RICHARD RATHBUN AND HIS CONTRIBUTIONS TO ZOOLOGY.

In the October number of the Journal (page 620) mention was made of the death of Dr. Richard Rathbun, Assistant Secretary of the Smithsonian Institution and for nearly twenty years in charge of the United States National Museum.

Dr. Rathbun states in a brief autobiography which has kindly been placed in the hands of the writer that his interest in science dated from 1868 when, at the age of sixteen years, he was attracted by the fossils in the quarries near Buffalo, New York, in which he was employed as financial clerk and overseer of work. Fascinated by the glimpses of the ancient life of the world as revealed in Hugh Miller's "The Old Red Sandstone," young Rathbun set about the collection and study of the Silurian fossils occurring in the sandstones and limestones at Medina, Albion and Lockport, New York.

In these early years, before he was nineteen years of age, he founded the collection of paleontology in the museum of the Buffalo Society of Natural Sciences, and was appointed curator of that section of the museum. At the age of nineteen Rathbun entered Cornell University and continued his paleontological studies under the direction of Charles Fred Hartt. Here he remained for two years, devoting himself largely to the study of a collection of Devonian and Cretaceous Brachiopods and Lamellibranchs from Brazil. The results of these studies are embodied in Rathbun's earliest scientific papers.

The first of these, on the Devonian Brachiopoda of Ereré, province of Pará, Brazil, was completed at Albany with the assistance of Professor James Hall and published in the Bulletin of the Buffalo Society of Natural Sciences.[1] In this paper occur careful descriptions and illustrations of fifteen new species, while the remaining eight species of the collection are referred to previously described forms from North America. This paper was revised and elaborated four years later[2] to include the

[1] References to bibliography are placed at the end of the paper.

results of Rathbun's own collections and in it is incorporated a discussion of the relationships of the Devonian fauna of Brazil and North America.

The Devonian Trilobites and Mollusks of Ereré, Province of Pará, Brazil, collected by Professor Hartt in 1870-71 are described in a joint paper by Hartt and Rathbun, published in the Annals of the Lyceum of Natural History, New York.[3]

The study of the Cretaceous fossils of the Hartt collection required access to the collections in the Museum of Comparative Zoology of Harvard College, and here Rathbun remained from 1873 to 1875. At the same time he served as assistant in Zoology at the Boston Society of Natural History. These studies resulted in a preliminary report on the Cretaceous Lamellibranchs, including detailed descriptions of twelve new species.[4] During the years 1875 to 1878 Rathbun served as geologist to the Geological Commission of Brazil, where he made a study of the geological formations and the scanty mineral resources of several different provinces. While in Brazil he published a report of these geological studies including an account of his search for coal deposits and an extended survey of the coral reefs which lie along the coast.[5]

Several additional papers recording the results of his work in Brazil were published between 1876 and 1879. In one of these[6] the arrangement and formation of the Brazilian coral reefs and the characteristic life of the different faunal zones are explained with great clearness. The Extinct Coral Reefs at Bahia,[7] and the Coral Reefs of the Island of Itaparica, Bahia, and of Parahyba do Norte[8] are the titles of other articles on the same subject. His geological papers include an interesting description of the Brazilian sandstone reefs and the agencies concerned in their formation[9] and reviews of the current literature on the geology of Brazil.[10]

After Professor Hartt's death from yellow fever early in 1878, Rathbun returned to the United States and prepared two papers describing the life and scientific work of his honored friend and teacher.[11]

Rathbun had already acquired some experience in the investigation of marine life from his connection with the explorations of the U. S. Fish Commission as voluntary scientific assistant during the summers of 1874 and 1875,

and on his return from Brazil in 1878 he again joined the Commission as a regularly appointed scientific assistant. His interest was thereby diverted from the paleontological field to that of recent animal life, and from this time on his zoological papers deal exclusively with living forms.

He first followed Alexander Agassiz, with whom he had been associated at Harvard, in the study of Echinoids, and his first paper in this new field comprises a list of eleven species of Echinoids from the coast of Brazil.[12] This was followed by a more detailed account of the geographical distributions of all the species of echinoderms known from that locality[13] with descriptions of species new to science. Other papers on echinoderms include reports upon the echini and stalked crinoids collected by the U. S. F. C. steamer Albatross in the Caribbean Sea and Gulf of Mexico,[14] the species of starfishes of the genus Heliaster represented in the U. S. National Museum,[15] and a catalogue of the collection of recent echini in the U. S. National Museum, with notes on geographical distribution.[16]

Rathbun's connection with the U. S. Fish Commission continued until 1896, during which time he published numerous papers describing the results of dredging expeditions off the eastern and southern coasts of the United States, and some of the new species of various groups of invertebrates secured.

In 1879-1880 he was detailed to New Haven, where, under the direction of Professor Verrill, he prepared many duplicate sets of the various species of marine invertebrates represented in the Fish Commission's extensive collections for distribution to museums and other institutions of learning. At the same time he served as Assistant in Zoology at Yale, but in the following year the work was transferred to Washington, where he was appointed curator of the Department of Marine Invertebrates of the U. S. National Museum. Three large series of these sets were eventually prepared and the lists of species in each published in the Proceedings of the U. S. National Museum.[17]

Under Rathbun's direction collections of marine invertebrates were later prepared by the National Museum for various exhibitions. The catalogue of the collection of economic crustaceans, worms, echinoderms and

sponges for the Great International Fisheries Exhibition at London in 1883[18] contains an excellent account of the economic importance of these groups and the industries in which they are concerned, while another catalogue[19] describes the collection illustrating the scientific investigation of the sea and fresh waters. He also prepared and published the records of the dredging stations of the U. S. Fish Commission for many years, in part with the coöperation of Sanderson Smith.[20]

During this period Rathbun continued his systematic studies on various groups of invertebrates, publishing annotated lists of corals in the U. S. National Museum, with diagnoses of a number of new species[21] and a catalogue of the marine fauna of Provincetown, Mass.[22] He was also interested in the parasitic copepods, of which he published a list of the species in the United States National Museum[23] and described many new forms.[24]

In the economic aspects of marine biology Rathbun produced the best of all his zoological work, and rendered a great service both to science and industry. His account of the natural history of crustaceans, worms, radiates and sponges[25] in Goode's Natural History of Aquatic Animals, published in connection with the Tenth Census, is a work of the highest excellence. This was followed by three extensive reports on the history and methods of the fisheries. Of these, the first deals with the crab, crayfish, lobster, shrimp and prawn fisheries,[26] the second with the leech industry and trepang fishery,[27] and the third on the sponge fishery and trade.[28] Other reports published in connection with the Tenth Census include an account of the various fishing grounds of North America,[29] and a survey of the ocean temperatures of the eastern coasts of the United States.[30] Altogether these reports comprise 550 quarto pages and 106 plates, and they form one of the most important of all contributions to marine economic zoology.

Other economic papers include notes on the decrease of lobsters,[31] lobster culture,[32] transplanting of lobsters to the Pacific Coast,[33] the shrimp and prawn fisheries,[34] methods of deep-sea dredging,[35] investigations by the schooner Grampus,[36] a review of the fisheries in the contiguous waters of the State of Washington and British Columbia.[37] and an introduction to the report on the Albatross explorations in Alaska,[38] in addition to yearly con-

tributions to the reports of the U. S. Commission of Fish and Fisheries from 1888-1896 respecting food fishes and the fishing grounds. That he could also write in a popular manner is shown by his articles on the "Giant Squid,"[39] and "The United States Fish Commission."[40]

Rathbun's publications by no means represent his major service to the Fish Commission, for his duties as chief executive officer and in charge of the scientific work of the Commission, in addition to several terms as acting commissioner, gave him the opportunity, for which he was so well fitted, of devising and directing the scientific investigations of the entire staff. To his skillful management much of the practical success of the Commission previous to 1896 is due.

Very important services to economic zoology were rendered by him in preparing the evidence for the case of the United States in the Paris fur seal Tribunal, in arranging for yearly surveys of the fur seal population in the Bering Sea, and later as the United States representative on the "Joint Commission with Great Britain relative to the preservation of the fisheries in waters contiguous to the United States and Canada." During these years (1891-1896) the fisheries conditions were very thoroughly investigated and an extended report published by Congress.[41]

In 1896 Rathbun severed his connection with the Fish Commission and entered upon the administrative service of the Smithsonian Institution, of which he was appointed Assistant Secretary early in 1897. His natural generosity caused him to devote more and more of his time and energies to his executive duties and from 1899, when he was placed in charge of the National Museum, he had little opportunity for original investigations.

His later writings were mainly limited to his administrative reports of the National Museum[42] during the years 1899 to 1917 in which he displayed great skill in the forceful presentation of the details required. To the building up and exhibition of the priceless collections of this great national institution and to the encouragement of its scientific research he gave his entire time and thought for upwards of twenty years.

His last publications relate to the culminating efforts of his life—the great new natural history building of the National Museum[43] and the national gallery of art,[44]

together with a paper of historical interest on the history of the Columbian Institute for the Promotion of Arts and Sciences.[45]

On the day of Dr. Rathbun's death, July 16, 1918, the staff of the Smithsonian Institution recorded "their profound sorrow at the loss of a sincere friend, an executive officer of marked ability and one whose administration has had a wide influence upon the scientific institutions of the nation."

To his far-sighted wisdom, administrative ability, and untiring zeal systematic and economic zoology owe much, and to him the American public for generations will be indebted for an exposition of natural history which has few rivals.

For a brief account of the personal side of Dr. Rathbun's life, his success as an executive of the U. S. Fish Commission, Smithsonian Institution and National Museum, together with the honors which were accorded him, the reader is referred to Dr. Marcus Benjamin's recent paper in Science.[46]

Richard Rathbun's scientific career may be summarized in a few words; a youthful enthusiast in paleontology, an investigator of the Devonian and Cretaceous deposits and the coral reefs of Brazil, a contributor to systematic paleontology and zoology; in middle life a leading authority on the economic aspects of marine zoology and the means of its investigation; but most prominently and gratefully recognized in his full maturity for his remarkable ability in the administration of the United States National Museum; to him in large measure the successful development of this great national center of research and exposition is due.

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