continued and relatively slow subsidence is indisputable.

As far as I have learned, only one earlier observer, Purves, a Belgian geologist, has regarded Antigua as a tilted-up and beveled-off reef-enclosed island, and even he does not appear to have explicitly stated that it reached the atoll stage of development, although he comes so near to describing such a stage that one must suppose he understood it, mentally at least. His most definite statement is as follows:

La puissance de cette vaste formation calcaire indique qu'elle s'est déposée pendant une longue période d'affaissement du sol qui a suivi l'extinction de l'activité volcanique et pendant laquelle des récifs de coraux très-étendus se sont librement établis autours des bancs formés par les matériaux volcaniques éjectés lors des dernières éruptions. Ces roches, actuellement visibles, ne représentent pas la substance même du récif, car, pendant la formation du dépôt, ce récif devait être situé à une distance considérable de la côte. Ces amas de marnes et de calcaires avec leur masse de débris de coraux détachés mais très-bien conservés, de bois flotté et échoué, de coquilles et d'orbitoides, représentent évidemment le dépôt particulier que l'on voit encore de nos jours se former par l'accumulation entre la barrière de récifs et les côtes d'une île affectée d'un mouvement d'affaissement lent et continu ('84, 307).

In spite of this clear indication of the association of the Antigua limestones with an ancient barrier-reef system and the explicit recognition that the ancient reef is not now visible, the island has not gained the reputation that it deserves as a tilted-up and beveled-off atoll. Several observers of later date than Purves do not make so close an approach to imputing this origin to it as he did.

Antigua has many features of interest, which I enjoyed seeing during a ten-day visit in November, 1923. Its lower lands of fertile calcareous soil have long been cleared and cultivated, sugar cane being the chief crop. English harbor, an embayment on the southern coast between slightly cliffed headlands of submountainous form, back of which rises a well-defined tuff cuesta, was at one time strongly fortified as the chief British naval base in the West Indies; it was there that Nelson refitted his fleet after an engagement with the French in an early year of the nineteenth century. St. Johns, the chief town of the island to-day, was an excellent center for my excursions, which were all the more pleasant from the competent guidance by hospitable officials and residents with whom I made acquaintance. The town lies at the head of an open embayment which enters the northwestern end of the broad medial lowland worn down across the island on the weak beds between the cuestas of the underlying cherts and the overlying limestones; the other end of the medial lowland is entered by Willoughby bay, across which the limestone cuesta on the north affords a delightful view. Many of the physiographic features above described may be reviewed to advantage from the crest of the main chert cuesta which serves as a delightful Belvidere near the center of the island; and not the least interesting consideration that might be broadly enjoyed in the prospect there opened or more closely reviewed during an examination of the inclined tuffs and limestones in their many outcrops would be the contemplation of the island as a tilted-up and beveled-off atoll; but the conscious contemplation of Antigua as of that origin was denied me; for in spite of my ten-day exposure to the contagion of the infectious facts, a four-month period of unconscious incubation elapsed before the explanation of the facts as here presented "broke out" upon me. It then appeared that the deep understructure of the island agrees, as far as it is now revealed, in every essential respect with the understructure that an atoll, formed according to Darwin's theory of slow upgrowth from a slowly subsiding foundation, should possess.

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THE FISHERIES BIOLOGICAL LABORATORY, WOODS HOLE, IN 1923[1]

WHEN the laboratory was opened on June 20 three investigators of the bureau's regular staff who had been at the station during the greater part of the preceding winter and another who had arrived early in June were already there engaged in investigations which had begun at or through the laboratory in the preceding summer and continued without interruption.

The temporary official staff of the station consisted of the director and one scientific assistant. The laboratory enjoyed the hearty cooperation of Superintendent W. H. Thomas and the general staff of the station under his direction. Invaluable service to the director and to investigators was rendered by Robert A. Goffin, collector, and by the fisheries steam launch, *Phalarope*, with Robert Veeder as master. Helpful service was rendered in the office and library by Allan A. Graffin, and in art work by Kenneth G. Phillips, under the War Veterans Bureau. In addition to the *Phalarope*, employed for longer trips, two smaller launches and a number of rowboats were available.

In all, there were in the laboratory 28 investigators and assistants, of whom 14 were engaged upon official work and 14 upon independent studies. There fol-

[1] Published by permission of Mr. Henry O'Malley, United States Commissioner of Fish and Fisheries.

lows a list of the investigators and topics of investigation. Results are given in a few instances, selected not with special reference to the merits of the particular researches, but rather with a view to better illustrating the type of investigation and the general interest of the work pursued in the Fisheries Laboratory.

Charles J. Fish, general assistant, of the *Albatross*, who had been attached to the laboratory throughout the preceding year, continued his investigation of the daily and seasonal variation in the plankton of the Woods Hole region. The work until July had consisted of daily observations on physical conditions and plankton collections taken from the end of the Fisheries dock. Beginning with July of the past summer, and employing the *Phalarope*, similar observations have been made at regular intervals throughout Vineyard Sound and Buzzards Bay, with the primary purpose of studying the horizontal distribution of the various planktonic organisms. The unusually cold weather prevailing throughout the previous spring was found to have had a notable effect on the plankton of the region. Almost all the pelagic forms appeared later than usual. The diatom swarm that in 1922 appeared on June 15 arrived in Great Harbor this year on August 9. Some animals that were comparatively common during the preceding summer did not appear at all in the summer of 1923. The effect of the temperature on the breeding seasons of invertebrate animals was distinctly observable in Vineyard Sound, where in the deeper waters temperatures were found in August to compare with temperatures at Woods Hole in Great Harbor in late May and June, and where at the same time the plankton was found to be identical with that of Great Harbor in May and June. All observations indicate that temperature is the dominant factor governing the seasonal distribution of the local plankton fauna. Dr. Fish's data and conclusions will appear in publications of the bureau.

Mrs. Marie D. Fish, field assistant of the Bureau of Fisheries, is engaged in studies of the identification and seasonal distribution of the larval fish of the Woods Hole region, having available material collected daily at Woods Hole and at certain intervals in Buzzards Bay and Vineyard Sound and in the waters of the sea immediately without the sound, as well as collections made at the station in past years by the late Vinal Edwards, by Robert A. Goffin and by others. She has also assisted Dr. Fish in his plankton studies.

Paul S. Galtsoff, naturalist of the *Albatross*, was engaged primarily in examination of data and materials collected in the biological and hydrographic reconnaissance of Long Island Sound that he has been conducting since June, 1922, with the use of the Fisheries Steamer *Fish Hawk*. Salinity determinations (by titration) were made upon 500 samples of water previously taken in the sound, and the volume of the plankton was determined for 275 quantitative samples of plankton. He made a comparative test of the centrifuge method and the filtering method (sand filter) as employed in microplankton examinations, finding that the sand filter method yielded more accurate results. He made also a study of the food of oysters from Wareham River, Buzzards Bay, finding (in June) that it consisted chiefly of bottom-living diatoms. In cooperation with Mrs. Galtsoff, he continued investigations of regeneration of silicious sponges after their dissociation. It was learned that Ca-ions are necessary for the formation of the aggregates of separated cells, that alkaline sea water (pH 9.8) increases adhesiveness of protoplasm and facilitates to a certain extent the formation of aggregates of cells from different species, and that the rebuilding of a new organism from a clump of cells depends on the stereotropic reaction of the cells. The histology of the regenerative process was also studied.

J. Paul Visscher, special assistant of the Bureau of Fisheries in cooperation with the Department of the Navy, was engaged in a study of the fauna and flora of ship's bottoms and the factors affecting attachment of organisms to the bottoms. By expeditions to various ports, on notification of arrivals, he examined 15 vessels in course of the summer, supplementing observations made in a similar manner during the preceding winter and spring. The materials collected were studied at the laboratory, where he also conducted experiments to determine the reactions of fouling organisms to light and to color of substratum. It was determined for certain specific forms that the larvae at the time of attachment are negative to light, and it was also found that steel plates submerged in a tidal current incurred less fouling if painted in lighter colors. He also conducted studies of the life history and distribution of barnacles and determined for three species the resistance when exposed to fresh water and to air.

Professor Charles B. Wilson, of Massachusetts State Normal School, Westfield, Massachusetts, assisted by John E. Wilson, temporary assistant, examined a collection of free-swimming copepods made by Dr. R. P. Cowles in course of the survey of Chesapeake Bay that he conducted with the use of the Fisheries Steamer *Fish Hawk* during the years 1920 and 1921. The collection comprised about 700 hauls made at 35 separate stations at different times of the year, at different hours of the day and night, at different depths, and under different conditions of tide, salinity and temperature of water, as well as with nets of various sizes of mesh. They examined

all the hauls, recorded the different species of copepods found in each, calculated the total numbers of individuals in each haul and the relative number of individuals of each species represented. By incidental examinations of local fishes they secured 25 species of parasitic copepods, including four or five new species and one new genus, which will be more fully described at a later time.

The four major investigations of the bureau, of which account has just been given, were all concerned in some way with the small floating or swimming organisms of the sea and its bays and with the conditions affecting the distribution and abundance of such organisms. The investigations were not cooperative; each was entirely independent of the others; but, whatever the original purpose of each study, the results of all must link together to form a broad contribution or series of related contributions to knowledge, (1) of the geographic, local and seasonal distribution of marine and semi-marine plankton organisms, (2) of the effects of the physical conditions of the sea upon the distribution and abundance of such organisms, and (3) upon the seasons and the success of the breeding of marine animals in general. The usefulness and the interest of such studies are obvious, both to those whose interest lies primarily in the discovery of principles of biology and to those who would be able to interpret and to forecast the relative abundance of food fishes at particular times and places; for in the plankton or floating life in the waters is comprised not only "the pasturage of the sea," but, it may be said, the great nursery for nearly all animals of the ocean and its shores and bottoms.

The director of the laboratory, assisted by James T. Penney, obtained a considerable body of material for study of the natural history of Limnoria, the conditions of breeding, and the structural and physiological differences correlated with differing environmental conditions. This study is in continuation of studies in progress based upon material collected at Beaufort, N. C. It is evident that, correlated with the shorter breeding season at Woods Hole, as compared with Beaufort, N. C., the broods of young are much larger in number of individuals in the colder northern waters. The director also made observations in waters of Cape Cod supplemental to previous studies of hydrogen-ion concentration of natural waters as a factor affecting the distribution of freshwater fishes.

The director of the laboratory acted as leader of a party of thirty naturalists from the Fisheries Laboratory and the Marine Biological Laboratory, which made a zoological reconnaissance of Penikese Island with reference to animal life above the tide line. The materials collected were subsequently assorted and distributed to specialists for study and identification. It is hoped that a report may be completed within a year to be published possibly in conjunction with a report of the botanical survey of the island made a few days earlier. The two surveys were undertaken in observance of the fiftieth anniversary of the founding by Louis Agassiz upon Penikese Island of the first marine biological station in America. The observance, by the surveys and otherwise, was initiated by the Marine Biological Laboratory of Woods Hole.

INVESTIGATIONS BY OCCUPANTS OF TABLES

Dr. F. E. Chidester, of West Virginia University, engaged in study of the literature of fish migration and the possible factors affecting it, including hydrogen-ion concentration. He made experiments to develop methods of determination of small quantities of oxygen and carbon dioxide in the blood of fishes, and spent some time in anatomical studies relating to the brain of the blue shark and to other organs of vertebrates.

Dr. N. A. Cobb, of the U. S. Department of Agriculture, with four assistants, investigated the physiology of nemas, especially that of the alimentary tract, with the use of polarized light and *intra-vitam* staining, and by direct observation of the feeding and other habits of nemas. For this purpose he introduced the application of modified petrographic microscopes with decidedly advantageous results. Marine nemas were employed for his studies, because the general physiology is the same in principle as that of the plant-infesting and the soil-inhabiting forms under investigation by the Department of Agriculture while, in size and transparency, the marine forms are far more favorable to such investigations than are the smaller forms in more direct contact with crops of the land. Furthermore, he finds that at the Woods Hole laboratory the marine forms are far easier to collect in sufficient quantity and variety. Incidentally, the examinations were extended to other phyla—to nearly all the animal phyla, in fact. It is thought that the results of the incidental work, which was much aided by eminent specialists at Woods Hole, may in future be the stimulus for much fundamental physiological investigation inside the cell.

Paul S. Conger, of the United States National Museum, assistant to Dr. Albert Mann, specialist in diatoms for the Carnegie Institution of Washington, spent six weeks at the laboratory making collections of diatoms, chiefly marine, as material necessary to continue the studies that Dr. Mann has been conducting for several years relative to the diatom flora of Woods Hole.

Dr. John C. Hemmeter, of Baltimore, Maryland, studied the comparative histology of the abdominal organs of the selachians obtainable at Woods Hole

with special attention to digestive organs—stomach, pancreas (including islets of Langerhans), and liver —and to their reciprocal relations in hematopoiesis and hemolysis with the spleen. In connection with the histological studies, the osmotic phenomena and histology of the blood itself was investigated. Mrs. Hemmeter aided in histologic work and in preparing drawings from microscopic preparations.

Miss Catherine Indorf, of the University of Missouri, studied with Dr. Cobb the structure and habits of nemas, and the technique of their investigation, with the special view of obtaining a knowledge of the technique to be applied in the investigation of a serious agricultural pest in northern Missouri, *Heterodera radicicola.*

Dr. Edwin Linton, of Augusta, Georgia, continued his systematic studies of the internal parasites of fishes, giving attention not only to the final hosts of the parasites but also to intermediate carriers as well, including invertebrates, fish-eating birds and fishes.

Dr. G. A. MacCallum, of Baltimore, investigated parasites of fishes, chiefly sharks, with special reference to trematodes of the gills and nasal glands. He also collected parasites from turtles and other reptiles, obtaining some new forms, which will be studied and reported upon at a later time.

Thomas F. Morrison, of Princeton University, examined many different forms of marine animals for fluorescence. It was found that the phenomenon of fluorescence is very widespread, but, due to pigmentation present, it is not perceptible in all cases. Clear protoplasm, such as is found in the embryonic tissues, exhibits a light blue fluorescence, while similar tissues from adults exhibits a greater variety of fluorescent colors. Various body fluids were found to be fluorescent, the fluorescence of the decomposition products being especially marked. The chemical nature of these substances was studied, and it was found that practically all groups of biochemical compounds contain fluorescent members. The source of light used in these experiments was a carbon arc and glass filter. The incident light was rich in ultraviolet to 350 μμ but weak beyond 300 μμ. The upper limit was 425 μμ.

During a brief stay at the laboratory, Professor A. M. Reese, of West Virginia University, worked upon the structure and development of the oral glands of certain pit vipers.

L. R. Safir, of Columbia University, continued genetic researches with the use of *Drosophila melanogaster.* His particular problem was to locate more definitely in the third chromosome the loci of some 8 or 10 factors. Crosses involving upward of 30,000 offspring were carried out. He also studied the effect of X-rays on the offspring derived from a Mendelian cross, arriving at the general conclusion from genetic evidence that the X-raying of the flies caused a disturbance in the sex or X chromosomes so that they do not disjoin.

Dr. Henry C. Tracy, of the University of Kansas, studied the development of reactions in teleost embryos and larvae, with particular reference to chemical and physical factors influencing the early movements of teleost larvae.

Professor H. V. Wilson, of the University of North Carolina, with Henry V. Wilson, Jr., was at the laboratory for a few days obtaining material for histological studies of sponges.

R. E. COKER,
Director

UNIVERSITY OF NORTH CAROLINA

SCIENTIFIC EVENTS

THE NATIONAL MUSEUM OF ENGINEERING AND INDUSTRY

ONE million dollars has been assured towards the establishment of the National Museum of Engineering and Industry, Incorporated, with headquarters in the Engineering Societies building. A campaign to raise an additional nine million dollars has been started. The president of the new organization is Dr. Elihu Thomson, who recently received the Kelvin Gold Medal from the Royal Society at the Kelvin centenary in London. The vice-presidents are Dr. Edward G. Acheson, one of the creators of the modern abrasive industry, Dr. Leo H. Baekeland, inventor of velox paper and bakelite and president of the American Chemical Society, and Dr. Edward Weston, creator of the Weston type of electrical instruments. Its trustees are Mr. Philip T. Dodge, chairman of the International Paper Company; Mr. Howard Elliott, chairman of the Northern Pacific Railroad; Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute; Dr. Elmer A. Sperry, president of the Sperry Gyroscope Company, and Mr. Worcester R. Warner, of Warner & Swasey, Cleveland, Ohio, makers of telescopes. Mr. George E. Roberts, vice-president of the National City Bank, is treasurer and Mr. H. F. J. Porter, industrial engineer, is secretary.

In cooperation with the Smithsonian Institution the new organization is planning to erect on its grounds in Washington a building to house the original models of early inventions and the records of constructive achievement of pioneers, inventors and engineers in the development of transportation and industry. In this way the United States will be given the kind of institution which all the great European nations have possessed for years, and in the layout of the proposed museum use will be made of the data collected by an expert who has recently returned from a year's survey of museum practice abroad. An important de-