

tribes of that continent, and in this way it proved to be a very valuable demonstration in comparative ethnology.

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#### SCIENTIFIC BOOKS.

*The Coral Siderastrea radians and its Post-larval Development.* By J. E. DUERDEN. Washington, U. S. A. Published by the Carnegie Institution. December, 1904. Pp. 130, with 11 plates.

This handsome Carnegie memoir contains the record of an investigation begun at the Institute of Jamaica and subsequently carried on at the Johns Hopkins University and the American Museum of Natural History in New York. The author's prolonged residence in the West Indies gave him unusual opportunities in the way of command over living material, and the memoir makes valuable additions to our knowledge on many points of coral morphology.

An introduction deals with the systematic zoology and the habits of the species which is abundant and accessible in Kingston harbor. The form is obviously one of those convenient hardy types destined to play a part in laboratory investigations of histological and physiological character. Both the adult colony and the young polyp after metamorphosis grow in confinement and may be hand-fed. There follows an ample description of the anatomy of the adult. The species, like other West Indian corals, is possibly protogynous, although Professor Duerden calls to mind that Gardiner has established the converse phenomenon, protandry for *Flabellum*. Duerden takes up the question as to the way in which the coral skeleton, as a product of cellular activity, is produced. He confirms Miss Ogilvie's observation that the corallum can be seen in favorable parts of the adult and young polyps to be composed of minute skeletal units of a polygonal shape and exhibiting a fibro-crystalline structure. But whereas Miss Ogilvie interpreted these bodies as actual cells which were produced through the proliferation of the ectoderm, becoming calcified as fast as produced, Duerden regards them

as secretory products which are laid down wholly external to the ectodermal cells. In support of this view, essentially that advanced by von Koch, Duerden finds that the layer of ectoderm concerned in the production of the skeleton is always a simple layer, and that, moreover, it is always separated from the corallum by a homogeneous mesoglaea-like stratum. It is in this stratum of homogeneous matrix that the author believes the calcareous crystals forming the skeleton are first deposited.

A third section deals with the post-larval development. The larvæ, of the usual coral type, were obtained in July, and were kept under continuous observation for some months after attachment. Many valuable facts concerning the succession of the tentacles, mesenteries and various parts of the corallum are recorded in this section. A feature of interest lies in the attention paid to individual polyps. The partial transparency of the young animal permits of instructive views during life, and thus in one and the same individual the correlated development of the various organs could be followed from day to day. A result of this method was that periods of rapid growth and relative rest could be distinguished. The author points out that a phylogenetic significance possibly attaches to some of the more persistent stages, such as, for instance, that in which complete pairs of mesenteries (directives) are found at the two ends of the œsophagus, with two pairs, each consisting of a long (complete) mesentery and a short one, on each side of the œsophagus. This condition continued unchanged for a period varying from three weeks to three months. The author's theoretical views as to the meaning of this particular stage are summed up as follows:

The long retention of freedom of the fifth and sixth pairs of protocnemes suggests to my mind an ancestry in which the mesenteries as a whole, including the metacnemes, were alternately long and short, excluding, of course, the axial directives. Among modern examples this is retained in the mesenterial system of the zoanthids, *Porites*, and *Madrepora*, and was perhaps characteristic of the Rugosa.

The building up of the corallum is followed out in detail through the formation of the third cycle of permanent septa. Among the illustrations of this part of the work special mention is due the microphotographs of macerated skeletons of developing polyps, and the figures of living polyps with the beginning skeleton *in situ*. Much interest attaches to Professor Duerden's account of the development of the septa. It has been hitherto assumed that the septa of a new cycle appear in the exocœles (*i. e.*, the space between two pairs of mesenteries), but are later embraced by the newly appearing pairs of mesenteries in such wise as to lie in the entocœles (*i. e.*, the space between the mesenteries of a pair). Thus the same septa would be first exocœlic and then entocœlic. In opposition to this scheme Duerden's observations lead him to the conclusion that while exosepta are formed in successive cycles, they never become entosepta. The cycles of entosepta are strictly new formations, appearing as do the primary six septa in entocœlic spaces. The succession of the cycles of exocœlic septa is maintained through the continued peripheral bifurcation of preexisting exocœlic septa. The bifurcated extremities become the (exocœlic) septa of a new cycle, while the main septum is incorporated in the growing body of one of the last formed cycle of entosepta. Having respect only to the actual facts as observed in *Siderastrea*, it has been found that any one of the permanent septa, later than the first six, has a double origin. It is in part a new formation (entocœlic), and in part a preexisting formation (exocœlic). The two parts fuse, and the fusion is interpreted by Professor Duerden as the incorporation by a growing organ of the remnant of a vanishing organ. In a developing corallum according to this view exosepta are formed at each stage of growth, only to disappear as the permanent septa, entosepta, come into existence. Thus the development of coral septa affords an excellent example of substitution: temporary organs precede and are replaced by permanent organs performing the same function as the former. As a corollary to this conclusion the author expresses his belief that the

exoseptal predecessors of the permanent septa do not wholly disappear in all corals, as independent structures, but persist in some species in the shape of the *pali* found in front of the larger septa.

H. V. W.

*Die Krystallgestalten der Mineralogie in Stereoskopischen Bildern.* Von Professor THEODOR HARTWIG, Professor at the Staatsrealschule in Steyr, Upper Austria. Vienna, Verlag von A. Pichler's Witwe und Sohn.

As the author says in his description of the set,<sup>1</sup> the method of stereoscopic illustration has been applied within a few years in medicine, in technical science, as for instance in drawings of machines, for the representation of microscopic objects, and in the measurement of terrestrial and astronomical distances. In this application to crystallography Professor Hartwig has prepared 120 stereographic drawings of crystals, which are printed on white cardboard and placed in a simple stereoscope with adjustable focus, the whole packed in a neat box.

The drawings are divided into two sets, (A) the simple crystal forms and separate projections of the axes of the six systems, and (B) the more usual combinations in examples of natural crystals. The usual clinographic projection is used, modified of course for the stereoscope, and in all cases the axes are projected inside the forms. The effect of solidity produced by these drawings and the clearness of the relations shown is surprising; in some ways they surpass the usual glass models with colored threads inserted to represent the axes. In the development of hemihedral forms from the corresponding holohedral the effect is particularly good and yet something is left to the imagination of the student in completing their derivation. The drawings are intended to supplement solid models, especially in individual instruction, and perhaps in some cases to replace the more expensive glass models, as with the hemihedral forms mentioned above.

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<sup>1</sup> *Zeitschrift für Lehrmittelwesen und pädagogische Literatur*, Vol. 1, No. 7, 1905, pp. 217-220.