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AN ATLANTIC HELIOPORAN CORAL (COELENTERATA: OCTOCORALLIA)

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The well-known blue coral of the tropical Indo-Pacific, *Heliopora coerulea* (Pallas, 1766), with its massive corallum containing tabulated corallites, has long been considered unique among octocorals in producing a skeleton of crystalline aragonite not composed of fused sclerites. This coral was placed by Bourne (1895, 1900) in a new subdivision of the octocorals called Coenothecalia, along with the fossil tabulate genera *Heliolites*, *Thecia*, *Plasmopora*, *Propora* and *Lyellia*. These fossils were included in the anthozoan order Tabulata by Hill and Stumm (1956), and divided between the subclasses Heliolitoidea and Tabulata by Sokolov (1971 [1962]).

Hickson (1911, 1912) assigned a peculiar coral-like organism dredged off Cuba by the U.S. Coast Survey steamer *Blake* (Agassiz, 1888) to the Coenothecalia under the name *Ceratoporella nicholsoni* (originally *Ceratopora*, preoccupied). However, recent investigations by Hartman and Goreau (1966, 1970) have revealed that *Ceratoporella* and related forms are not coelenterates but sponges, for which they proposed the new class Sclerospongiae, at the same time demonstrating close similarity to the fossil stromatoporoids and suggesting that at least some of the Tabulata (e.g., some Mesozoic and Cenozoic Chaetetidae) may be related. With this discovery, the widely distributed tropical Indo-west Pacific *Heliopora coerulea* remains the only living representative of Bourne's Coenothecalia.

A. E. Verrill, in his never-completed report on the octocorals of the *Blake* and *Albatross* expeditions, illustrated an unusual Caribbean octocoral with the growth-form of a telestid, having a rigid calcareous skeleton and typical octocoral sclerites in the polyps. The specimen was among many that were lost before Diechmann restudied the *Blake* and *Albatross* collections, so the species does not appear in her published report (Deichmann, 1936).

A colony of stoloniferous octocoral collected by Dr. John B. Lewis at Barbados, now in the U.S. National Museum of Natural History, can be identified unmistakably as Verrill's long-lost species. Examination of the rigid skeleton by scanning electron microscopy shows that it is not formed by fused sclerites as is usually the case in octocorals, and x-ray diffraction analysis shows that it is not composed of calcite as is the case in *Tubipora*

and other alcyonacean and most gorgonacean corals, but of aragonite as in *Heliopora*. This discovery prompted a morphological comparison of the specimen with *Heliopora*, the results of which lead to the conclusion that the Caribbean coral is closely related to it and should be classified in the same order.

It is highly gratifying to rediscover this species originally found by Verrill, and to describe it now under the name that he originally proposed for it.

Lithotelesto micropora, new genus and species
Figs. 1–6

Colonies consisting of rigid cylindrical polyps 0.7–0.8 mm in diameter arising from a ribbon-like stolon attached to solid substrate (in the type-specimen, a cidarid sea-urchin spine). Primary polyps producing lateral polyps of second and possibly third order according to Verrill's illustration (Fig. 1a), which indicates a total height of about 7 mm. The tallest polyp of the type is 5 mm in height, unbranched.

Anthocodiae armed with crosses and capstans of typically octocorallian form (Fig. 1b), fully retractile within the rigid calices, which are not tabulated internally. Calicular wall externally sculptured with 16 round-bottomed grooves (Fig. 1c) alternating with ridges which distally project as low, blunt dentations around the calicular rim (Fig. 3a). The ridges are 0.05–0.1 mm wide, interrupted in a few places resulting in anastomosis of the grooves. The wall is perforated by a row of pores along the bottom of each groove (Figs. 1c–d; 2b); pores at approximately the same level in adjacent grooves join inwardly behind the ridge and open into the gastric cavity as a single pore (Figs. 3b; 6). The inner surface of the wall is smooth, visibly marked only by the rows of pores but showing no trace of skeletal septa or pseudosepta (Fig. 1d). The outer surface is covered by a conspicuous yellowish cuticle.

Examination of the skeleton of an unbranched polyp by scanning electron microscopy (Fig. 2a) shows the pores to be about 0.04–0.05 mm in diameter (Fig. 2c) and 0.18–0.23 mm apart (Fig. 2b). Between the pores are minute, shallow, circular punctae about 0.015 mm in diameter (Fig. 2d), up to 0.06 mm apart but sometimes contiguous (Fig. 2b), for the most part arranged in two rows. Punctae also occur scattered on the inner surface of the wall, where the pores are aligned in rows. No trace of fusing spicular structure is present, even at the calicular rim (Fig. 3a) where it is very obvious in those forms that have spicular walls (e.g., *Tubipora musica* (Linnaeus), *Pseudocladochonus hicksoni* Versluys, and some species of *Telesto* and *Calvularia*). High magnification shows the wall to be composed of hexagonal crystals of aragonite, sometimes with several faces exposed (Fig. 5c). Transverse thin-sectioning of the calicular skeleton shows

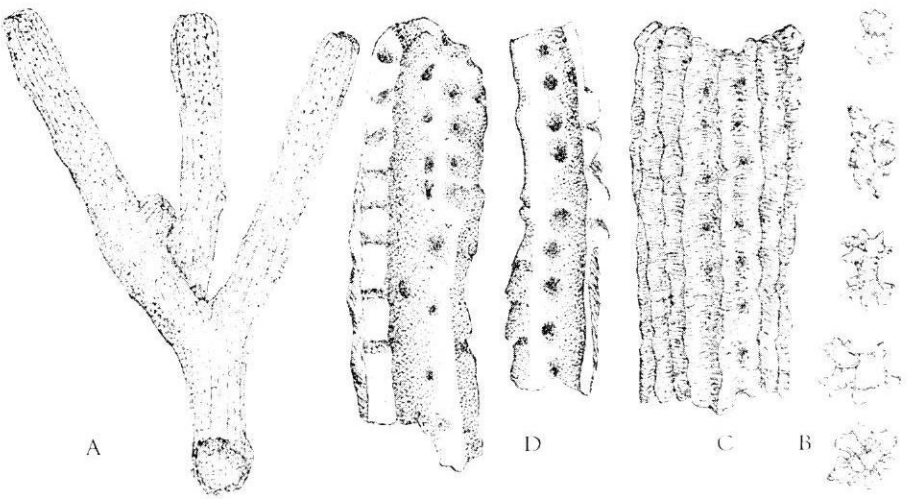


Fig. 1. *Lithotelesto micropora.* Verrill's unpublished figures. a, Colony ×6.6 approx.; b, Sclerites ×120 approx.; c, Outer surface of calicular wall ×30 approx.; d, Inner surface of calicular wall ×30 approx.

that the ridges each contain a center of calcification from which the crystals of aragonite radiate outward (Fig. 6), hence are structurally similar to the simple trabeculae of stony corals.

The sclerites as seen by scanning electron microscopy (Fig. 4) agree satisfactorily with Verrill's rather crude illustration of them (Fig. 1b). Basically they are 6-radiate capstans, some modified into crosses and some very irregularly developed. The largest are about 0.09 mm in length.

The polyps have the general anatomical features typical of octocorals, and the anthocodiae retract fully within the distal part of the calices. The proximal part of the anthocodial wall is filled with sclerites, which extend in 8 narrow interseptal rows along the backs of the tentacles. The distal, infolded part of the anthocodial wall is extremely thin and lacks sclerites except for the interseptal rows. The 8 anatomical septa extend from the hypopharynx to the lower limit of the gastric cavity and are furnished with very strong retractor muscles (Fig. 6). The asulcal septa are distinguished by their bilobed filaments. The tissue lining the gastric cavity of the polyp is extremely thin and the mesogloea is reduced to a mesolamella. Extensions of the gastric cavity pass through the pores in the calicular wall and continue as solenia in the external grooves of the wall, which are filled with mesogloea containing widely scattered sclerites (Fig. 6). The solenia extend along the grooves in the stolons and possibly in canals penetrating the stolons.

Holotype.—USNM 52523.

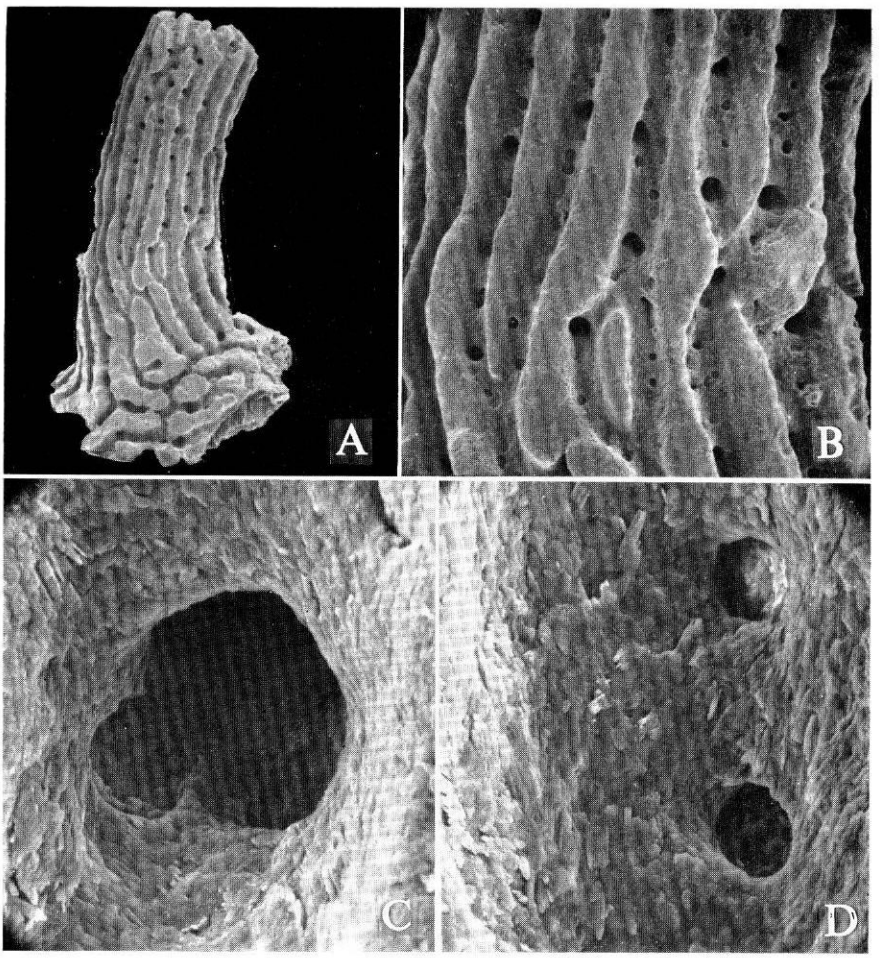


Fig. 2. *Lithotelesto micropora.* SEM micrographs of polyp from type-colony. a, Side view of calicular skeleton ×20; b, Outer surface of wall ×66.6; c, pore ×666; d, Two punctae ×666.

Locality.—Lesser Antilles: off west coast of Barbados, dredged in 50–400 m; coll. Dr. John B. Lewis, NR1 2ID103.

Comparisons.—Although differing widely from *Lithotelesto micropora*, the skeleton of *Heliopora coerulea* (Fig. 5a) shows some striking structural similarities. The walls of both the corallites and the diverticular pits ("Coenenchymal fenestra," Bourne, 1895) are conspicuously marked with punctae similar to those of *Lithotelesto micropora* in size and appearance (Fig. 5b). The walls are composed of hexagonal crystals of aragonite (Fig. 5d) closely resembling those of *Lithotelesto.*

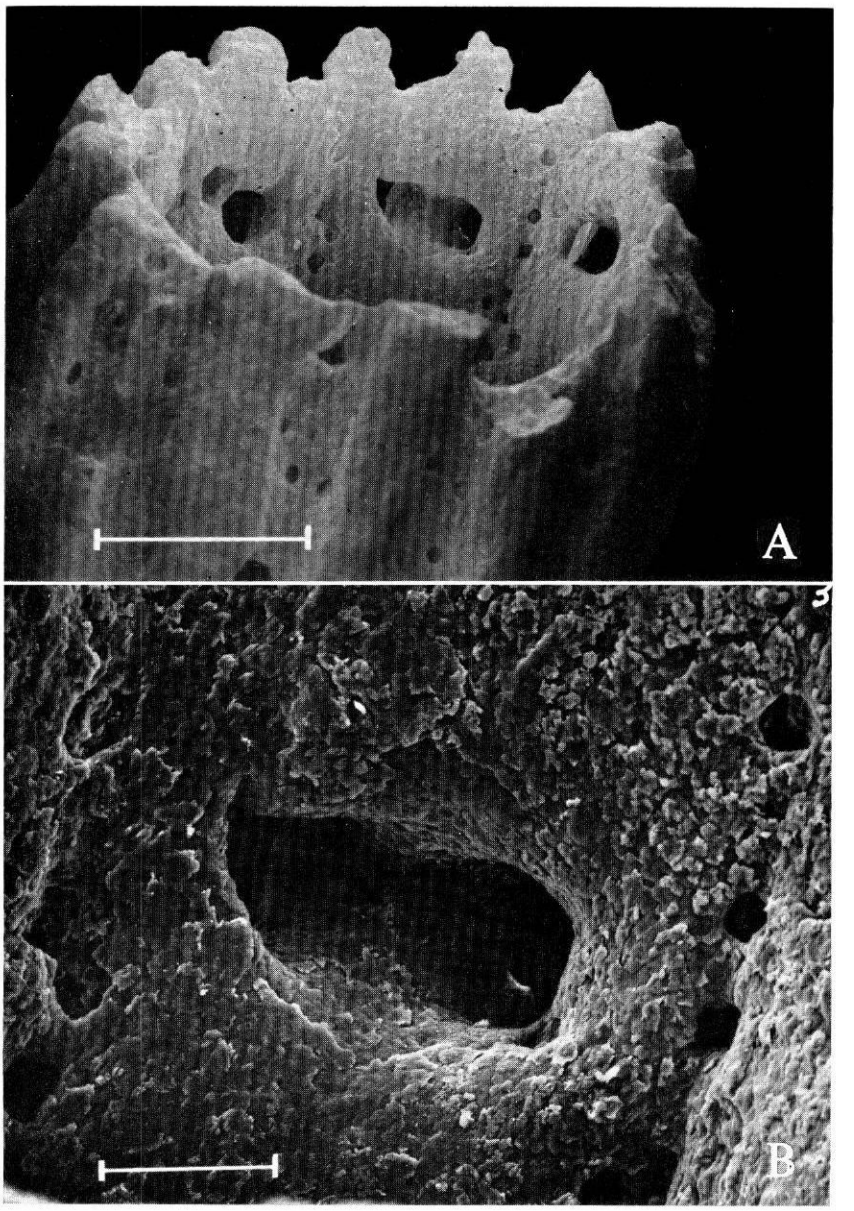
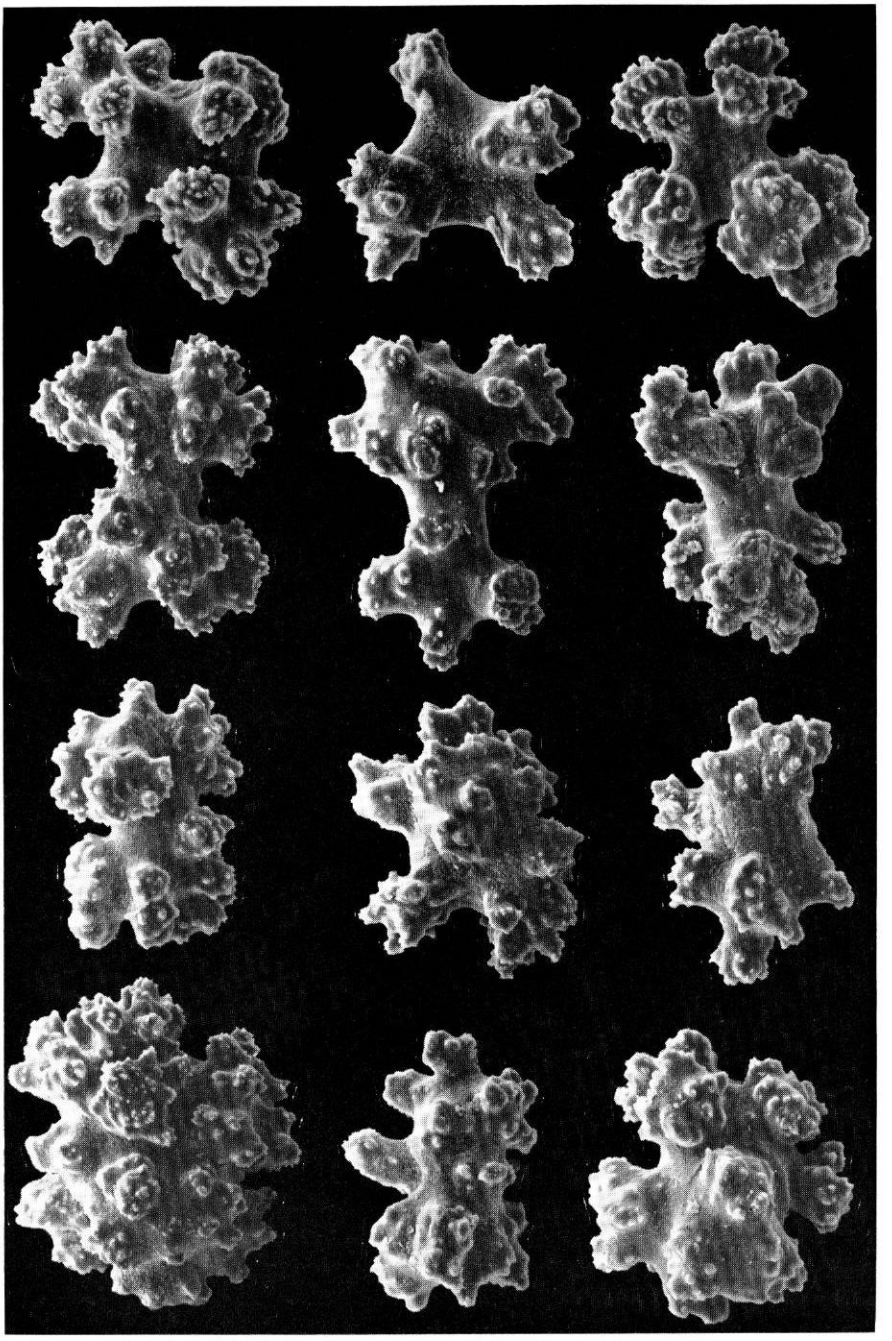


Fig. 3. *Lithotelesto micropora.* SEM micrographs of polyp from type-colony. a, Oblique view of calicular margin ×150, length of scale 200μm; b, Common internal orifice of porepare ×500, length of scale 50 μm.



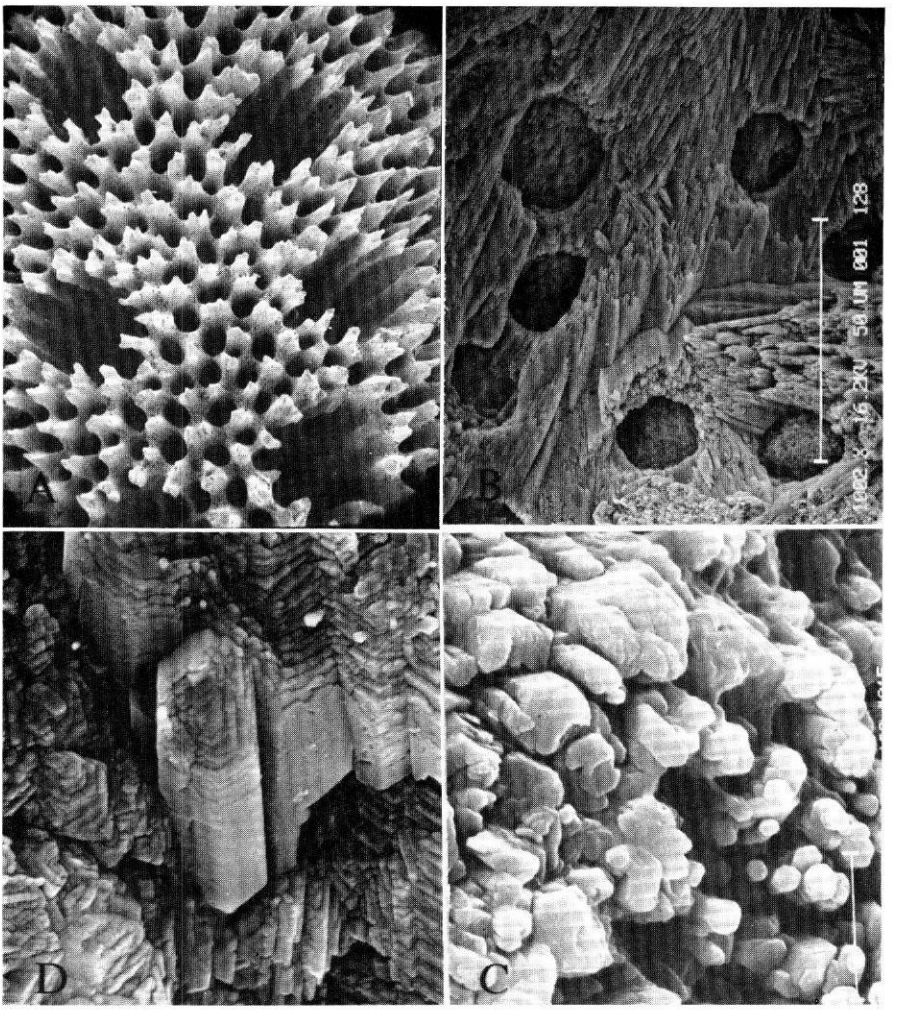


Fig. 5. a–c, *Heliopora coerulea*, SEM micrographs of: a, Surface of corallum showing calices and diverticular pits ×20; b, Inner surface of calicular wall showing punctae ×666, length of scale 50 μm; c, Aragonite crystals of calicular wall ×10,000, length of scale 2 μm; d, *Lithotelesto micropora*: aragonite crystals of calicular wall ×10,000.

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Fig. 4. *Lithotelesto micropora*. SEM micrographs of sclerites from polyp of type-colony ×500.

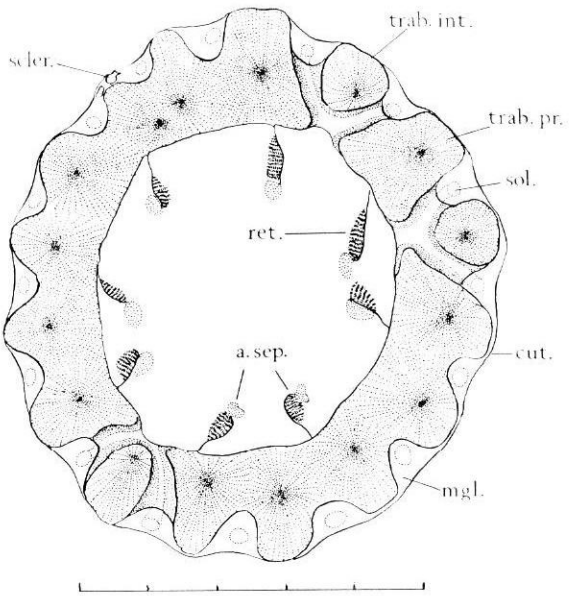

Fig. 6. *Lithotelesto micropora.* Cross section of polyp in middle region ×100. *a. sep.* = asulcal septa; *cut.* = cuticle; *mgl.* = mesogloea; *ret.* = retractor muscle; *scler.* = sclerite; *sol.* = solenial canal; *trab. int.* = intermediate trabecula; *trab. pr.* = principal trabecula. Scale represents 0.5 mm.

The gross form of the corallum in *Heliopora* is so well known (Moseley, 1876, 1881; Bourne, 1895, 1900; Bouillon and Houvenaghel-Crevecour, 1970) that we will not discuss it further here. Details of the ultrastructure will be described and compared with that of *Lithotelesto* and other octocorals in a subsequent paper.

Remarks.—Because of the severely limited amount of material available, sclerites were not analyzed by x-ray diffraction, but those of a polyp embedded in epoxy resin for sectioning were tested with Feigel's solution. This yielded no evidence that the sclerites are aragonitic, although the calicular wall gave a strong positive reaction. The extremely scanty material available for study also precludes a detailed investigation of the polyps. The tentacles stand vertically in the oral cavity, but it has been impossible to reconstruct the way in which retraction is accomplished. No gonads are recognizable.

Classification.—We propose to include *Lithotelesto* in the order Coenothecalia, which must be redefined on the basis of characters different from those used by Bourne. As we consider the important characters to be the crystal structure, mineralogy and morphology of the wall rather than the

commonality of walls as conceived by Bourne (1895:468), the name Coenothecalia is inappropriate, and we prefer Bock's name Helioporidea based on the name of the type-genus and family. The ending is here altered to conform with those in use for the other octocorallian orders.

Order HELIOPORACEA Bock, 1938 (nom. correct.)

Colonial monomorphic Octocorallia permanently anchored basally or attached by stolons, with a rigid calcareous skeleton composed of hexagonal crystals of aragonite, not fused sclerites, into which the polyps, with or without sclerites, are completely retractile.

Lithotelestidae, new family

Helioporaceans with stoloniferous growth form, with both stolons and calices forming a rigid skeleton of crystalline aragonite; cylindrical calices bear secondary lateral calices; polyps fully retractile, containing octocorallian sclerites in the form of capstans and crosses composed of calcite.

Lithotelesto, new genus

Diagnosis.—Small, scantily branched colonies consisting of axial polyps bearing a few tall secondary polyps, arising from narrow stolons encrusting solid objects. Skeleton of body walls rigid, not formed of inseparably fused sclerites but consisting of vertical trabeculae of crystalline aragonite which produce prominent longitudinal ridges separated by round-bottomed grooves, perforated by numerous small pores aligned along the bottom of the grooves; skeletal surface marked by small, impressed punctae. Anthocodiae retractile into the distal end of the calices, armed with numerous 6-radiate capstans commonly modified as crosses; calices not tabulated. Outer surface covered by cuticle.

Type-species.—*Lithotelesto micropora*, n. sp., here designated.

Distribution.—Lesser Antilles; 50–400 m.

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