

specialised carnivores, and the manner—if any—whereby the algæ are digested is yet to be ascertained.

Mr. A. G. Nicholls, of the University of Perth, besides rendering great assistance to the leader of the expedition with his work on corals and beginning work on the calcium content of sea water, has taken charge of the work on the life history of the 'black-lip pearl oyster' (*Meleagrina margaritifera*). An area on the reef flat has been marked off with a stout fence of mangrove wood, ample settling surface for spat being provided not only by the mangrove stakes, but also by numerous empty clean clam shells. Some 450 oysters have been placed in this enclosure. Gonad samples are taken fortnightly, and one breeding period, during the first week in November, so far noted. Mr. G. W. Otter is carrying out a survey of the varieties, numbers, distribution, and powers of destruction of the rock borers, especially the lamellibranchs, and is obtaining results of interest. He is also working on the wood-boring Teredinidæ.

Collecting both on the reef and from the bottom near reefs by dredges and the Agassiz trawl—the latter from a 20-foot whale-boat with a 6 h.p. engine purchased locally—has proceeded apace, but intensive collecting is being held over until after the

summer, when it is hoped that an additional boat will be chartered, and excursions can be made far afield. For the time being, the expedition is doing its best work by concentrating on the intensive study of the conditions on and around this small reef, and from the various lines of research so vigorously being prosecuted there is every indication that, at the end of the year here, there will be available for publication the most complete account to date of the conditions under which this type of coral reef exists.

Mr. J. A. Steers, assisted by Mr. M. Spender and Mr. C. Marchant, who constitute the geographical section, have cruised northward from Townsville in a launch chartered there, to Flinders Islands (north of Cooktown) and back, calling at Low Islands for several days on both outward and return trips. They have examined many reefs and coral cays in this long stretch, and have been able to form a very clear idea of the vastness of the problem confronting geographers in this region. Mr. Steers is now on his way back to England, but Mr. Spender and Mr. Marchant are to arrive at the Island shortly, the latter for two months only, the former, with periods of surveying on selected cays and on the mainland opposite the island, for the remaining period of the expedition.

### Obituary.

PROF. BASHFORD DEAN.

**D**R. BASHFORD DEAN, who died at Battle Creek, Michigan, U.S.A., on Dec. 6, 1928, was equally eminent as an ichthyologist and as a student of medieval armour. He acquired both interests in early boyhood in circumstances which fostered them, and he continued to pursue both until the end. For several years he was the active curator of fishes in the American Museum of Natural History, New York, where he planned the public exhibition of fossil and existing fishes. For a still longer period he was curator of arms and armour in the Metropolitan Museum of Art, New York, and likewise planned the installation of the collection. In each case he largely added to the collection by the acquisitions he obtained during his numerous and extensive journeys in the Old World.

Dean was born in New York on Oct. 28, 1867, and was educated first at the College of the City of New York, where he made good progress in zoology. Next, in 1886, he entered Columbia College, where he studied geology and fossil fishes under Prof. J. S. Newberry, whose researches on Devonian fishes he afterwards continued. In 1890 he graduated as Ph.D. with a thesis entitled "Pineal Fontanelle of Placoderm and Catfish," which was published by the New York State Commission of Fisheries. Meanwhile, he had already become tutor in natural history in the College of the City of New York, and had also been appointed assistant on the Fisheries Commission. He thus had early experience both of teaching and of research. In later years he was for a time one of the professors of zoology in

Columbia University, where he had some brilliant pupils; but most of his energies were devoted to research and the enlargement of the collections of which he had charge.

Dean's training led him to take the widest view of ichthyology, and he was equally well versed in the methods of embryology and of palæontology. His outlook is well shown in his useful handbook on "Fishes, Living and Fossil," which was published in the Columbia University Biological Series in 1895. It deals mainly with the lower and older groups of fishes, which are of the greatest interest from the evolutionist's point of view. It regards them in all aspects, and facilitates comparisons by adequate synoptical tables and pages of clear figures drawn by himself. It summarises the knowledge and ideas of the time, expressing several opinions which Dean's own researches afterwards caused him to modify. His latest and most important volume, on "Chimæroid Fishes and their Development," published by the Carnegie Institution of Washington in 1906, displays the same wide scope. It combines embryological observations on specimens which he collected in Japanese seas with extensive anatomical research and numerous descriptions of important fossils. It reaches the conclusion now generally accepted, that the chimæroids are highly specialised sharks.

Among Dean's papers on fossil fishes may be specially mentioned those on the Devonian shark which he named *Cladoselache*, and those on the armoured Devonian fishes commonly known as *Arthrodira*. He showed that the fins of *Cladoselache* could only be explained on the theory that

the fins of fishes had been derived from continuous fin-folds. He also proved that the body-cavity of this primitive shark extended backwards almost as far as the tail fin, by examining microscope sections of the fossil which revealed the structures of the kidney. His researches on the Arthrodira led him to the conclusion that they were not Dipnoi, but while recognising them as much more primitive fishes, he failed to discover their connexion with ancestral sharks which Stensiö has lately demonstrated. Dean also devoted much attention to the supposed Devonian lamprey *Palaeospondylus*, which he regarded as wrongly interpreted: he thought it might be the larva of some larger fish.

Dean made many observations on the embryos of all the existing ganoid fishes, the Port Jackson shark, and certain hag fishes, besides the chimæroid fishes already mentioned. He prepared series of beautiful drawings, but many still remain unpublished. His memoir on the embryology of *Bdellostoma stouti*, contributed to Carl von Kupffer's "Festschrift" in 1899, may be specially mentioned as illustrated by some of his finest drawings.

Dean also took every opportunity of studying living fishes, and he made many important observations on the specimens of *Ceratodus* living in the London Zoological Gardens, which were published in the *Proceedings of the Zoological Society* in 1906 and 1912.

From the beginning of his career, Dean realised the difficulty of becoming acquainted with existing knowledge of his subject, and devoted much time to the preparation of an adequate bibliography. By 1910 this had become so unwieldy that he felt he could not complete it himself, and he then succeeded in obtaining the co-operation of the American Museum of Natural History for the final preparation and publication of the work. Under his general direction, the two volumes of the index to authors and titles were extended and edited by the late Dr. C. R. Eastman, and published in 1916-17. The third and final volume, extended and edited by Dr. E. W. Gudger with the co-operation of Mr. A. W. Henn, includes an exhaustive subject index, and was published in 1923. This great work of reference, which extends to the year 1914, is of inestimable service to ichthyology, and gained for Dr. Dean the D. G. Elliot medal of the United States National Academy of Sciences, immediately on its completion.

In 1893 Bashford Dean married Miss Alice Dyckman, who belonged to one of the oldest Dutch families of Manhattan Island, and his wife not only furthered his life-work by her sympathy and help, but also accompanied him on his numerous and extensive travels. He was as well known among the zoologists of Europe as among those of North America, and he had a large circle of friends in Britain. He was a corresponding member of the Zoological Society of London. His always delicate health handicapped him in his activities, but his enthusiasm never flagged, and his old-world courtesy and friendliness endeared him to all who were associated with him.

A. S. W.

PROF. E. H. L. SCHWARZ.

THE death of Prof. Ernest H. L. Schwarz, professor of geology in the Rhodes University College, Grahamstown, leaves South African geology much poorer owing to the loss of his enthusiasm, originality, and ability as a teacher and lecturer. Prof. Schwarz was born in London on Feb. 27, 1873, and educated at Westminster School and the Royal College of Science. His father was a London merchant engaged in the South American trade, but he went to South Africa, being attracted by its mining development, and in 1895 settled in Johannesburg, where he became editor of the *Scientific African*.

Prof. Schwarz was more interested in academic than in applied geology, and in 1896 joined the Geological Survey of Cape Colony and spent nine years in its service under Dr. A. W. Rogers. He investigated the older rocks of Cape Colony, and in co-operation with Dr. Rogers correlated them with those of the Transvaal. During his surveys of the Cape Devonian beds he described the complex folds in the Bokkeveld Series, the glacial beds in the Table Mountain Sandstone, and in an account of a collection of rocks from Tristan da Cunha founded his Flabellites Land for a Devonian continent occupying the South Atlantic and extending northward into the Mississippi Valley. In an account of some Karroo beds he suggested that certain tuffs had been formed by the deep-seated shattering of the granite basement. He made important contributions to the Cretaceous and Kainozoic geology of the eastern Cape Colony, and described Baviaan's Kloof (1903), with the series of tectonic basins which he called 'fault-pits'; he gave the name of the Alexandria Formation to a succession of beds which have been recorded as ranging from the Upper Cretaceous to the Pliocene. He also urged the great influence of marine planation in forming the plateau of the same part of Cape Colony.

In 1905 Prof. Schwarz was appointed to the chair of geology at Grahamstown, and had the opportunity to give play to his interests in the speculative sides of geology and cosmogony, and in his "Causal Geology" (1910) he applied some of the natural corollaries of T. C. Chamberlin's planetesimal theory to later geological history. In connexion with his educational work he prepared an excellent summary of the geology of South Africa and a small work on African geography.

While working in the backblocks of the Cape, Prof. Schwarz had been impressed with the diminution of the agricultural population and attributed it to growing desiccation of the country. The reduction of Lake Ngami from a great lake to a swamp, and later to a bare plain, seemed to Schwarz one effect of a process that was doing widespread injury throughout South Africa. He published his conclusions in 1920 in "The Kalahari, or Thirstland Redemption," in which he advocated the diversion from the Upper Zambezi of some of the flood waters that now rush wasted to the sea. He held that much of the water could be turned back