratories, and personnel are about equally divided between the major oceanographic disciplines — biology, chemistry, physical oceanography, meteorology and geology or geophysics all are conducted on a single cruise. Each group consisted of one or two senior members and a staff of young people. Indeed, most of the scientists were recent graduates and the average age must be somewhat below thirty. In addition, for this particular cruise, UNESCO trainees were on board from India, Ceylon, Indonesia and Egypt.

About half of the ship's company were women, and this applied to both the scientific staff and the ship's crew. My room was kept spotless by a chambermaid who entered each morning with a long and cheerful Russian conversation which I never understood. Pert waitresses in gauze caps directed us to seats in the dining room and answered our questions about the food. As anticipated, borscht was a staple of the menu, occasionally replaced by a cold cucumber soup (kvas). All provisions for a three to six months cruise are loaded at Vladivostok, home port of the 'Vityaz', and my first impression of the vessel as we watched her dock in Freemantle was of the Russian galley help in their scarves and heavy stockings, collecting a day's rations of potatoes from the mountain of supplies on the after deck.

Language presented little difficulty, for all members of the scientific staff could understand English. Hosts for the chemistry meeting were Dr. Alexei Bogojavlensky and Mme. Alexandra Isaeva, whom we quickly learned to call Alex and Sasha. Both are from the Institute of Oceanography in Moscow. Dr. Olga Koblenze-Mischke was host to a second international party on board, which was concerned with the calibration of techniques for the estimation of the primary production in the sea. Direct measurements for both groups were made at sea on six stations, so that data was obtained under regular sea conditions by all investigators. On completion of the sea experiments, six of the Russians accompanied the other foreign scientists to Sydney for a period of discussion and examination of the results. The results are now being prepared for a UNESCO report.

On the last night at sea, the captain of the 'Vityaz' entertained his foreign guests to a cocktail party highlighted by vodka and caviar. A spirit of friendship prevailed and toast after toast was exchanged, as the hope was expressed repeatedly that this might be only the first of many international exchanges.

Oceanus gets around

THE article: "Antibiosis in Seawater", by Dr. A.K. Saz, published in the December 1962 issue was reprinted and translated by the U.S. Information Agency for worldwide distribution.

Mr. Schevill's article on whale sounds was reprinted from the same issue by "Current Science", for distribution in high schools.

SHE'S HERE !

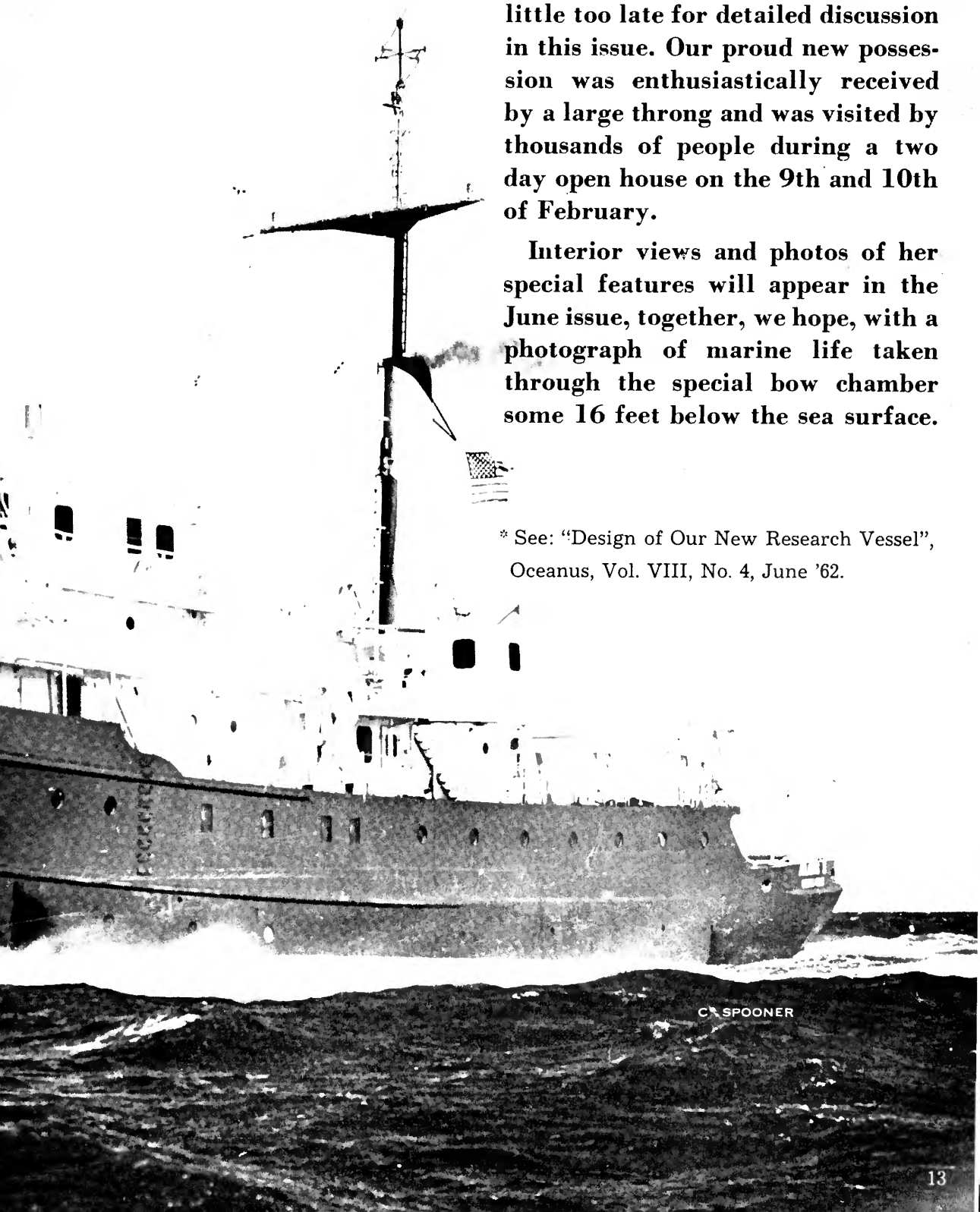
"In a real sense 'Atlantis II' is your vessel too, because she is part of a national scientific effort to increase man's knowledge of the oceans so that all may ultimately benefit."

Paul M. Fye

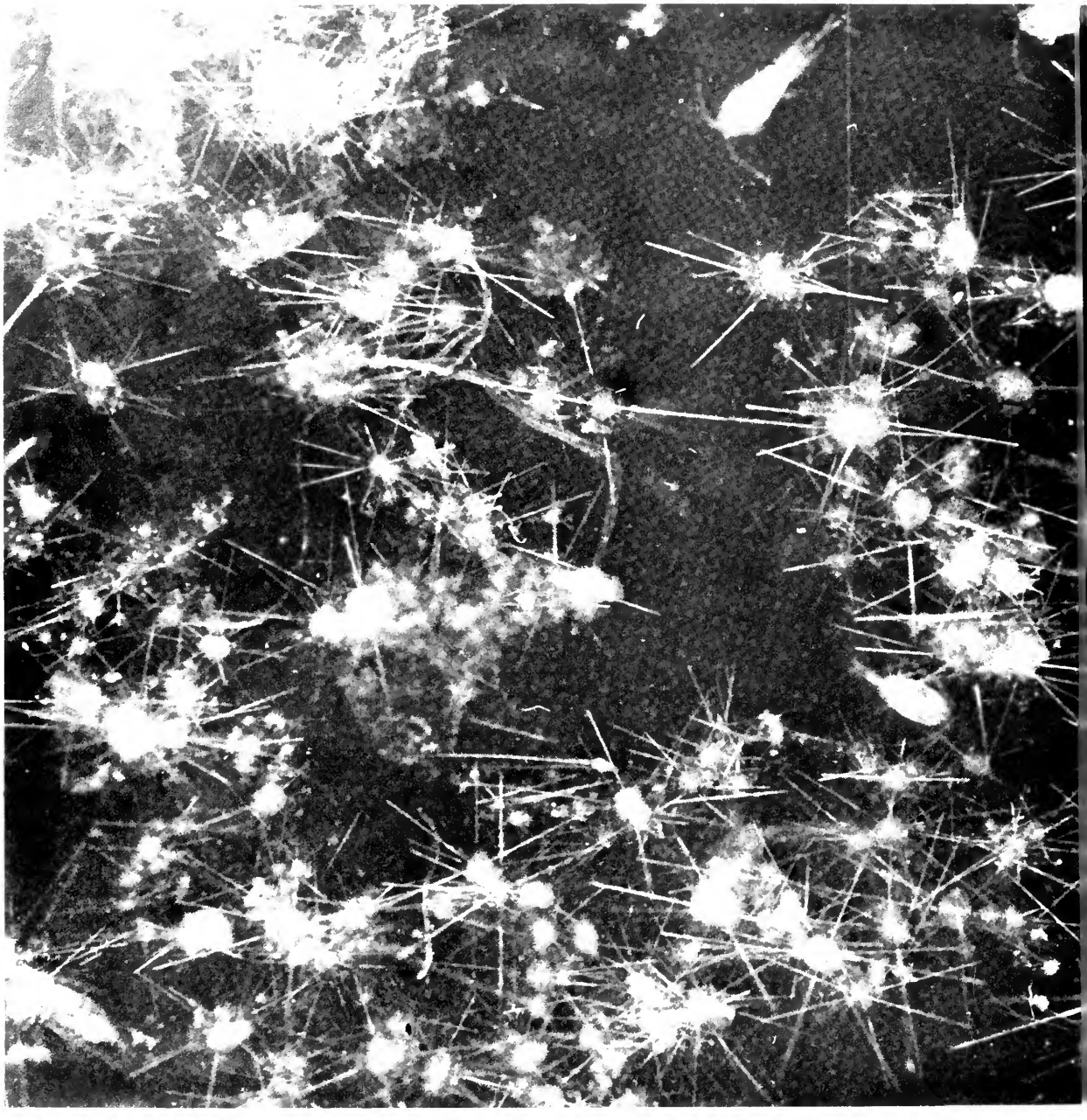
Director

"AND we are proud as peacocks", in the words of Dr. B. H. Ketchum. The 'Atlantis II'* arrived at Woods Hole on the last day of January, a little too late for detailed discussion in this issue. Our proud new possession was enthusiastically received by a large throng and was visited by thousands of people during a two day open house on the 9th and 10th of February.

Interior views and photos of her special features will appear in the June issue, together, we hope, with a photograph of marine life taken through the special bow chamber some 16 feet below the sea surface.



* See: "Design of Our New Research Vessel", Oceanus, Vol. VIII, No. 4, June '62.



Why does this protozoan of unusual elegance and beauty concentrate strontium from seawater?

The above species is: Phyllostaurus siculus; abundant in the Gulf Stream, in the Canary Current, and in December to February tows in the Sargasso Sea, south and east of Bermuda. Relatively primitive in structure. In the Mediterranean this has sporadic blooms of enormous abundance — making up as much as 70% of the animals caught — and leading to collections giving ash with a content as high as 15% strontium. 60 x enlarged.

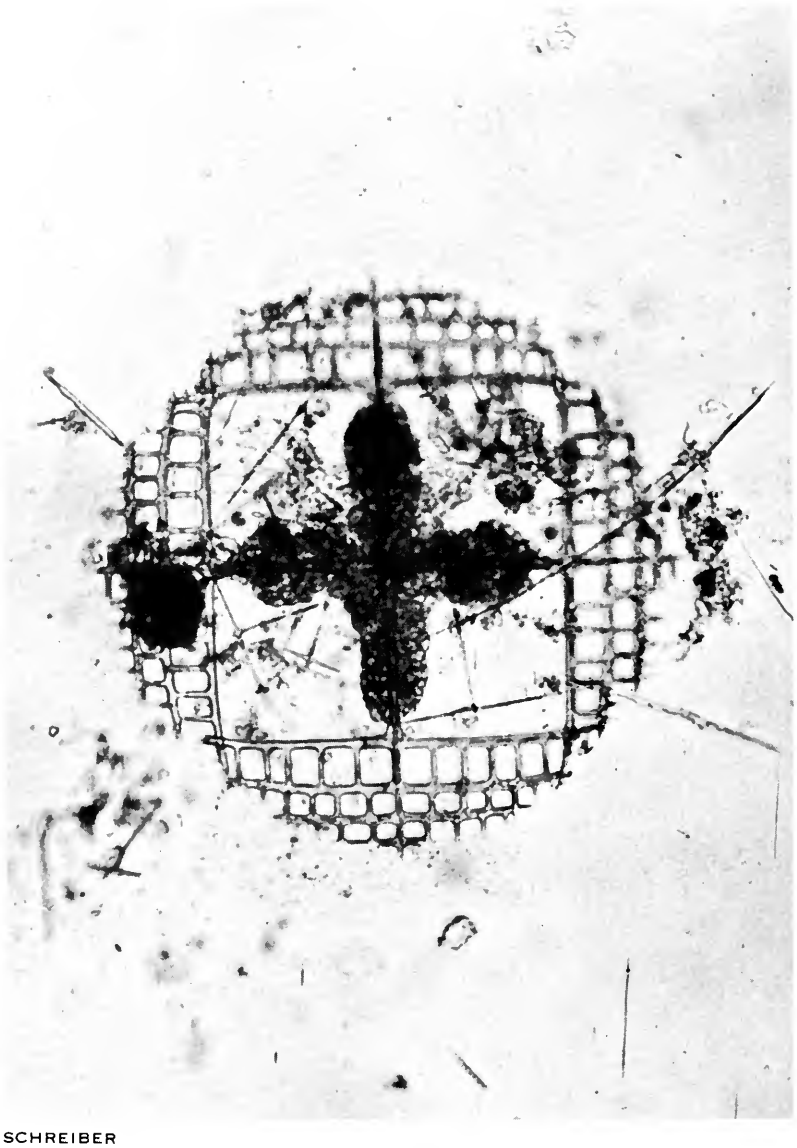
SCHREIBER

Nature's Beauty

by V. T. BOWEN

ACANTHARIA

AMONG the most interesting of the single celled animals of the oceans are the Acantharia. As the photographs accompanying this note show, they have an elegance of form rarely equalled; many more photographs would be required to begin to show their variations of structure, and the fantastic elaboration of some designs. As examples of morphological evolution and as possible tools in the identification of ocean circulation patterns, the Acantharia are of considerable interest to plankton taxonomists. To biochemists and geochemists, these bizarre organisms offer a further point of interest: the skeleton is formed of strontium sulfate. Strontium, the fifth most abundant metal ion in sea water, is by most organisms hardly distinguished from calcium, the third most abundant. We have no idea what chemical processes permit this one group of Protozoa to concentrate strontium selectively and use it for their skeletons;



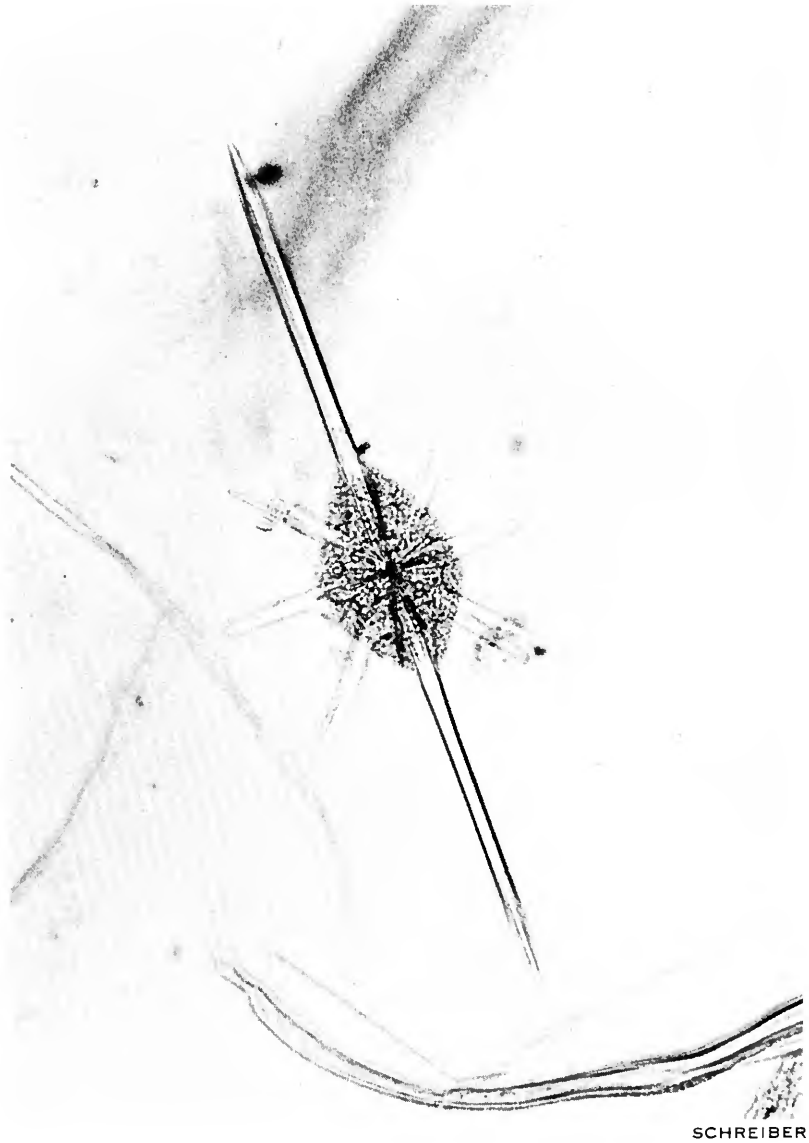
Never abundant in our collections, the ***Lythoptera fenestrata*** *is found from the Gulf Stream to the North Equatorial Current and in the Mediterranean. So far, not found south of 10° North. 300x enlarged.*

SCHREIBER

furthermore, since sea water is far from saturated with respect to strontium sulfate, we have no idea why such a material should have been chosen. It must require a fair fraction of the energy output of these tiny creatures simply to keep their supporting structures from dissolution. As the only marine organisms which can separate strontium from calcium, and consequently the only group which could strongly alter the ratios of these two elements, the Acantharia are of real geochemical interest in respect to their frequency, distribution, abundance and life histories.

Since 1961 we have been cooperating with Professor B. Schreiber of the University of Parma, Italy. In samples from two 'Chain' cruises in 1961,* Professor Schreiber and his associates have identified and counted more than 45 species of Acantharia, obtained in 42 plankton tows made from just off the New England coast to 0° 13′ south latitude. Many more specimens await identification. Almost all tows from east and south of the Gulf Stream contain some specimens of this group of protozoa. Their frequency varies enormously, from less than one per hundred animals

* See: "'Chain' Cruise #17", Oceanus Vol. VIII, No. 1 and: "Equatorial Studies", Vol. IX, No. 2.

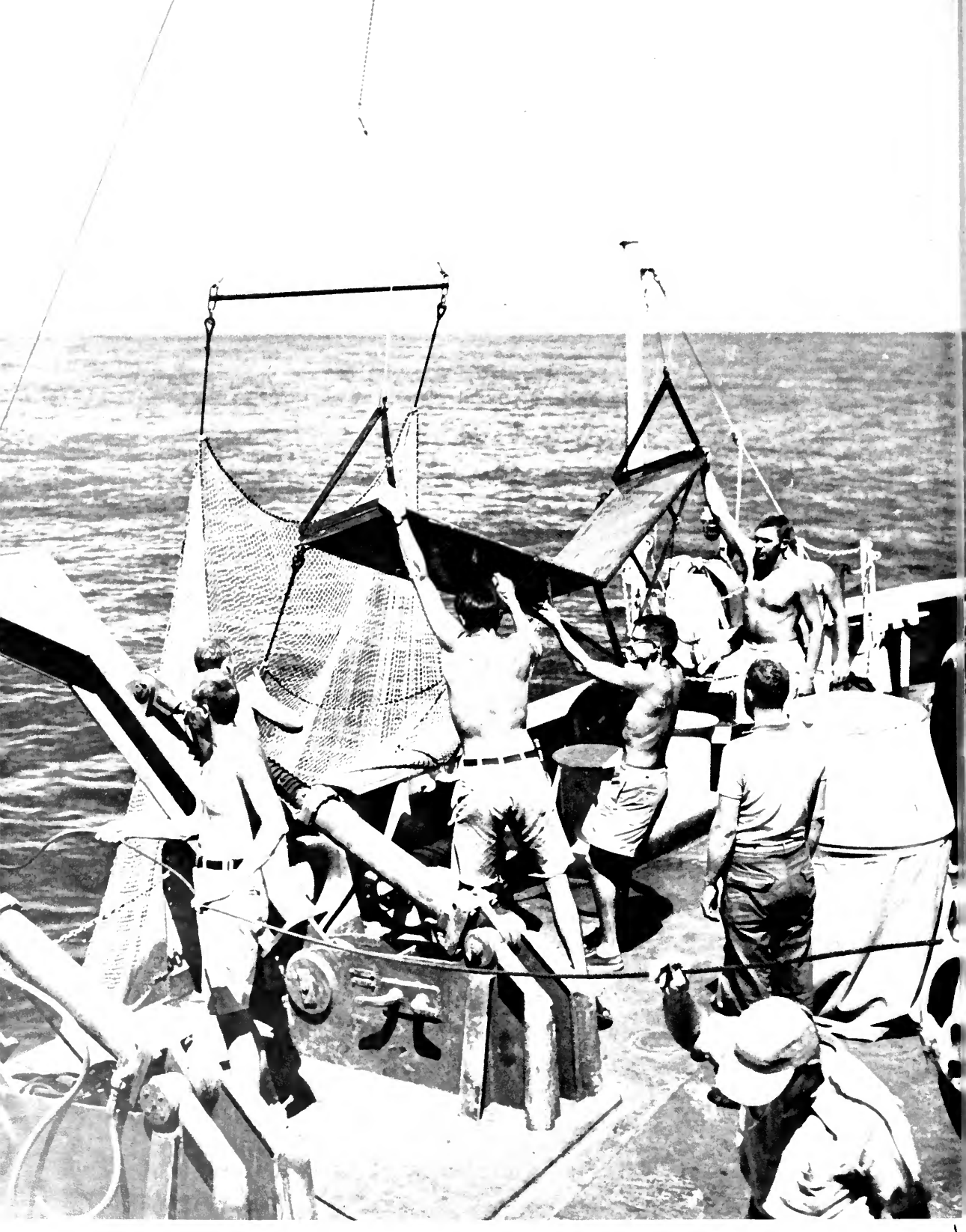


SCHREIBER

*This **Amphystaurus complanatus** is an abundant species in tows from the North Equatorial Current, the Sargasso Sea south and east of Bermuda, and the Gulf Stream. Often more than one half millimeter long. 300x enlarged.*

caught, to as many as 30 per hundred; their abundance varies even more, from less than one, to more than 400 organisms per cubic meter of water sampled. This series of collections is enough to hint at the association of certain species, and of high Acantharian abundances with certain water masses. Much more study of similar series of plankton tows will be needed to establish such associations firmly. The establishment of cultures of Acantharia in the laboratory is urgently needed for life history information and for the measurement of physiological variables of concern to the geochemist. Progress in both these directions is being made, on our collaborative basis with the group in Parma, but the advances are necessarily slow.

In the meantime, it is a pleasure to enjoy the beauty of design, the fascinating variations, and the chemical puzzles presented by their composition and abundance. Before Darwin — faced with similar collections of seemingly nonsensical properties of organisms — one naturalist was reduced to marvelling at: "The exuberance of nature". One is drawn back to this phase in contemplating series of Acantharia.



To sea anyone? In a new program, supported by funds from the National Science Foundation, the Institution co-operates with three independent schools to attract students to the science of oceanography.

Education

IN addition to ICSU, SCOR, SCAGI, NIO, IGY, APO, IUGG, etc., etc., another series of letters has been added to the alphabet soup of oceanography. Oh, no! Oh, yes! And this one is a real puzzler: ISSCEO. Pronouncing these letters in our native tongue, as we are sometimes wont to do, we come out with; Iss-kay-oh, and the thought struck us that the public relations people, who are spending sleepless nights trying to determine the key word for the next astronaut to use, ("all systems are go", and "A-OK" being slightly outmoded) are hereby given permission to use: Iss-kay-oh.

Now that we have had our fun, we shall leave the serious words describing the excellent program behind the letters to Mr. Gilbert E. Stokes of Tabor Academy, Chairman of ISSCEO:

THE Independent Secondary Schools Cooperative Effort in Oceanography (ISSCEO) originated from a meeting held at Woods Hole in March 1960. The project includes a limited number of boys from three schools, (three juniors and three seniors) who have taken on research which depends on original data collected in their field. The program is supported by funds from the National Science Foundation granted on the first of January, 1963.

At the Moses Brown School, Providence, R. I., a group is working on the study of wave action beneath the surface of a shallow lake. At St. George's School, Newport, R. I., boys are working on the geology and ecology of a salt marsh. At Tabor Academy, Marion, Mass., the program is centered on a study of water currents and the ecology at the mouth of a fresh water river where it enters the ocean.

Education —

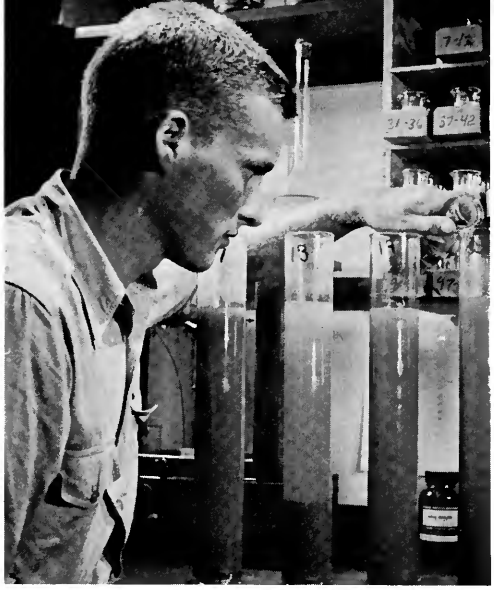
In addition to these extra-curricular, non credit studies at each school the ISSCEO program includes monthly lectures given by staff members of the Woods Hole Oceanographic Institution.

The broad aims of the program are: first, to provide able students a challenging task in the study of the earth sciences. The fields of limnology and oceanography serve as good research disciplines because the student becomes aware that a knowledge of all the basic sciences is essential to such disciplines, and that science is not compartmentalized into various subject matters, or "courses", but depends upon comprehensive knowledge.

Secondly, to expose the student of the techniques required, both in field observations and in laboratory investigations, and to demonstrate, more pointedly than can be done in a classroom course, the precision, accurate thinking, patience, and library research necessary in dealing with scientific problems. Thus, the student also will obtain a better understanding of natural environments. The program is flexible enough so that, depending upon his own interests, a student can pursue any specific investigation which appeals to his enthusiasm, whether it is devising new apparatus or probing into some fundamental question.

Finally, we provide an opportunity, early in a boy's academic career, to realize the satisfaction that can be derived from scientific research. It is also hoped that this early training will cause students to choose a vocation in the earth sciences.

In a recent report from the Woods Hole Oceanographic Institution it was stated: "Among the personnel involved from the Institution, the consensus of opinion was that the students are first rate, exciting, and that the educational challenge is well worth the effort."



Laboratory work

Instrumentation

Sea observations

New Aircraft

The interior of our aircraft is designed for utility, not comfort.

THE Institution has completed arrangements with the Navy to obtain a four engine aircraft for oceanographic research. A $100,000 grant from the National Science Foundation is being used to defray the costs of its modification for scientific purposes.

The new aircraft is a C-54, the Armed Forces version of the familiar and reliable DC-4, and will replace the DC-3 (R4D) which has been serving this Institution for the past five years. The C-54 is being completely overhauled and instrumented by American Airmotive in Miami, Florida where its conversion is proceeding on schedule and it is hoped that the plane will be ready for its initial test flight by April 1st. Its modifications will include the installation of Doppler navigation, additional electrical circuitry, radar, search blisters, camera ports, gust probes, psychrograph mounts, a radiometer hatch and a dropsonde chute.

Because of its greater speed and much greater range the plane will be able to undertake research in areas of the world that were inaccessible to the R4D. Its first assignment will be working in conjunction with the International Indian Ocean Expedition, primarily for meteorological investigations. Mr. A. F. Bunker, Institution meteorologist, who is supervising the scientific instrumentation of the aircraft is also the Scientist in Charge of the Indian Ocean aerial program. A series of two months tours are planned to the Indian Ocean. The program will include the study of the turbulent heat exchange, water vapor momentum, and radiative flux across the sea surface, cloud and rainfall distribution and the thermal structure of the atmosphere. Flights will be made in areas where observations will also be gathered simultaneously by oceanographic vessels, weather ships, and instrumented buoys. Bombay probably will be the main base of operation.

The routes to and from the Indian Ocean will be determined in part by their amenability to the ONR marine meteorology program in regions that so far have received little attention, such as the Sahara and Arabian Deserts and the jungles of Africa and South America.

The pilot is Captain Norman Gingrass, who has been with the Institution for nine years as pilot of the R4D and the PBY flying boat which preceded it.

F.C.R.

WORTHINGTON

A moored buoy being set overboard from the M.V. 'Erika Dan' in the winter of 1962, and its remains found a year later in the Faroe Islands.

Buoy program

Generally, one only hears of the successes in scientific research. Advances are not always made rapidly and many difficulties often have to be overcome.

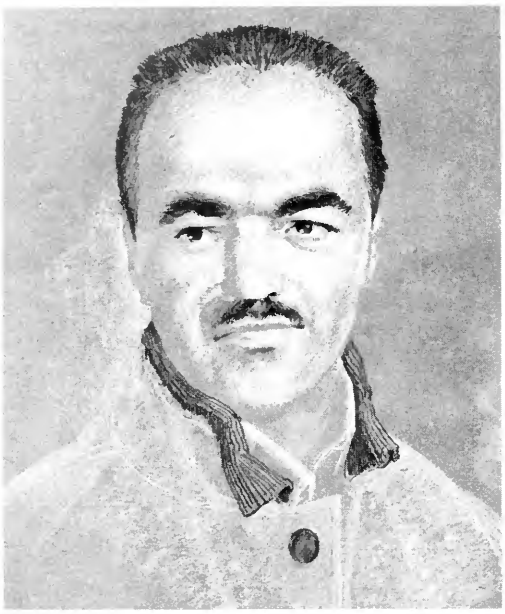
THE buoy program, announced in Oceanus, Vol. VIII, No. 2, December 1961, is having its ups and downs. A recent success was the over the horizon transmission of digital data over high frequency radio bands. In cooperation with the International Telephone and Telegraph Company data was transmitted from two moored buoys near Bermuda to ITT receivers at Southampton, L. I., N. Y.

Among the downs are the difficulties we have encountered with the mooring systems. Of 78 buoys set out with their attendant strings of current meters and other instruments, only 47% have been recovered completely, 20% were partly recovered and 33% were completely lost. Meant to stay on station for three months, the longest lived buoy stayed on for 233 days, but others were lost after a few days.

Fish bites

Much of the trouble with the mooring lines is considered to be due to "fish bites". Other countries which have taken up our moored buoys systems, including Russia and Canada, also have suffered much trouble. We understand that the Russians have their ships stay by the buoys until the data has been collected and the buoy retrieved.

An amusing coincidence occurred recently in the Faroe Islands. One of our buoys had stranded there and a picture of the buoys was recognized by Mr. J. Gredsted, who was Chief Officer of the 'Erika Dan' of the J. Lauritzen Company during our Arctic cruise last year. The buoy had been set out by that ship about 150 miles SSW of Cape Farvel off Greenland, in about 13,000 feet of water. Three days later the buoy had disappeared only to be found this spring across the North Atlantic, minus its string of current meters.



MINOT

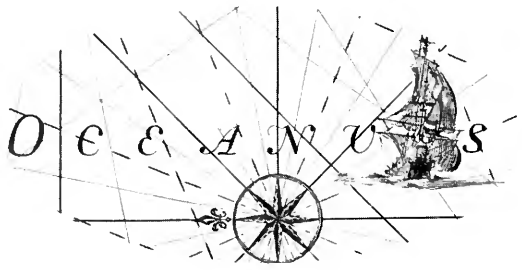
Martin J. Pollak

Memorial Library

THE late Martin J. Pollak, who initiated some of our physical studies in the Mediterranean Sea and in the Puerto Rico Trench, and whose gentleness brought him many friends, was remembered on March 8th when the Martin J. Pollak Memorial Library was dedicated on board our new research vessel, the 'Atlantis II'.

Martin, who died in June 1960, left his scientific library to the Institution. Largely due to the efforts of his friend Dean F. Bumpus, of our staff, the collection together with other books obtained through gifts from the U.S. and 15 other countries, was thought to serve its best purpose on board our new vessel, a ship that Martin, who loved the sea, undoubtedly would admire.

The excellent portrait shown here was painted by Mary Minot of our staff.



Printed by Leyden Press, Inc., Plymouth, Mass.

Associates' News

Spring Meetings

AS last year there will again be three Associates' Dinners this year. One at Wilmington, Delaware, one at New York and one at Boston. Dates, places and speakers will be announced shortly by direct mail to the Associates and Prospective Associates.

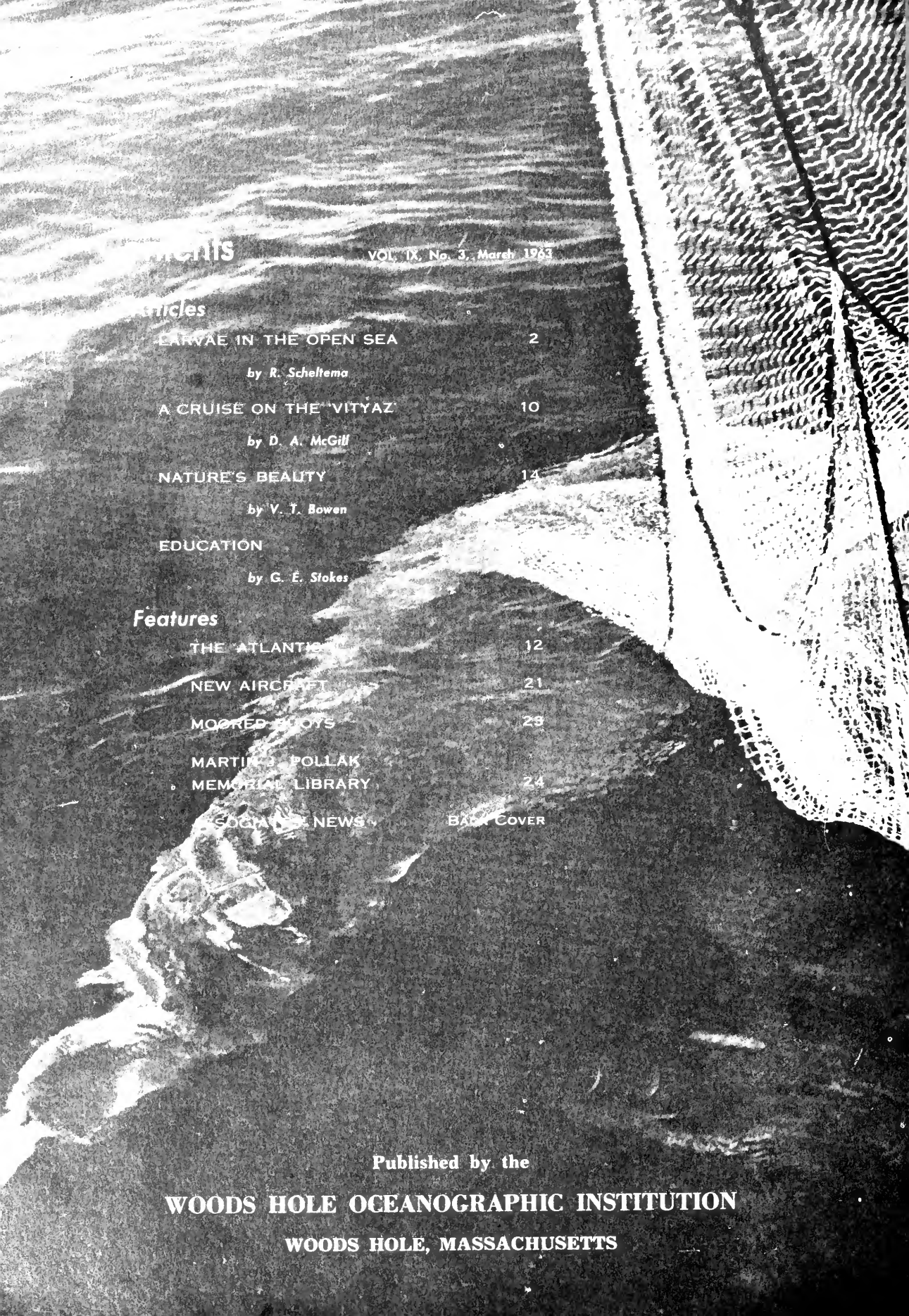
The Editor will be at sea on the R.V. 'Chain' in the Equatorial region and regrets that, for the third year in a row, sea duty will not enable him to be present at the meetings.

THE ASSOCIATES of the Woods Hole Oceanographic Institution are a group of individuals, corporations and other organizations who, because of their love for the sea and interest in science and education, support and encourage the research and related activities of the Institution.

Membership dues in the Associates are as follows:

Member	$50
Contributing Member	$100
Patron	$500
Life Member	$1,000
Corporate Member	$1,000
Sustaining Corporate Member	$5,000 or more.

All contributions and dues are tax deductible to the extent provided by law.



Contents

VOL. IX, No. 3, March 1963

Articles

Features

Published by the

WOODS HOLE OCEANOGRAPHIC INSTITUTION

WOODS HOLE, MASSACHUSETTS