THE STONY CORALS OF THE PORTO RICAN WATERS.

BY

T. WAYLAND VAUGHAN.
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THE STONY CORALS OF THE PORTO RICAN WATERS.

By T. WAYLAND VAUGHAN.

INTRODUCTION.

In the following account of corals collected around Porto Rico by the U. S. Fish Commission steamer Fish Hook during the expedition of 1898-1899, I have used a considerable part of a paper written for the Royal Leyden Geological Museum, entitled "Some Fossil Corals from the Elevated Reefs of Curacao, Arube, and Bonaire." As that paper may not be easily accessible to all of those into whose hands the present one may fall, instead of referring to it, the necessary data are republished here.

My conclusions regarding synonymy may not meet universal agreement among students of zoophytes. The number of species recognized is very often a function of the amount of material studied. My guide in the separation of species has been the absence of intermediate forms, and from the study of enormous amounts of material I have felt justified in uniting previously characterized species to a greater extent, probably, than any other student of West Indian corals; but I have recognized that the species can often be divided into considerable numbers of forma or varieties and have correspondingly treated many of them. By means of the notes on the material from Porto Rico and the profuse illustrations, one should be able to know precisely what particular varieties or forms of the species have been collected and studied.

The following table gives the numbers of the stations at which the species were collected and the depth and character of the bottom:

<table>
<thead>
<tr>
<th>Name.</th>
<th>Locality.</th>
<th>Depth (fathoms).</th>
<th>Bottom.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caryophylla baetica Duchassaux</td>
<td>Not given.</td>
<td>48</td>
<td>Sand, mud, shells.</td>
</tr>
<tr>
<td>Cystophora portoricensis, sp. nov.</td>
<td>Station 6091</td>
<td>81 to 99</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Paracyathus filippil Duchassaux &amp; Michelotti</td>
<td>Station 6092, 6093</td>
<td>97 to 100</td>
<td>Sand, mud, shells.</td>
</tr>
<tr>
<td>Oculina diffusa Lamarck, var.</td>
<td>Station 6092, 6094</td>
<td>10 to 16</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Azitella acropora (M.-Edw. &amp; H.) mirabilis (Huchings &amp; Michelotti)</td>
<td>Station 6097</td>
<td>16</td>
<td>Sand, mud, shells.</td>
</tr>
<tr>
<td>Meandrina meandrites (Linn.) young</td>
<td>Station 6097</td>
<td>16</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Cladocora arborescens (Le Sueur)</td>
<td>Station 6097</td>
<td>16</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Psammocora dublis M.-Edw. &amp; H.</td>
<td>Station 6097</td>
<td>16</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Astrangia solitaria var. portoricensis, var. nov.</td>
<td>Not given.</td>
<td>16</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Orbicella aequora (Linn.) var.</td>
<td>Mayaguez</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>Pavilla formosa (Esper)</td>
<td>Playa de Ponce</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>Manicina areolata (Linn.)</td>
<td>Ensenada Honda, Mayaguez</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>Platygrya virida (Le Sueur)</td>
<td>Mayaguez</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>Siderastrea radians (Pallas)</td>
<td>do</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>Aegialia elephantotus (Pallas)</td>
<td>Culebra</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>Agarica sp.</td>
<td>Culebra</td>
<td>16</td>
<td>Reef.</td>
</tr>
<tr>
<td>&quot;Diaspora&quot; cribsa Pouteaux</td>
<td>Mayaguez, etc.</td>
<td>225 to 251</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Isorora mureta (Linn.)</td>
<td>Culebra</td>
<td>225 to 251</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Portites portites (Pallas) forma clavaria Lam</td>
<td>Culebra, Ensenada Honda</td>
<td>225 to 251</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Portites sp. forma divaricata Lam</td>
<td>Culebra, Ensenada Honda</td>
<td>225 to 251</td>
<td>Coral sand.</td>
</tr>
<tr>
<td>Millepora alticornis Linn</td>
<td>Mayaguez, Culebra</td>
<td>225 to 251</td>
<td>Reef.</td>
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</tbody>
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In the arrangement of families I have followed Verrill quite closely, as his classification seems the most satisfactory in many respects. The new family names which are proposed are for the most part necessary changes of old names, his general scheme being followed.

The plates are from photographs by Mr. Levin C. Handy. The drawings for the other figures were made by Dr. J. C. McConnell and Miss Florence Wieser.

DISCUSSION OF SPECIES.

Class ANTHOZOA.

Order ACTINÆ.

Suborder SCLERACTINÆ.

Family CARYOPHYLLIDÆ Verrill.

Genus CARYOPHYLLIA Lamarck, 1801.


A single young specimen of a species of Caryophyllia was obtained. C. berteriana is apparently the only species to which it can be referred. The correctness of the identification is not quite positive, and therefore the name above is followed by a question mark. Locality not given.

Genus PARACYATHUS Milne-Edwards & Haime, 1848.

Paracyathus de filippii Duchassaing & Michelotti. Pl. 1, figs. 1, 2a.


Two specimens of this common West Indian species were obtained from station 6062, Mayaguez Harbor, and station 6075, Boca Prieta, Point Guaniquilla. Both are young and neither is very good. Bathymetric occurrence, 8 to 30 fathoms.
THE STONY CORALS OF THE PORTO RICAN WATERS.

Genus CYATHOCERAS Moseley, 1881.

**Cyathoceras portoricensis**, sp. nov. Pl. ii, figs. 1, 1a, 1b, 1c.

Corallum attached by a fairly large base, from which arises a rather long, thick, stout, bent pedicel. Calice elliptical in cross section. Greater diameter of calice, 9.3 mm.; lesser diameter of calice, 7.5 mm.; height of corallum, 22.5 mm.; greater distance across area of attachment, 7.5 mm.

There is no distinguishable epithelial coat on the outside of the corallum. Costae correspond to all septa. Near the calice they are quite prominent and show three different sizes; a few millimeters below the calicular margin they are not prominent, being represented by granulations in rows very slightly or not elevated. The cycles of costae may be indistinct or those corresponding to the first and second cycles of septa may be somewhat larger than those corresponding to the third and fourth.

There are four cycles of septa, in six systems. The members of the first and second cycles project considerably above the upper margin of the corallum wall, are nearly equal in size, those of the first cycle being slightly larger, and extend inward to the columnella. The members of the third cycle are considerably smaller, and those of the fourth cycle are very small. The inner margins of the septa of these two cycles are free, i.e., no septal groups are formed. The septal margins are entire or microscopically dentate. The ornamentation of the septal faces consists of fine, more or less elevated strie, along which granulations are arranged. The strie diverge inwardly and outwardly from a vertical line corresponding in position with the wall. The strie on one side of a septal face alternate with those on the opposite side, thus giving the edge of the septum a transversely zigzag character. The granulations on the septal faces are low, and besides being placed along the strie are arranged in curves parallel to the septal margins. The inner margins of the septa fall perpendicularly to the bottom of the calice. There are no pali. No endotheca of any kind was observed, but the base of the corallum is filled up solidly with internal calcareous deposit.

The calicular fossa is deep and narrow. The columnella, which projects somewhat in the bottom of the fossa, is well developed, is compressed elliptical in transverse outline, spongy, and apparently essential. It appears to be made up of several twisted ascending trabeculae, that have fused one to another and to the inner ends of the first and second cycles of septa.

From station 6051, off entrance to San Juan Harbor, Old Fort SW. 1/4 W., 1 1/2 miles. Bathymetric occurrence, 43 fathoms; bottom, sand, mud, and shells. Type, No. 19633, U. S. Nat. Mus.

I have been unable to find any description of a cora, corresponding to this in the literature on the recent deep-sea corals, and therefore propose a specific designation. In view of the great amount of study that has been put on the West Indian deep-sea species by such excellent workers as Pournalès and Moseley, it was a surprise to find a new species in the Porto Rican collection.

Moseley proposed the genus *Cyathoceras* for two species: C. cornu, from off the mouth of Rio de la Plata, 600 fathoms, and off Twofold Bay, New South Wales, 120 fathoms; and C. rubescens, off the Ki Islands, 129 fathoms. He remarks: "This genus is formed to receive two species which might be placed with *Desmophyllum* if they had not columnellas in every respect resembling those of the *Caryophyllus*." 1 Before the specimen above described was cleaned I thought it was a *Desmophyllum*, and before I discovered there were no pali I thought it was a *Caryophyllus*. The present species is so distinct from each of those described by Moseley that there is no need to point out specific differences. It resembles more closely *C. rubescens* than *C. cornu*, but *C. rubescens* possesses five cycles of septa besides other differences.

I do not feel certain that *Cyathoceras* is entitled to hold rank as a good genus. It is extremely close to *Ceratoctrochus*, as represented by *C. duodecimcostatus* (Goldfuss), the difference between the two genera consisting in *Ceratoctrochus* having a pointed or small base, whereas *Cyathoceras* possesses a rather large base. Even if they should be united, they may for the present be kept separate.

Genus DELTOCYATHUS Milne-Edwards & Haime, 1848.

**Deltoctyathus italicus** (Michelotti). Pl. i, figs. 2, 2a. (Copied from Lindström).

One dead, worn specimen of this species was obtained. It is the variety *colclor* of Pournalès, possessing six horns corresponding to the six primary septa. 2

From station 6067, Mayaguez Harbor. Bathymetric occurrence, 97 to 120 fathoms.

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Family OCULINIDÆ Milne-Edwards & Haimé.

Genus Oculina Lamarck, 1816.

Oculina diffusa Lamarck, var. Pl. I, figs. 5, 5a.


A number of specimens of this species are in the collection from stations 6097, off Humacao, village of Humacao; 6087, off Culebra, Point Mula light-house; 6092, off Vieques Island, Culebritas light-house; 6093, off Culebra, Culebritas light-house. Bathymetric occurrence, 10 to 16 fathoms.

These specimens differ from the typical diffusa by having the branches more attenuate and more slender; one branchlet measures 2 cm. between bifurcations, and possesses a diameter of only 3 mm. The appearance of these specimens is so different from the usual diffusa of the Florida reefs that I at first thought them a distinct species, but a study of the splendid suites of specimens in the United States National Museum has caused me to believe that they may be only varieties of the same thing. I doubt very much if Oculina pollens Ehrenberg can be kept separate, in spite of what at first appear important differences. This suggestion is based upon studies of Ehrenberg’s types and the material in the United States National Museum. The only difference between the Porto Rican specimens and O. pollens consists in the corallites of the latter being not so prominent as those of the former. The pali of the Porto Rican specimens are the same as in O. pollens. The same is true of the costae. As yet I have not studied sufficient material to have a definite opinion about the relations of the species. The data preliminary to the revision of all the West India species of Oculina have been accumulated, but an opportunity for working them out has not yet come to hand.

Family STYLOPHORIDÆ Verrill.

Genus Axhelia Milne-Edwards & Haimé, 1849. (+ Madracis Milne-Edwards & Haimé.)

Type species: Axhelia myriaster Milne-Edwards & Haimé.
Type species of Madracis: Madracis asperula Milne-Edwards & Haimé.


I am unable to discover any criterional differences for the separation of Axhelia (subsequently spelled Axohelia) from Madracis. Milne-Edwards & Haimé in speaking of the species of Madracis state: “Elles représentent dans cette division aberrante les Axhelia, de la famille des Oculinides, ayant des cloisons et une columelle très prés semblables; mais leur énchemaïme, quoique très dense, est d’une structure différente, et les chambres des polypiérites ne tendent pas à se remplir par l’envahissement du tissu mural.”

The only tangible difference is, in Axhelia the visceral chambers fill up by the encroachment of the wall, while in Madracis “the chambers of the corallites do not tend to become filled by the invasion of the mural tissue,” but this is weakly expressed. In young calices of Axhelia the visceral chambers are open, but they are filled in older calices. The figure of Madracis asperula given by Milne-Edwards & Haimé are from a young specimen.

Axhelia asperula (Milne-Edwards & Haimé). Pl. I, fig. 4, and Pl. xvii, fig. 2.


Several specimens from station 6087, off Culebra, Point Mula light-house, agree with both the figures and the description given by Milne-Edwards & Haimé, except that the calices are smaller, slightly less than 1.5 mm. in diameter. Bathymetric occurrence, 15½ fathoms.

The Stony Corals of the Porto Rican Waters.

 Axohelia mirabilis (Duchassaing & Michelotti). Pl. 1, fig. 3, 3a.


A single specimen of this species was obtained at station 6051, off entrance to San Juan Harbor, in 43 fathoms of water.

Pourtales has called attention to the specific identity of Stylophora mirabilis Duchassaing & Michelotti, Stylophora dumetosa Duchassaing, and what he had previously identified as Axohelia myriaster Milne-Edwards & Haine. He seemed doubtful concerning his own Axohelia schrammi. 1 We have good suites of specimens in the United States National Museum, so I do not hesitate to include Axohelia schrammi also in the synonymy of mirabilis. I can discover no criterional characters from the description or figure of Ax. myriaster by which the West Indian species can be separated from it. The branches may or may not be very coalescent. But as the original locality for myriaster is given as the East Indies, and as I have not studied the type, I have followed Pourtales in giving the name mirabilis to this West Indian species. The Axohelia decactis (Lyman) is a different species. Some specimens in the United States National Museum from off Arrowsmith Bank, Yucatan, 130 to 167 fathoms, Cat. No. 10279, are interesting because they show on the same specimen both striate and echinulate ctenenchyma. The echinulations may be tall and coarse, or delicate.

The principal difference between the specimen here referred to asperula and those referred to mirabilis consists in the branches of the former being not so attenuate as those of the latter species.

Family EUSMILIDÆ Verrill.

Genus MEANDRINA Lamarck, 1801.

Type species: Meandrina pectinata Lamarck (= Madrepora meandrites Ellis & Solander, Nat. Hist. Zooph., p. 161, tab. xlVIII, fig. 1).

1815. Meandrina (pars), Oken, op. cit., p. 70, pl. ii, second column, bottom fig. (= pl. iv A, Esper, reduced).

This name Meandrina has had a perplexing and exasperating history. When Lamarck proposed it, he included only one species in the genus, referring at the same time to a figure by Ellis & Solander; this species is Meandrina pectinata of Lamarck, the Madrepora meandrites of Linnaeus' and of Ellis & Solander. This species is the type and it can not be supplanted by any other. In 1815 Oken proposed the name Pectinia for a genus in which he included two species, Meandrina pectinata and Madrepora lactuca. In the same work Oken used Meandrina, which was defined "Mündungen als Furchen vielfältig hin und hergewunden wie hirnwindungen, unverzweigt, in Klumpen." 2 He included in the genus M. areola (=Manicina areolata (Linna.)), and M. meandrites, which he divides into two varieties, (a) Gemeines Hirnkorall, Madrepore meandrites Pallas, labrinthiformis Linn. Blätter gezähnelt. Das gewöhnliche, das man in Kabinetten antrifft." This is partly Diploria labinthiformis, but quite surely a considerable number of species are here confused. "(b) Irrgarten, M. labrinthiformis Pallas, meandrites Linn.; Blätter ungezähnelt. Sehr selten, Amerika, auch im Mittelmeer," u. s. w. This is Meandrina meandrites (Linn.). "Hieher Madrepore gyrosa, dedalea, natana."
The figure given by Oken, pl. ii, second column, bottom figure, is a copy, somewhat reduced, of Esper's pl. iv a, which is *Madrepora meandrites* Linn. = *Meandrina meandrites* (Linn.). I think it best to consider the figured species as the type of the genus. This would make *Meandrina* Oken a synonym of *Meandrina* Lamarck. Lamarck in 1816 included nine species in his *Meandrina*, the last one being the *Madrepora flagrana* of Esper (= *elviosa* of Ellis & Solander). Dana's *Ctenophyllia* covers precisely the same ground as Lamarck's original *Meandrina*. In 1848 Milne-Edwards & Haimé, in the *Ann. Sci. Nat.*, t. x, use *Ctenophyllia* for Lamarck's original *Meandrina* (following Dana), and in the *Comptes Rendus*, t. xvii, make *flagrana* the type of *Meandrina*, i.e., they ignored the *Système des Animaux sans Vertèbres* of 1801, and selected as the type of the genus the last species referred to the genus in Lamarck's *Histoire Naturelle des Animaux sans Vertèbres* of 1816. In 1851, in their *Polyziens des Terrains Paléozoiques*, *Pectinia* of Oken replaces their previous *Ctenophyllia*; the same course is followed in the *Histoire Naturelle des Coralliaires* in 1857.

The type of *Meandrina* being fixed, we can make disposition of the other names. First, as to *Pectinia*. Since two species were originally included in the genus by Oken, one of them must be the type. The species *pectinata* cannot be the type, because it was already the type of *Meandrina*; therefore *lacteae* must become the type of *Pectinia*, and *Tridacophyllia* of Milne-Edwards & Haimé must become a synonym of *Pectinia*. *Meandrina* becomes a synonym of *Meandrina*. *Ctenophyllia* is an exact synonym of *Meandrina*. A new name must be used for what Milne-Edwards & Haimé have called *Meandrina*. The name *Platygyna* of Ehrenberg,1 which has not been used by subsequent authors, is available. This name is fully discussed later in considering the species referable to it.

These changes in the names are unfortunate, but they can scarcely be avoided. They may be summarized thus:

<table>
<thead>
<tr>
<th>Present names.</th>
<th>Name used by Milne-Edwards &amp; Haimé, 1867.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Meandrina</em></td>
<td></td>
</tr>
<tr>
<td><em>Pectinia</em></td>
<td></td>
</tr>
<tr>
<td><em>Platygyna</em></td>
<td></td>
</tr>
</tbody>
</table>


*Ctenophyllia profunda* and *pachyphylla* Dana (1848) probably should be included in the above synonymy. Twelve species of *Meandrina* (*Pectinia auct.* have been described or named, viz, *meandrites* by Linnæus; *lamellosa* by Humphreys; *pectinata* by Lamarck; *pachyphylla* by Ehrenberg; *quadra* and *profunda* by Dana; *brasiliensis*, *daneae*, and *sewae* by Milne-Edwards & Haimé; *disticha*, *elegans*, and *carinosa* by Duchasssing & Michelotti. My study of the synonymy of *meandrites* has resulted in the identical conclusion of Gregory, except that I have also included Dana's *profunda* as questionable.

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1 Corallenth. Rothen Meeres, p. 323.
The West Indian species of *Meandrina* may be divided into two sections, typified by the mode of multiplication of the valleys. Milne-Edwards & Haime recognized these characters, as their descriptions show, but they did not give them the importance that should be attached to them. The valleys in the *nucundrites* section are usually arranged in a recognizably radial manner, radiating outwardly from the center of the upper surface of corallum (the valleys may be irregularly arranged). The other section is typified by *M. brasiliensis*. In transverse outline the corallum is elliptical and there is often or usually a valley zigzagging along the longer transverse axis or parallel to it. The shorter valleys run perpendicularly outward from the longer transverse axis. This mode of growth is similar to that of *Manicina arboleta*.

The granulations on the faces of the septa and the septal dentations in *Meandrina brasiliensis* are coarser than in *Meandrina nucundrites*. These differences are very striking when the specimens are compared side by side. Pourtales many years ago called attention to the dentation of the septal margins of "*Pectinia*" *nucundrites*. The dentations are small but perfectly distinct.

The following species are included in *Meandrina nucundrites*: *lamellosa* Humphreys; *pectinata* Lam. (an exact synonym); *pachyphylla* Ehrenberg (also an exact synonym, the type was examined by me in the Museum für Naturkunde at Berlin); *quadraata* Dana; *disticha*, *elegans*, and *caribba* Duchassaing & Micheliotti. The types of Duchassaing & Micheliotti's species were studied in Turin. Their *Pectina quadraata* and *P. elegans* are the same thing. The width of the valleys is from 13 to 15 mm. The specimen called *P. quadraata* often has the walls of adjoining series separated, or there may be a depression along the summit of the colline where the two walls come together; in other instances the fusion of the walls of the adjoining series is complete. In *P. elegans* the fusion is more often complete than in the former. I could find no basis for even varietal separation. The *disticha* and *caribba* are the same, except for some difference in the shapes of the colonies. The valleys in *disticha* are from 8 to 9 mm. wide, in *caribba* 8 to 10. They are narrower than in the specimens called *quadraata* and *elegans*. A specimen in the U. S. National Museum, from Belize, Honduras (A. F. Moran, collector), has valleys 7, or less, to 15 mm. wide and 8 or 9 mm. deep. Two specimens, also in the U. S. National Museum, from the Caloosahatchie Pliocene of Florida, show about the same variation. *Ctenophyllia profunda* Dana is placed questionably in the synonymy of *nucundrites*. Dana's description is not sufficient to base a positive opinion upon, and I have not seen the type.

*Pectinia seba* Milne-Edwards & Haime seemed to be based upon Seba's pl. cviii, figs. 3 and 5, and Ellis & Solander's pl. li, fig. 1 (Lamouroux, Exp. Méth., also pl. li, fig. 1). All of these figures appear to me to be *Colpophyllia gyrora*.

*Pectinia dana* (Milne-Edwards & Haime) groups with their *brasiliensis*. The salient distinguishing features are, *dana* possesses an epiphae; the costae are distinct only above it, where they project but little. The costae of *brasiliensis* consist of rows of tall, distinct, separated granulations.

The result of the study of the species of *Meandrina* is to recognize in the Caribbean and Brazilian regions two species, viz, *M. nucundrites* and *M. brasiliensis*. "*Pectinia seba*" is a doubtful species, as is also *profunda* of Dana. The locality of *dana* is unknown, but is probably from the Caribbean Sea.

Two young specimens which appear to be *M. nucundrites* were collected, but neither shows the typical specific characters. The larger specimen (pl. iii, and pl. iv, fig. 1) is 79 mm. long, 40 mm. wide, and 38 mm. high. There is one main valley parallel to the greatest length of the specimen, and subsidiary valleys are forming on each side. The form resembles that of *Pectinia dana* Milne-Edwards & Haime very closely. (See pl. v.) The second specimen is 35 mm. long, 16 mm. wide, and 22 mm. high. It is a simple coral, with one straight valley. These specimens are interesting, as they show what the young of *Meandrina nucundrites* probably is.

Photographic reproductions of the type of *Pectinia dana* are given, pl. v, for the purpose of comparison. The photographs were sent through the kindness of Prof. Edmond Perrier of Paris. I do not consider the Porto Rican specimens to be the same species as *Pectinia dana*, because the formation of subsidiary valleys begins earlier in the former, and the costae of *dana* show small spines above the epiphae and just below the calicular edge.

From station 3080, off St. Thomas, Sail Rock; station 6087, off Culebra, Point Mula light-house. Bathymetric occurrence, 15 fathoms to 50 fathoms.
A large number of specimens of this species was collected at station 6087, off Culebra, Point Mula light-house, in 15 fathoms of water. The specimens are typical and show no noteworthy variations. A few notes on the synonymy of this species may be in place. Milne-Edwards & Haime (op. sup. cit.) have placed Ehrenberg's Cl. cespitosa var. β and his Cl. candelabrum in the synonymy of arbuscula. I have studied Ehrenberg's types in the Museum fur Naturkunde in Berlin and verified the reference of Milne-Edwards & Haime. The original specimens of three species of Duchassaing & Michelotti were studied in Turin. Their Cl. arbuscula, conferta (Dana's species), and unipedalis are the same species. The corallites in Cl. conferta are more crowded than is usual. The Cl. parvistella is placed in the synonymy of arbuscula from a study of their description and figures. The type was not found in Turin. The only character at all diagnostic given in the description is "calycibus * * * vix tribus millimetris latis," and that is the usual diameter of the calices in arbuscula, the measurement given by Milne-Edwards & Haime. This leaves Cl. parvistella without any basis for specific recognition.

Cladocora debilis Milne-Edwards & Haime.

One specimen, here referred to this species, was collected; the locality is not given. The specimen is in bad condition, being incrusted by Serpula tubes and nullipores. The calices are of about the same diameter as in arbuscula, but are much shallower and the pali are much more developed. The species is undoubtedly identical with specimens in the U. S. National Museum labeled Cladocora debilis by Dr. Rathbun. I can not feel sure that this species is really distinct from Cl. arbuscula. The essential differences consist in the calices of arbuscula being deeper and the pali much less developed than in debilis. These characters are subject to variation, and a more extensive study may necessitate the mergerence of the two forms. Pourtales has suggested that what he has identified as Cl. debilis may be only a deeper water variety of Cl. arbuscula (op. sup. cit.).

The other species of Cladocora from eastern America are: Cladocora patricia Pourtales, Brazil; C. pulchella Milne-Edwards & Haime, West Indies; C. johnsoni Gane, Pliocene of South Carolina; C. jamaicensis Vaughan, Cretaceous of Jamaica. The Cladocora conferta (Dana) is a doubtful species. It possesses more septa than arbuscula.

Genus ASTRANGIA Milne-Edwards & Haime, 1848.

Astrangia solitaria (Le Sueur)? variety portoricensis, var. nov. Pl. 1, figs. 6, 6a, 6b.

The two specimens representing this variety are so different from the usual form of the species that I at first considered it a distinct species and drew up the diagnosis accordingly. A more detailed comparison has caused me to think that it may be only an aberrant variety of A. solitaria. The single corallite, taken as the type, will be described, and then a comparison will be made with the other specimen. This corallite is turbinate, 14 mm. tall; the greater diameter of the calice, 7 mm.; lesser, 6.5.
THE STONY CORALS OF THE PORTO RICAN WATERS.

Externally ornamented by low, flat, equal, densely granulate costs, which are distinct to the base; immediately below the calicular edge the costs may be slightly prominent. There are 3 complete cycles of septa, and a fourth cycle is present in 9 of the 12 half systems. The members of the fourth cycle fuse to the sides of those of the third, and the members of the third fuse to those of the second. The first and second cycles reach the columnella. None of the septa are very exsert. The members of the first cycle are slightly the most prominent; those of the second not quite so prominent as those of the first, and those of the fourth are the least prominent. The margins of the third and fourth cycles are dentate; those of the first cycle entire; the margins of all members of the second cycle are broken off. Pali exist before all septa, except those of the last cycle. Each one consists of a more prominent, erect, somewhat rounded tooth, with other similar teeth below, which are scarcely to be distinguished from papillae on the upper surface of the columnella. Columella, weak, spongy. Calicular fossa, deep, narrow at the bottom.

From Porto Rico; more definite locality not given.

There is one other specimen of this variety, probably a part of the same colony. It shows no additional characters of value except that reproduction may be by lateral gemmation.

The following are the species of West Indian Astrangids:


Astrangia astreiformis Milne-Edwards & Haime (? + Astrangia michelini Milne-Edwards & Haime). Astrangia danae L. Agassiz, from the northeastern coast of the United States is very close to this species, but there are, in my opinion, sufficient differences to keep the two distinct.

There are three astrangids found on the Brazilian reefs. One is Phyllangia americana; another may be only a varietal form of A. solitaria, but probably is a distinct species; the third is an undescribed species, which I have named in manuscript, Astrangia rathbuni.

The Tertiary species might be added to this list: Phyllangia floridana Gane. Pliocene, of Caloosahatchie, Florida; Astrangia lineata (Conrad) and (Camangia) bella (Conrad), Chesapeake Miocene, of the Southern Atlantic slope of the United States.

The Astrangia (Camangia) marylandica (Conrad), of Verrill and Gane, is, as, Gane has intimated, the young of Septastrea serradita (Lonsdale).


The three species with which comparison should be made are Phyllangia floridana Gane, Astrangia lineata (Conrad) and Astrangia solitaria (Le Sueur). The corallites of Phyllangia floridana are not so tall, possess wider bases, the costs are more prominent, and the margins of the septa of the first cycle are not so exsert. The pali and columnella are the same in both, and the septal dentations seem to be of the same character. The margins of the septa of the first and second cycles are entire in Ph. floridana. All of the septa of Astrangia lineata possess well-developed truncated dentations, and there are no differentiated pali. As already stated, this apparently should be regarded as a variety of A. solitaria (Le Sueur).

Pourtales1 says of A. solitaria, "All the septa are coarsely and bluntly denticulated." All of the septa may be denticulate, or the margins of the first cycle may be entire or faintly crenate. The actual difference of var. portoricensis consists in the larger size of the corallites and their more distinctly turbinate shape.

I have three fine colonies of A. solitaria for comparison, one from Honduras (W. A. Stanton, collector), property of the U.S. National Museum, and two loaned me by Dr. J. E. Duerring and collected by him in Jamaica. The size of the adult corallites is quite constant; the variation in diameter in the Honduran specimen being between 4 and 5 mm. The tallest corallite in the Honduran specimen is about 8 mm. The usual height is between 5 and 6 mm. Duchassaing & Michelotti's figure of A. neglecta, (op. sup. cit.), pl. x, figs. 3, gives a good idea of the general appearance of the species. The characters of the septal margins have been noted. The septa of the third and fourth cycles are finely dentate; those of the first and second cycles are usually bluntly or crenately denticate. Occasionally the crenations may be faint, and very rarely a septum appears to possess an entire margin.

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1 Ill. Cat. Mus. Comp. Zool., No. iv, p. 76.
Astrangia astreiformis Milne-Edwards & Haime, var. Pl. 11, figs. 2, 2a, 2b.


There is one specimen in the collection referred to this species. It is not typical, the corallites are not soldered one to another to their summits, but many corallites are free from very near their bases. There are distinct, usually equal, costae on the outer free part of the corallites. There is a fairly good suite of specimens of *A. astreiformis* in the United States National Museum, and a careful comparison has been made with them. There is much variation within a single corallum in the approximation of the corallites, and very often, or usually, the outside of the free portion of a corallite is distinctly costate. As the septa and columnella are the same as in typical *astreiformis* and the specimen from Porto Rico, and as the other features are so variable, I have considered them specifically identical.

The *Astrangia michelini* has given me much trouble. The figure given by Milne-Edwards & Haime suggests great similarity to this specimen from Porto Rico. I have not seen the type and do not know where it is from.

From station 6060, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

**Family ORBICELLIDÆ, nom. nov.**

Type genus, **Orbicella Dana.**

Salient family characters: Calcareous tissues normally imperforate, except in the columnellar region. Corallites grouped into rounded, gibbous, or digitiform masses. Septal margins dentate. Reproduction normally by gemmation between the corallites, occasional abnormal reproduction by fission.

I have shown in my Eocene and Lower Oligocene Coral Faunas of the United States that the name *Astrea* can not be used in coral nomenclature; that the name was first applied to a mollusk; also, if the name were used for a genus of corals, that it would have to supplant *Siderastrea.* I have therefore dropped the family name *Astreidae* altogether. The old Astreid corals of those found in Porto Rico are distributed in four families, viz: *Eusmilidæ* Verrill, *Astrangidæ* Verrill, *Orbicidæ* nom. nov., and *Favidae* Gregory. The reasons for proposing the latter new name will appear later.

**Genus ORBICELLA Dana, 1846.**


Attention has several times been called to the fact that Dana understood by *Orbiodia* what Milne-Edwards & Haime meant by their later described *Helios.*

The characterization given by Dana is "Cells nearly circular, more or less prominent, not subdividing, or rarely so; stars with distinct limits formed by the coalescence laterally of the lamellae, and therefore cells appearing tubular and separated by interstices." From his characterization and subsequent treatment of the species, it is evident that *Orbiodia radiata* or *annularis* is regarded as typical. Dana confused some other genera with *Orbicella,* similar to the confusion by Milne-Edwards & Haime of other genera with *Helios,* the meaning of the respective authors, however, is clear, and Dana's name, because of priority, must replace that of Milne-Edwards & Haime.

I have seen in the literature on corals no reference to the genus *Favites* Link. He defined the genus "Unförmige, kalkartige Massen, mit oberflächlichen zerstreuten sternförmigen blättrigen Oeffnungen"; and included in it "*F. astrinus, Madrepora favites,* Linn. Gmel. Syst. Nat., p. 3763, Esper's Pflanzenth. Forts. 1, Madr., t. 44-46—*F. cavernosus,* Linn. Gmel. Syst. Nat., p. 3767, Esp. Forts. 1, Madr., t. 37—and *F. pentagonus,* Esp. Forts. 1, Madr., t. 39." Link's *Favites astrinus* includes a species of *Favia* (Esper, t. xlvi) and species of *Prionastrea.* *Favites cavernosus* in *Orbicella cavernosa. Favites pentagonus* is a *Goniastrea.* Four genera are included in *Favites.* The name *Favia* was first given by Oken to a species not included in Link's list, but it applies to *Madrepora favus* of Esper (pl. xlvi); *Orbicella Dana* takes in *F. cavernosa.* *Faviscicella* Dana, 1846, contains a conglomerate of

forms, *Faviia, Dichocenia, Priomastra, etc.* The name in my opinion should be discarded, as it is a sort of renaming of Oken’s *Faviia.* Milne-Edwards & Haime, 1848, proposed *Goniastrea,* which equals a part of Link’s *Faviites,* and proposed at the same time *Priomastra,* which takes in the residue of *Faviites.* *Faviites* should be used instead of *Goniastrea* or *Priomastra.* Since the greater portion of *Madrepora favoa* of Esper is *Priomastra,* as this is the first name in the list of Link’s species, and as *Priomastra* occurs after the characterization of *Goniastrea,* in my judgment *Faviites* should supplant *Priomastra.*

*Tubastræe de Blainville* was not given a Latin form by him, and was not used Latinized by him in any combination, so it does not have to be considered in a discussion of synonymy.

**Oribicella acropora** (Linn.) var. Pls. vi and vii.


Gregory has published notes on the synonymy of this species. He bases his placing of *annularis* under the synonymy of *acropora* upon finding in some calices no septa corresponding to the last cycle of costae, while in other systems or in portions of other systems the septa of the last cycle may be well developed, i.e., he destroys the specific distinction established by Milne-Edwards & Haime. Since the greater portion of *Madrepora favoa* of Esper is *Priomastra,* as this is the first name in the list of Link’s species, and as *Priomastra* occurs after the characterization of *Goniastrea,* in my judgment *Faviites* should supplant *Priomastra.*

H. Stanley Gardiner identified a coral from Rotuma Island in the South Pacific as *Oribicella acropora* (Linnæus); he adds some notes, and calls attention to Esper’s (Fortsetzungen) pl. xxxviii, fig. 2. I have not seen Gardiner’s specimens and do not know how closely they resemble those from the West Indies, but we do know that Esper’s specimens came from the West Indies. He says concerning his specimens *"Sie kommen von den südlichen amerikanischen Meeren."* We can be sure that what is here called *Oribicella acropora* is what Esper called *Madrepora acropora,* and I suspect that Gardiner’s *Oribicella acropora* is a different species.

The remainder of the synonymy is extremely perplexing because of the insufficient description of the species, lack of figures, or that the types are lost or confused.

**Cyphastrea obbata** Duchassaing & Michelotti. The specimen so labeled in Turin is a rounded-head possessing the general aspect of *Oribicella acropora,* the calices are small, usually 2 mm. in diameter; the septa are in three complete cycles, the third cycle being very small; the coste are as in *Oribicella acropora.* A specimen labeled *Cyphastrea obbata* in the Muséum d’Histoire Naturelle at Paris is an entirely different thing. It belongs to the genus *Solenastrea* and is the same as the *Heliastræa*...
abditæ D. & M., which is not a synonym of Orbicella acropora, as Gregory states in his synonymy of the species.

Cyphastræa costata Duncan. The type from Barbuda preserved in the collection of the Geological Society of London is a specimen of Orbicella acropora. Some of the septa are cribiform almost to the corallite wall, while others extend as solid lamellæ far into the corallite cavity joining the columnella by septal processes; in fact, the columnella is made up of these processes. The corallite walls are dense, and are united among themselves by costæ which are stout and correspond to all cycles of septa; diameter of corallites 3 to 4 mm., usually about 3.5. Exotheca well developed; the dissepiments extend straight across the intercostal spaces; two dissepiments to 1.5 mm. Distance between corallites 1 to 2 mm., usually only about 1 mm. Almost any corallite of Orbicella acropora will show the septal peculiarities of Duncan's Cyphastræa costata, so Duncan's species is the exact equivalent of the former. A specimen, also in the Geological Society of London, from Santo Domingo, seems to be a Solenastrea; the corallites are joined by a vesicular exotheca and differ in other ways from Duncan's type. The specimens identified by Gregory from the Bahamas as Cyphastræa costata are Orbicella acropora. The material studied by him is in the British Museum.

Orbicella hyades is, according to Pourtaëls,¹ probably a Solenastrea. The Solenastrea hyades of Duchasneaux is a Solenastrea, as an examination of the specimens in Turin Museum showed, and is not a synonym of Orbicella acropora, as Gregory makes it. I was unable to find the type of Heliatraæa rotulosa in Turin, and as the work of Duchasneaux & Michelotti is throughout so poor, the species can not be determined, so should be discarded altogether. Gregory places it in the synonymy of Orb. acropora, and so much as one can make out of the original description supports his reference.

Some of the specimens of this species instead of being rounded heads, or more or less explanate, are small columns. One specimen from the elevated reefs of Curacao (K. Martin collection) is about 90 mm. long and possesses a maximum diameter of 25 mm. Except in form, there is nothing abnormal. Plesiastrea ramea Duncan, from Santo Domingo, is absolutely the same as this growth form of Orbicella acropora. I have examined the type in the collection of the Geological Society of London, and the officers of the society have kindly sent a duplicate to the U. S. National Museum. Phyllocenia limbata Duncan is the same as the Plesiastrea ramea (type, coll. Geol. Soc. Lond.). Phyllocenia sculpta Duncan (non Michelin) var. tegula Duncan, also from Santo Domingo, is an explanate form of Orbicella acropora. Except in form, it possesses no distinguishing characteristics, size of corallites, septa, costæ, columnella, exotheca, and endotheca as commonly in O. acropora. (Type, coll. Geol. Soc. Lond.; duplicate in U. S. National Museum.) Gregory's Echinopora franksi from Barbados is only a specimen of the same species. At first I thought it could be separated from O. acropora by its having solid walls, without exotheca between the corallites, but an examination of the splendid suite of recent specimens in the U. S. National Museum showed this to be only an individual variation. There is no character by which it can be separated from O. acropora. (Type in British Museum; duplicate in U. S. National Museum.)

There are three specimens of this species in the collection from Porto Rico; the largest is a head about 33 cm. high and 27 cm. in diameter. The calices are larger than is usual in the species, usually 4 to 4.5 mm. in diameter, and the septa are thinner than usual. The members of the first and second cycles have very exert margins.

From Mayaguez.

Family FAVIDÆ Gregory.

Type genus Favia Oken.

Salient family features the same as in the Orbicellidae, except that reproduction is by fission or septal budding.

A large number of genera belong here, e. g., Gonevastrea, Prionastrea (=Favites Link, pro parte), Platygryra, Leptoria, Stiboria, Mauicinu, etc.

Verrill's Meandrinidæ,² in my opinion, is equal to Faviidae. It has been shown in this paper that the original Meandrina of Lamarck is not the Meandrina of Milne-Edwards & Haime, Verrill, Duncan, and others; therefore the family name must be changed.

The group of genera represented by Lithophyllia (=Scolymia Haime, the older name), Isophtyllia, Musea, etc., probably should be grouped in another, but closely related, family, or in a subfamily.

Genus FAVIA Oken, 1815.

Favia fragum (Esper). Pl. viii.

1787. Madrepora ananas (pars), Linnaeus, Syst. Nat., ed. xii, t. 11, p. 1275.
1797. Madrepora fragum, Esper, Pflanzenth., 2. Ser., Th. 1, p. 79, pl. lixiv, figs. 1 and 2. (Non Madrepora ananas, Esper, Pflanzenth., pp. 126-131, pl. lixiii.)
1855. Favia coarctata, Duchassaing & Michelotti, op. sup. ed., p. 76, pl. x, figs. 17, 18.

This species has usually been known by the name Favia ananas, the specific name being referred back to Pallas's Elenchus Zoophytorum. The name Madrepora ananas was not available for this species, as Linnaeus had already applied it to a paleozoic coral from Gothland, now known as Actinaria ananas. Professor Lindström has discussed the name as applied to the fossil species in his "On the Corallia Baltica of Linnaeus." After Pallas there followed great confusion, the Baltic fossil and the West Indian recent species bearing the same name, and evidently considered by authors to be the same thing. In the meantime Esper proposed the name Madrepora fragum for the West Indian species. Therefore the ananas of Linnaeus must be restricted to the fossil species, and the ananas of Pallas must give way to fragum of Esper. The confusion of ananas is still greater for Esper, although he renamed Pallas's ananas, applied the same name to a species of Dihococnea from the East Indies, now known as Dihococnea porculata. The Explanaria ananas of Ehrenberg is, as shown by an examination of his material in the Museum für Naturkunde at Berlin, Dihococnea stokesi.

Esper's figures and the description of fragum are very good, and answer perfectly to the ordinary West Indian Favia. A note which accompanies the figures in the Museum of Comparative Zoology's copy, and which presumably was made by Pourtales, states, "This seems to be what we have labeled F. ananas throughout the collections."

I was able to examine the types of Duchassaing & Michelotti's Favia incerta and Favia coarctata in Turin. The difference between the three may be tabulated thus:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favia incerta</td>
<td>Wall between corallites not thick; calicular margin not elevated.</td>
</tr>
<tr>
<td>Favia coarctata</td>
<td>Wall between corallites not thick; calicular margin elevated.</td>
</tr>
<tr>
<td>Favia ananas</td>
<td>Wall between corallites thick; calicular margin elevated.</td>
</tr>
</tbody>
</table>

The first species is founded on a somewhat worn specimen. Another worn specimen, grouping with incerta, is labeled Favia fragum. The series of six specimens possessed by Duchassaing & Michelotti, had they studied them carefully, should have shown them that they were dealing with variations of a single species, to which they attached four different names.

There is in the U. S. National Museum a suite of over 80 recent specimens from various localities in the West Indian region. Notes on the variations of these specimens may be of interest in connection with the synonymy given above. First, there are 17 specimens from the island of Curaçao, collected by the Albatross expedition in 1888. The specimens are all small encrusting, usually capulliform or subhemispherical masses. The greatest distance across a colony rarely exceeds 45 mm. The calices are subelliptical or are deformed; in only one instance did I find one instance did I find indications of two calicular centers in a series, except where fission is in progress. Reproduction is by septal budding—fission. The calices are divided into subequal halves. The calices are not very long; 6.5 mm. in length by 4.5 in breadth is large for one in which there is no evidence of the beginning of division. There are calices, almost circular, only 3 mm. in diameter. The thickness of the walls between corallites varies very much, from merely a separating rim to 2 mm., or even more. The elevation of the calicular margin also shows great variation. It may not be noticeably elevated, or it may form the rim of a truncated deformed cone, standing a millimeter, or even slightly more, above the depression between adjoining corallites. The septa vary between three complete cycles and very nearly four complete cycles; common numbers are from thirty-six to a few over forty. The septal cycles are not distinctly.

marked, but the members of the first and some of the second are usually larger than the others. The youngest septa are much smaller than the bounding older ones. The amount of exertness and the thickness of the septa are variable, but the septa could scarcely ever be characterized as very thin, although they sometimes are quite thin. The septal margins are irregularly and rather jaggedly dentate, and bear near the columnella an irregular, jagged, palpiform tooth. Costae correspond to all septa and show a variation in size corresponding to that of the septa; they are rather acute, not very or only fairly prominent, and have their margins pointedly dentate, the dentations on the costae being more regular than those on the septa. The columnella is rather large, very spongy, and usually forms a flattish bottom to the fairly deep calice.

From east of Fort Taylor, Key West (Dr. Edward Palmer, collector), is a lot of 32 specimens. These in general differ from the Curaçaoan specimens by having thinner walls between the corallites, 1.5 mm. being about the average thickness; in some specimens the adjoining calices are separated by merely a rim, by having the calicular margins not or scarcely perceptibly elevated, and by having very often narrow corallites with a tendency to become sinuous. One specimen possesses a calice 6 mm. long and less than 2 mm. wide. The intergradation between these specimens and those from Curaçao is seen to be perfect when some specimens from Key West (collected by Hemphill) and Tortugas (collected by Palmer) are placed between them. There is no need to cite more specimens, except one from St. Thomas (collected by the Albatross expedition). This specimen would be referred to *Favia inerta*, *D. & M.* It is an irregularly capuliform mass with a greater diameter of 55 mm., a lesser of 46, and a height of 38. It has the general appearance of the ordinary *F. fragum*, except that over the whole upper surface of the colony the walls are thin and simple. Instances of simple walls have been cited before, but in no case did such occur over the whole upper surface of the specimen. Around the edges the specimens from St. Thomas has assumed the form of wall usually found in *F. fragum*, so that if one had a piece broken from the edge, especially at one particular end, he would immediately pronounce it *F. fragum*.

From the above discussion one might think this species has no criterional characters; but it has, and they are quite definite. They are: (1) The size and shape of the colony; (2) the size and shape of the calices; (3) the number of the septa; (4) the septal dentations, the pali, and the character of the columnella. This gives a number of characters, and throws over only the basis on which Duchassaing & Michelotti attempted to differentiate the species.

Verrill has described 3 species of *Favia* from Hartt's Brazilian collections. They are *Favia leptophylla*, *Favia graviida*, and *Favia conferta*, all three from the Abrolhos Reefs. We have in the U. S. National Museum, from Brazil, 29 specimens of this group of *Favia*, and upon them and Verrill's original description I base the following remarks. The features by which the species would be separated among themselves are:

*F. leptophylla* .......Septa 24 to 30, calices circular or deformed, about 0.25 inch in diameter.
*F. graviida* .........Margins elevated the same as *F. leptophylla*, except that there are four complete cycles of septa.
*F. conferta* .........Possesses narrow, long meandriform calices, usually serial, with several calicular centers.

There are no specimens of *F. leptophylla* in the U. S. National Museum. The other two species, in my mind, grade into each other, showing a variation in prominence of calicular margins and thickness of wall between adjoining corallites similar to what has been described for *F. fragum*. The essential specific characters are (1) the number of septa, usually at least four complete cycles—i.e., they are more numerous than in *F. fragum*; (2) the calices are nearly always larger, or at least longer, than in *fragum*, and may be so long and sinuous that they are meandriform; when the calicular margins are free and elevated, they rise perpendicularly from the common surface of the corallum; (3) the septal dentations seem very much more regular than in *F. fragum*. There are points of resemblance between *fragum* and the Brazilian species, but the two seem to me very distinct. I would suggest that of Verrill's two names, *graviida* and *conferta*, applied to the Brazilian species, *conferta* be suppressed and *graviida* be used as the specific designation.

As I have seen no specimens of *F. leptophylla*, I can express no opinion upon it.

The three specimens of *Favia fragum* in the Porto Rican collection present no special characters worthy of note. The size of one is, greater diameter, 26 mm.; lesser, 24 mm.: height, 18 mm. Two specimens, preserved in alcohol, came from the Playa de Ponce.
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**Genus MANICINA** Ehrenberg, 1834.

**Manicina areolata** (Linn.). Pl. iv, figs. 2 and 3.


1769. Madrepora maxibrates (pars), Esper, Pflanzenth., p. 76 (bis = 81) — 84, pl. iv, non iv A.


1834. Manicina praeculta, Ehrenberg, op. sup. cit., p. 327.


1880. Manicina areolata, Fourtala, Mem. Mus. Comp. Zool., vol. vii, No. 1, pl. v, figs. 1-22 (all figs.), and pl. vi, figs. 1-7 (all figs.).


The names Ehrenberg's species were studied in the Museum für Naturkunde, in Berlin, and the specimens of Duchassaing & Michelotti were studied in Turin. Gane's *Manicina plicenciis* is placed in the synonymy of *M. areolata*, as a result of comparison of his type material with recent specimens in the U. S. National Museum.

From Ensenada Honda, Mayaguez, and Aguadilla, a single specimen from each place. Those from Mayaguez and Aguadilla are small and beach-worn. The one from Ensenada Honda is good, and was preserved in alcohol. Station 6079, off St. Thomas, Sail Rock, in 20 to 23 fathoms.

**Genus PLATYGYRA** Ehrenberg, 1834.


The names Meandrina and Meandrina have been disposed of. The name Platagryra Ehrenberg remains to be considered. Ehrenberg placed the following species in the subgenus (as recognized by him), viz: *labyrinthica*, including the varieties α *leptochila* and β *pachychila; lamellina*, sp. nov. *cerebriformis* Lamarck, including the varieties α and β; *phygria* Lamarck; *spatiosa*, sp. nov. I made a careful study of most of the original specimens referred to these species by Ehrenberg.

There are six specimens in the Museum für Naturkunde, in Berlin, bearing the name Meandrina (*Platagyra*) *labyrinthica*, but there appear to be four distinct species.

1. Specimens Nos. 682, 683, and 687 are Oeloria *labyrinthiformis* of Milne-Edwards & Haime.


3. Specimen No. 689. No locality is given. "M. filograna Esper" is written on the label below the name given by Ehrenberg. The corallum is a head deformed by certain parts dying; it is about 160 mm. high. The valleys are very long and sinuous, frequently forming sharp angles in the sinusities. Wall between the series thin and acute at top, thickening below. Depth of valleys 6.5 to 7 mm. Cross section of colline angular above. Septa, 12 to 15 cm., nearly all of equal size, only occasionally a small or rudimentary one between a pair of large ones; they do not project much above the wall between the valleys. The septal dentations are subequal, except that the lowest is much larger than the others. The columella is formed of septal trabecule and lobes; it is very often of a loose, spongy texture. This is not filograna Esper, but is probably viridula Le Sueur (=strigosa Dana).

4. Specimen No. 671, bears "M. grandidobata M. F." on the label below Ehrenberg's name. This is correct, only it must now be called *clivosa* of Ellis & Solander.

I did not study *M. Platagyra lamellina*.

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1 Hist. Nat. Coroll., t. xi, p. 413.
M. Platygyra cerebriformis = Diploria cerebriformis (Lam.), which must be called Diploria labriformis (Linn.).

M. Platygyra phrygia = Leptoria phrygia, fide Milne-Edwards & Haime.

M. Platygyra spatiosa = a synonym of Dendrophyllia cylindrus. It is the basal portion of a large column.

Ehrenberg had in his Platygyra 8 species now distributed among 5 genera: Meandrina, 2 species (not Meandrina Lamarck 1801); Celoria, 3 species; Diploria, 1 species; Leptoria, 1 species; Dendrophyllia, 1 species. The name Meandrina cannot be applied to any of these forms. The order of the publication of these genera, except Meandrina, is:

Dendrophyllia Ehrenberg, 1834.
Diploria Milne-Edwards & Haime 1848.
Leptoria Milne-Edwards & Haime 1848.
Celoria Milne-Edwards & Haime 1848.

Arranged according to sequence on the page.

Ehrenberg in his treatment of Platygyra labyrinthica makes no mention of the West Indian forms, discussing only those from the Red Sea; therefore if we follow his published work, the former must be omitted. The name Platygyra must be used instead of one of the four genera above noted. Since Pourtales- was the first of whom I know to point out the difficulty or impossibility of separating Celoria and Meandrina (Milne-Edwards & Haime), I substitute Platygyra for Celoria, following Dr. Brüggemann, who, in his "Coralis of Rodrigues," shows that Platygyra should take the place of Celoria, and remarks that the type species is the Madrepora labyrinthica from the Red Sea. His course, in my opinion, is the only logical one.

Pourtales was the first of whom I know to point out the difficulty or impossibility of separating Celoria and Meandrina (Milne-Edwards & Haime). H. Stanley Gardiner has made some notes on the relations of the genera. I can find no tangible differences between the two, the columnar characters being insufficient, therefore I merge Celoria and Meandrina of Milne-Edwards & Haime into a single genus and call it Platygyra Ehrenberg. If the West Indian species can not be referred to Platygyra, they must receive a new generic designation.

Platygyra viridis (Le Sueur). Pls. i, x, x, x, x, x, x, x.


1820. Meandrina sinuosa? Le Sueur, Mem. Mus. Hist. Nat. Paris, t. vi, p. 276, pl. xv, fig. 4; + var. viridis, p. 279, pl. xv, fig. 6; appressa, p. 280, pl. xv, fig. 6; rubra, p. 280, pl. xv, fig. 7; vinoso, p. 280, pl. xv, fig. 8. Non Madrepora sinuosa, Ellis & Solander, 1786, nec Meandrina sinuosa, Quoy & Gaimard, 1838.

1820. Meandrina delicata, Le Sueur, op. cit., p. 281, pl. xvi, fig. 9.

1820. Meandrina labyrinthica, Le Sueur, op. cit., p. 282, pl. xvi, fig. 10.


1846. Meandrina atrigosa, Dana, Zooph. Wilkes Exp. Expl., p. 207, pl. xiv, figs. 4a, 4b.


1861. Leptoria fragilis, Duchassaing & Michelotti, op. sup. cit., p. 75.


1880. Meandrina labyrinthiformis, Pourtales, op. cit., p. ix, figs. 10-12.


1886. Meandrina labyrinthica, Quelech, op. sup. cit., pp. 10, 12, 91.

1895. Meandrina sinuosa, Quelech, op. sup. cit., p. 12.


In the preparation of the above synonymy the following collections have been studied: The Ehrenberg collection, in Berlin; the types and other specimens of Duchassaing & Michelotti, in Turin; the types of the four species of Milne-Edwards & Haime, in the Musée d'Histoire Naturelle, Paris.

1See paper on "Some fossil corals from the elevated reefs of Curaçao, Aruba, and Bonaire, pp. 45-48.


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Quelch's and Gregory's original specimens, in the British Museum (Natural History); and the excellent collection of the United States National Museum, which possesses Dana's type of *Meandrina strigosa*.

The first available name for this species is *viridis* of Le Sueur. The name *labyrinthisca* of Ellis & Solander cannot be used, as Pallas had applied it to *Madrepora mexandriae* Linneus. The *sinuosa* of Le Sueur is a misidentification of the *Madrepora sinuosa* of Ellis & Solander, so it cannot be used. The name is var. *viridis* of Le Sueur. The varietal name is here raised to specific rank.

There are over 20 specimens of the *Platygyra viridis* group in the U. S. National Museum. Before proceeding to a discussion of the specimens it would be best to examine Milne-Edwards & Haeime's mode of classification of the species of the genus, and those of their species that come from the West Indies.

Their first section comprises forms with "Le polypier formant une masse fortement gibbeuse ou même lobée," which comprises *M. filograna* (Esper) and *M. grandilobata* M. E. & H. (to which should be added *M. clivosa* of Ellis & Solander, sp.). The second division has "Le polypier formant une masse légèrement gibbeuse" (here is placed *M. superficialis*); the third "Le polypier formant une masse simplement convexe sans gibbosités," and contains *M. heterogyra*, *M. sinuosissima*, *M. serrata*, and *M. crassa*. *Meandrina valida* and *M. mammosa* Dana are placed in the "espèces douteuses," and *Meandrinà strigosa* Dana is referred to *Coloria* as a doubtful species.

To tabulate the characters which separate *heterogyra*, *sinuosissima*, *serrata*, and *crassa*:

- **M. heterogyra**——Corallum convex, oblong; 12 to 14 septa to cm., usually equal; width of valleys, 6 mm.; depth, 4 or 5.
- **M. sinuosissima**——The points of difference given by Milne-Edwards & Haeime are the subspheroidal form, the septa crowded and alternating in size, narrow above and enlarging in the interior of the valleys. Valleys nearly a centimeter wide.
- **M. serrata**——Would be separated from preceding by having valleys 7 mm. wide and 5 mm. deep.
- **M. crassa**——Form as in *heterogyra*, otherwise resembling *sinuosissima*, except that the columella is greatly developed and valleys are 7 mm. wide and 3 or 4 mm. deep.

Milne-Edwards & Haeime have based their division of these forms into 4 species on the following characters: (1) The corallum being elongate or subspheroidal; (2) the septa being all of the same size or alternately larger and smaller; (3) the collines being rounded above or acute; (4) the width of the valleys ranging between 6 mm. and 1 cm. in width and 3 to 5 mm. in depth. Minor importance is laid on the septal dentations and the development of the colunella. I came to the conclusion that we have to deal with a single species from an examination of the Duchassaing-Michelotti material in Turin, and again to the same conclusion from a study of the specimens of Milne-Edwards & Haeime in Paris and the specimens in the British Museum. I shall now describe in detail a single specimen from Belize, Honduras (collected by A. E. Morlan).

The specimen is about 23.5 cm. long by 19 cm. wide on the flattish base, and approximately 10 cm. high; i. e., the form is oblong. On one end the valleys are extremely sinuous, while on the other they are usually parallel, running perpendicular to the axis of elongation of the colony, and show very few sinuosities. The width of the valleys varies from 4.5 mm. to 9 mm.; i. e., in width of valleys this specimen takes in all species. The depth of the valleys varies from 2 mm. to 6 mm.; this specimen shows depths of valleys both lesser and greater than the extremes recorded by Milne-Edwards & Haeime in their characterization of the species. The walls between the valleys are solid, but may vary somewhat in thickness. The septa probably present the greatest variation of any element of the corallum. For long distances there may be only large septa, with no hint of smaller septa between them, whereas on other portions of the surface the alternation of larger and smaller is perfectly regular. A place where there are only larger septa shows twelve to the centimeter on one side of the colline and thirteen on the other. In another place, where there is fairly regular alternation of larger and smaller, there are fourteen larger and thirteen smaller to the centimeter. These measurements cover all the four so-called species. The septa may be narrow at the top, sloping downward into the bottom of the valley, thus giving the colline a triangular profile, or they may arch gently over the top of the colline and have their inner margins fall perpendicularly to the top of the paliform lobe at the base. The paliform lobes may be entirely suppressed, or they may be greatly developed, but whenever the inner margins of the septa fall perpendicularly to the bottom of the valley the paliform lobes are well developed. The septal dentations are usually quite regular, and are like the teeth of a saw ("en scie"), but there may occasionally be slight irregularities. The colunella varies much. It may consist of weak, spongy calicinal centers, each pair connected by a septum, representative of a lamellar
columella, or a spongy columella may be very considerably developed. Endotheca is well developed and quite vesicular; the dissepiments are thin.

It is evident that this one specimen, except in the matter of form, comprises all of the four above-discussed species. Whether a coral head is spheroidally rounded above or somewhat elongated in one direction is so much a matter of pure chance, depending upon the object to which it is attached, etc., that no one would think of separating species on that basis.

It seems to me that *Meandrina superficialis* of Milne-Edwards & Haine, judging from the specimen I saw in Paris, may belong here, but according to their description it is a synonym of *M. clivosa*. To what species it should be referred depends upon whether the surface of the corallum is thrown into lobes. In my notes on the Paris specimens I have placed it in the synonymy of *Meandrina strigosa*, and have added "sepia to cm. 19, all of the same size; width of valleys, 4 to 6 mm., depth only about 2 mm.; columella, lamellar, interrupted, surrounded by very little vesicular tissue." However, *superficialis* may belong under *clivosa* of Ellis & Solander.

The *Leptoria fragilis* of Duchassaing & Michelotti is the same as *Meandrina heterogyra*, and falls into the synonymy of *P. viridis*. I am not positive as to what should be done with their *Leptoria hieroglyphica*, but probably it also should be placed in the synonymy of *viridis*.

The *Meandrina labyrinthiformis* and *Meandrina strigosa* figured by Pourtales in the Florida Reef Corals are the same species. The *labyrinthiformis* has lower collines and the septa are more broadly rounded over the summits of the collines, while in *strigosa* the septa have a tendency to be almost angular where they cross the wall. The paliform lobes are represented as being fully developed in *strigosa*. The amount of variation of each of these features in a single corallum has already been pointed out.

A few notes on the variation of some other specimens should be added. There is a specimen, the *labyrinthiformis* type, from Eastern Dry Rocks, Florida (collected by Palmer), that I thought could be kept separate from the other specimens, because the septal dentations are not saw-toothed ("en scie"), but often are rather long spines, or they may even be forked. We possess from Bermuda a single specimen, in which both types of dentation exist, though in this the teeth are usually longer than in the majority of specimens, but it is not abnormal and the passage to the usual condition is perfect.

It seems scarcely necessary to expand these notes of characters and variation further. Quelch has made extremely interesting remarks in his report on the Challenger reef corals (pp. 91–94). He recognizes *Meandrina labyrinthica*, *Meandrina sinuosissima*, and *Meandrina strigosa*, with the remark that *sinuosissima* may be only "a very thick and hard triangular walled variety" of *strigosa*. I go further than he and place the *labyrinthica* or *labyrinthiformis* in the same species, but three usually good varieties may be recognized, in the line of Quelch’s separation into three species.

This species can be defined only in terms of its variation. One character seems absolutely invariable, i.e., the form of the upper surface; it is uniformly rounded and never thrown into gibbosities.

There is one large, fine specimen in the collection from Mayaguez, Porto Rico. It is a uniformly rounded head, with no gibbosities, 35 cm. high and 52.5 cm. in diameter. The base is flattish. The valleys are very long and usually sinuous, width from 5 to 8 mm., usually 6 mm. wide, depth 4 mm. or less. The collines may be rounded or subacute, wall between series is thick or thin along the summit, compact and usually stout. The number of septa to the centimeter is variable; a common scheme is about 14 large septa, with a varying number of smaller ones. In one instance there are 14 large and 13 small, in another 14 large and 7 small, in another 17 large and no small. The septal dentations are strong, acute saw-toothed, and fairly regular. The paliform lobes are well developed. Columella fairly well developed, spongy, sometimes showing a lamellar element along the middle.

THE STONY CORALS OF THE PORTO RICAN WATERS.

Family AGARICIDAE Verrill.

Genus SIDERASTREA de Blainville, 1830.

The synonymy of this genus is fully considered in my Eocene and Lower Oligocene Corals of the United States.¹

Siderastrea radians (Pallas). Pl. xv; pl. xvi, fig. 2.

1846. Siderina galaxea, Dana, Zooph. Wilkes Expl. Exped., p. 218, pl. x, figs. 12, 12b, 12e (non figs. 12a, 12d).

Linneus described a Madrepora astralae in Systema Naturae, ed. x, p. 796, but the description is not sufficient for even approximate identification. The only reference in the synonymy that I have been able to verify is the one to Sloane's Jamaica (vol. i, p. 54, pl. xx1, Lapis astralae & stellaria). I can not identify this figure. When Pallas' description of M. radians is taken together with Seba's figures (pl. cxin, figs. 12, 14, 17, 18), one can be reasonably sure of the identification being correct. The Madrepora astralae of the twelfth edition of Linneus is the same as the M. radians of Pallas. It appears to me that astralae of Linneus must be dropped altogether, and that radians of Pallas must be adopted.

There is one excellent specimen of this species in the collection from Mayaguez. It is an expanate mass, subquadrangular in horizontal outline; the greatest distance across is about 11 cm., lesser about 10 cm., and about 2 cm. thick.

Siderastrea siderea (Ellis & Solander). Pl. xiv, fig. 1, 2; pl. xvi, fig. 1.

1863. Siderastrea granulata, Duncan, op. sup. cit., p. 441, pl. xvi, figs. 6a, 6b.

Gregory places Siderastrea globosa Milne-Edwards & Haimi doubtfully in the synonymy of this species. From the original description of the species I would judge that it is not a synonym of S. siderea. Siderastrea stellata of Verrill, from Brazil, is a distinct species, and does not belong in the synonymy of S. siderea. It usually possesses four complete cycles of septa, but in most of its characters it resembles S. radians more closely. The upper portions of the septa are flattened, as in the latter species. The calices may form short series, sometimes are even meandriform. The examination of a large suite in the U. S. National Museum leads me to the conclusion that it is a valid species.

There are two splendid specimens of S. siderea in the Porto Rican collection. The larger is a head, possessing a greater diameter of about 20 cm., a lesser of about 14 cm., and a height of 15+ cm. The specimen grew over the surface of a mass of the same species and the thickness of this mass is included in the measurement of the thickness of the specimen.

Usually the leading distinction between Siderastrea radians and Siderastrea siderea is considered to be that the latter possesses four complete cycles of septa, whereas the former has the fourth cycle

incomplete. This distinction is especially useful when only specimens for sectioning can be procured, such as those from elevated coral reefs. But there are other differences probably more important.

<table>
<thead>
<tr>
<th>S. radians.</th>
<th>S. siderea.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper portion of the septal margins, between calices, flat.</td>
<td>Subacute.</td>
</tr>
<tr>
<td>Calices deformed; occasionally subhexagonal or rounded.</td>
<td>Subhexagonal.</td>
</tr>
<tr>
<td>Coralites, diameters 3 mm. by 2 or 2.5 mm., or even smaller.</td>
<td>Five mm. by 4 or 4.5, occasionally only 3 or 3.5 mm. in diameter.</td>
</tr>
<tr>
<td>Calicular fossa, septal margins perpendicular to horizontal plane through bottom of calice.</td>
<td>Septal margins slope to the bottom of the calicular fossa.</td>
</tr>
<tr>
<td>Septa, fourth cycle incomplete.</td>
<td>Fourth cycle nearly always complete.</td>
</tr>
<tr>
<td>Columella, solid.</td>
<td>Papillate.</td>
</tr>
</tbody>
</table>

The characters that first strike one's eye are the relatively smaller calices of *radians*, their more deformed outlines, and the flatness of the upper portions of the septal margins between calices. Besides, *radians* seems to be more explanate in mode of growth and to form smaller masses. *S. siderea* quite often forms rather large heads.

From Culebra.

**Genus AGARICIA** Lamarck, 1801. (UNDARIA + MYCEDIUM, Oken, 1815.)

*Agaricia elephantotus* (Pallas). Pl. xvii, fig. 1.


Gregory places *Mycedia fragilis* Dana in the synonymy of this species, but so far as my observations go the two are distinct.

One young specimen in the collection is referred to this species. It is a thin lamina; the greater distance across is 38 mm., and the lesser 26 mm. The parent coralite is not situated centrally, but near one edge, on the lowest part of the lamina, i.e., it is sunken. The specimen does not agree precisely with the characterization given by Milne-Edwards & Haime. In one calice there are ten large, exsert, equal septa; in each of three loculi between pairs of these larger septa are three septa, one larger septum with a smaller septum on each side; in each of the remaining seven loculi is one small septum. The total number of septa is twenty-six. The larger septa are prominent, especially around the calicular fossa. This specimen agrees with the figure given by Ellis & Solander.

From station 6090, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

*Agaricia* sp. Pls. xviii, xix.

This is a unifacial *Agaricia*, exhibiting features similar to those of *Madrepora undata* Ellis & Solander, *Agaricia agerites* (Linnaeus), and *Agaricia elephantotus* (Pallas). My opinion is that it should be referred to *A. agerites* and probably placed in var. *undata* of Ellis & Solander.

The following is the description of *Madrepora undata*:


In the largest specimen the distance between cardinal centers in a series is usually about 3 mm.; the distance from the top of a ridge below a series to the top of a ridge below the next series varies from 5 to 9 mm. The septa and septo-costae are usually rather regularly alternately larger and smaller,
around a calcinal center from 10 to 20 larger and as many smaller, but the larger are not so prominent
as in A. elephantotus. The edges of this specimen are somewhat reflected, and that may have an
influence on the appearance of the series.

The most striking differences between it and the usual Agaricia agaricites are: The distance
between collines in the latter is usually not so great, from 4.5 mm., or even less, to about 6 mm.;
the summits of the collines in A. agaricites are usually more acute; and there are in A. agaricites,
usually, not so many septa to the calice, about 18 large and as many small. The laminate corallum
of A. agaricites is usually thicker.

The specimen here discussed corresponds well to Milne-Edwards & Haime's characterization of
Mycedium elephantotus, but it does not agree with the characterization by Pallas or the figure given
by Ellis & Solander.

From station 6000, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

Agaricia cailleti (Duchassaing & Michelotti). Pl. xx.


Gregory¹ places this species in the synonymy of A. elephantotus with the remark that it appears to
be a deeper water variety of the typical A. elephantotus. The suites of specimens in the United States
National Museum do not show intergradation; therefore I have kept the two forms separate. The
distinguishing feature of A. cailleti is, the fronds are dissected and the divisions are crispate. The
calles are unifacial.

From station 6079, off St. Thomas, Sail Rock. There are seven good specimens of this species in
the collection. Bathymetric occurrence, 20 to 23 fathoms.

Genus BATHYACTIS Moseley, 1881.²

Bathyactis symmetrica (Poultales). Pl. i, figs. 7, 7a, 7b.


The diameter of an average-sized specimen is 8.8 mm. The base is imperforate, horizontal, with
distinct but not very prominent coste corresponding to all septa. The six coste of the first cycle are
slightly larger than those of the second, those of the third are still smaller, and those of the fourth
are very small. The members of the first and second are prolonged to the center of the base. The
wall is thin and is minutely granulated, even between the coste. The septa are imperforate in six
distinct systems, and each system contains four cycles. The members of the first cycle are independent
of the other septa and join directly to the columella. The members of the second cycle are also
prolonged to the calicenial center. The members of the third cycle fuse to the sides of those of the second
quite near the calicenial, and those of the fourth fuse to the sides of the third a little nearer the wall
than the calicenial. Thus there is a distinct group of septa between each pair of septa of the first cycle.
The septal margins are spinosely dentate, the dentations somewhat flattened in a plane perpendicular
to the septal plane. There may be granulations on the dentations. The fusion of the septa into groups
is affected by symbiota, but the symbiota are not confined to those places. They are fairly
abundant.

The calicular fossa is shallow. There is a small, weak, insignificant false columella.

Five specimens were obtained by the Fish Commission, all in very good condition.

It seems to me that Poultales's Antheniphyllocha potera, whose systematic position has been much
debated, probably is closely related to this species.

From station 6069, Mayaguez Harbor. Bathymetric occurrence, 223 to 231 fathoms.

² After this paper had gone to press it was discovered that Bathyactis symmetrica had been wrongly designated
"Dinserie" crina. Page 311 was courteously reprinted by the Government Printing Office, but it will be necessary for the
reader to make the following additional corrections: On p. 293, line 15, for Dinseria read Bathyactis; p. 299, line 17, for
"Dinserie" crina read Bathyactis symmetrica; p. 301, line 22 in table, for Dinseria crina Poultales read Bathyactis symmetrica
(Poultales); p. 319, under pl. i, after fig. 7, 7a, 7b, for Dinseria crina Poultales read Bathyactis symmetrica (Poultales); pl. 1, in
legend at bottom, for "Dinseria" read Bathyactis.
Family ISOPORIDÆ, nom. nov.

This name is proposed to take the place of Madreporidae.

Genus ISOPORA Studer, 1878.


Also, in part, of Esper, Pflanzenthiere; Ellis & Solander, Natural History of Zoophytes; and Lamarck, Système des Animaux sans Vertèbres.
1893. Eumadrepora, Odontocyathus, Polyostegia, Lepidocyathus, Isopora, Tylopora, Omeocyathus, Rhabetocyathus (as subgenera), Brook, Cat. Genus Madrepora, p. 22.

Brook has pointed out (op. cit., p. 22) that none of the species at present called Madrepora were included in the Linnean Madrepora. The Madrepora muricata was placed in Millepora. What we now call Madrepora was subsequently inserted in the original Linnean genus, and later the inserted part was made the type of Madrepora when it was subdivided. This is against all rules for nomenclature. The name Madrepora can not be employed as by Dana, Milne-Edwards & Haime, and later authors. Heteropora Ehrenberg can not be used, because de Blainville had previously applied the name to a genus of Bryozoa. The first available name known to me is Isopora Studer, applied in a subgeneric sense. I propose here to elevate it to generic rank. Studer included two species in it—Madrepora labrosa and Madrepora securis, both of Dana—designating neither one as a type.

The type species of Madrepora must be selected from the original list of species of Linnaeus, but I have not studied the generic history of all the species to determine the one to which the name Madrepora should be attached.


After having examined very extensive suites of specimens of this species, and having studied the material in the British Museum and most of Duchassaing & Michelotti’s types in Turin, I have reached the same conclusion as Brook, subsequently reiterated by Gregory, i.e., at present we know only one species of Madrepora from the West Indies, and this may conveniently be divided into three forms or varieties, viz., muricata s. s. (cericornia, †Am.), prolifera, and palmata.

I propose here to supplement what Brook has said on the early history of the nomenclature of this species.

The second reference given by Linnaeus in his original synonymy of Millepora muricata¹ is “Sloane jam. i, t. 18, f. 3, corallium album porosum maximum muricatum.” The full title of the work referred to is “A voyage to the Islands of Madera, Barbados, Nieves, S. Christophers and Jamaica, with the natural history of the herbs and trees, four-footed beasts, fishes, birds, insects, reptiles, etc., of the last of these islands; to which is prefixed an introduction wherein is an account of the inhabitants, air, water, diseases, trade, etc., of that place, with some relations concerning the neighboring continent, and islands of America. Illustrated with the figures of the things described, which have not been heretofore engraved; in large copper plates as big as the life. By Hans Sloane, M. D., in two volumes. London, 1709.” This old book possesses a considerable number of fairly good figures of Jamaican corals. The figure to which Linnaeus makes reference, pl. 18, fig. 3, is the typical Madrepora ceriornia of Lamarck. Pallas² divides the species into three varieties: (α) Varietas ramosa, under which reference is made to Browne’s Jamaica, Sloane’s Catalogus Plantarum Insulae Jamaicae (London, 1891), and Sloane’s Natural History of Jamaica. He also refers to Seba’s Thesaurus. I do not know

¹ Syst. Nat., ed. x, 1756, p. 792.
what pl. cviii, fig. 6, represents, but pl. cxiv, fig. 1, is the common cervicornis. Knorr's (Deliche Nature) pl. xi, fig. 1, also referred to by Pallas, is the same. Knorr's says, "Het is namentlyk dit eige zelve Koraal 't welk by Sloane Jamaica, Tab. xviii, fig. 3, onder den Naam van Coralium album porosum muricatum maximum gevonden werd, etc." (Op. cit., p. 6.) (β) Varietas corymbosa. Under this reference is made to Browne's Jamaica, p. 301, No. 6, Madrepora maxima compressa, palmata and muricata. Browne's states, "This grows the largest of all the coralline substances found about Jamaica; it is met with in large single masses of an irregular compressed form, which spread into broad, flat lobes toward the top." (Op. et loc. cit.) Browne refers to pl. 18 of Sloane's Nat. Hist. of Jamaica, but he seems to me to mean pl. 17, fig. 3. (γ) Reference is made to Sloane's Natural History of Jamaica, vol. i, p. 58, n. 5, tab. 17, fig. 3, which is what is usually denominated Madrepora palmata. Pallas states "Locus: Mare Americanum & Indicum."

Linnaeus in Syst. Nat., ed. xi, pp. 1279, 1280, again gives references showing that the West Indian forms were included in Millepora muricata now transferred to Madrepora, following Pallas. Ellis & Solander included the West Indian species in muriacea. Their var. α is cervicornis Lam.; δ has for a synonym var. β of Pallas; ε is the γ of Pallas, or palmata Lamarck. Esper's Madrepora muricata1 was composed of several species, but included the West Indian forms. In the Museum Calloianum 1797, p. 68, usually credited to Humphreys, the name muricata, so far as I know, is for the first time attached definitely to the West Indian species. Dana, Milne-Edwards & Haime, and subsequent writers on corals until Brook have not used the name. Brook was entirely correct in his use of the name. The form hitherto usually called cervicornis should be the typical form of the species.2

Isopora muricata s.s. (=cervicornis Lamk.). Pl. xxi, and Pl. xxii, fig. 2.

Specimens of this forma are abundant. It is characterized by being loosely and diffusely branched. The branches are often very long. Pourtales has published excellent figures in Agassiz's Florida Coral reefs.3

Collected off Gallardo Bank, tang. of Morillos de Cabo Rojo, ESE. § E. 9¼ miles, in 10 to 10½ fathoms of water.

Isopora muricata forma prolifera Lamarck. Pl. xxii, fig. 1; and Pls. xxiii, xxiv, xxv.

There are numerous specimens of this form. It differs from cervicornis by having more crowded branches, which often show indications of fusing into flabellate fronds. Culebra is one of the localities where this was found. The specimens represented by plates xxiii, xxiv and xxv, are from Dry Tortugas, Florida (Dr. Edw. Palmer, collector).

Isopora muricata forma palmata Lamarck. Pls. xxvi and xxvii.

Fine specimens of this forma were found at both Mayaguez and Culebra. The largest measures 91 by 55.5 cm. across. It is composed of several large fan-shaped masses.

It seems well to give here a somewhat full account of the variations of Madrepora muricata, and this can not be better introduced than by a quotation from Brook's4 discussion of forma palmata.

"The majority of the specimens which have come under my notice do not suggest a very close affinity to the arborecent forms prolifera and cervicornis, and for some time I was inclined to regard them as distinct. Nevertheless a number of intermediate forms occur, chiefly in the collection of the British Museum, which appear to render it necessary to regard all as varieties of one species; and there appears little reason to doubt that the ultimate form of the corallum, whether flabellate or arborecent, is to a great extent dependent on the environment. Tracing the frondose and vasiform specimens, without branchlets, back to M. prolifera, the first step is seen in those specimens already referred to, in which the course of the branches composing the fronds is indicated by grooves in the surface. In other specimens the branches, though confluent, are well marked at the apex of the fronds, and an increase in the size of the axial corallites is generally observable in such specimens."

2J. E. Duerden has some interesting observations on the polyps of this species in Jour. Inst. Jam., vol. 11, No. 6, 1899, pp. 621-622.
3Mem. Mus. Comp. Zool., vol. vii, No. 1, pl. xviii, figs. 1-9 (all figs.), fig. 1 represents a typical branch.
4The genus Madrepora, 1893, pp. 25, 26.
Next in the series come two Challenger specimens from St. Thomas, which show the characters of *M. prolifera* so unmistakably that they were referred to that species by Quelch. In one of these the branches form a complanate but not solid frond; usually from 2 to 5 branchlets are collected together in flattened groups and fused together laterally; they vary from 7 to 12 mm. in thickness, including wall. Radial corallites spreading at an angle of about 45°, tubular, with an oblique aperture, or naiform, rather unequal, 1 to 3.5 mm. long, with immersed ones between, especially in the line of fusion. The other specimen has stouter and less confluent branches, with radial corallites which, in some parts, recall the condition characteristic of *M. cervicornis*.

I went over carefully, in the British Museum, all of the specimens upon which Brook based his notes, and it seemed to me that his conclusion was correct. I have had photographic illustrations made of a number of specimens, and give here a résumé of the features exhibited by them.

Pl. xxiv, fig. 2, is the end of a branch, 20.5 cm. long, of the *cervicornis* variety, showing several branchlets. Pl. xxii represents a specimen, 37.5 cm. high, of the same forma. Pl. xxii, fig. 1, is the end of a branch of the *prolifera* variety, showing some branchlets slightly fused one to another. Pl. xxiv represents another specimen of *prolifera*, 39.5 cm. high, in which the branches and branchlets are somewhat crowded but remain separate. Specimen, pl. xxiii, also of *prolifera*, 35.5 cm. high, has the branches crowded and frequently fused one to another in the same plane. Pl. xxv represents still another specimen of *prolifera*, 51.3 cm. high, in which there is still greater fusion. As the illustration is only about one-half natural size, it does not show the fusion so forcibly as the specimen itself. Pl. xxvi represents a small specimen of *palmata*, greatest length 28.2 cm., which shows the course of the small branches and the free ends of branches around the margin. Pl. xxvii represents a young specimen of *palmata*, breadth 14.8 cm. Even in this specimen faint indications of component, fused branches may be seen.

These plates, together with the quotation from Brook, will show how the transformation in form takes place. Forma *cervicornis* (unniuorta u. k.) stands at one extreme, and forma *palmata* stands at the other. The plates published by Pourtales' form an interesting series for comparison in this connection.

Family PORITIDÆ Dana.

Genus PORITES Link, 1807.

*Porites porites* (Pallas).

1765. *Corallium, poris stellatis*, etc., Seba, Thes., t. iii, p. 202, pl. cix, fig. 11.


The reasons for the use of the specific name *porites* probably should be stated. The *Madrepora porites* of Pallas was not applied to what is now considered a species by any one, but would apply to any *Porites*. If his specific name is to be retained it must be restricted to some one species included in the original group of species. Milne-Edwards & Haime place "*Madrepora porites* (pars) Pallas" in the synonymy of *Porites clavaria* Lamarck, and also place "*Corallium poris stellati*, Seba, Thes. loc. rer. nat., t. iii, p. 202, tab. cix, No. 11" in the synonymy of the same species. Pallas in his synonymy of

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2 Since this manuscript was prepared Prof. J. W. Gregory has published a paper entitled "On the West-Indian Species of *Madrepora*" (Ann. and Mag. Nat. Hist., 7th ser., vol. vi, No. 31, July 1898, pp. 20-31), in which he concludes that the three traditional species of *Madrepora* should be recognized, considering that he was mistaken in the opinion expressed in his "Contributions to the Palaeontology and Physical Geography of the West Indies." From the evidence presented in my own discussion of the subject, I have arrived at the same conclusion as Brook, i. e., it seems to me that the three do intergrade. However, I believe in the retention of the three usually recognized forms of the species. Whether these three forms should be called species, forms, varieties, or subspecies depends upon the individual definitions of these words. In my opinion the proper treatment is to consider all of these *forms* as one species, because of intergradation, and that as the forms are usually distinct they should be differentiated and designated by names of value subordinate to that of the name species. On the other hand, if the existence of not very numerous specimens indicating intergradation is not considered sufficient to overthrow a species, the three forms should be considered species. The question is very largely one of nomenclature. Such discussions as that of Gregory, the one given by Du Rien in the Jour. Jamaica Institute, vol. ii, No. 6, 1899, pp. 621, 622, and the one given here by myself aid in understanding the biology of these *forms*, no matter by what nomenclature they are designated. Du Rien could find no difference in the polyps of the three forms.

I have recently seen, in possession of a curator vender at Palm Beach, Florida, a collection that bridges completely any imaginable gap between *prolifera* and *palmata*.

THE STONY CORALS OF THE PORTO RICAN WATERS.

Madrepora porites cites this same reference to Seba. I have, therefore, seized upon the "Corallium, poris stellatis" of Seba as the type of Porites porites (Pallas). Seba states that the coral is found on the shores of Curação.

I have recognized only one species of branching Porites in the West Indian region, considering all specimens that show intergradation as belonging to the same species. Practically the same conclusion was reached by Rathbun. I have accordingly divided the specimens from Porto Rico into three "formae," and have illustrated each of them.

When I employ the specific designation Porites porites (Pallas) without placing the name of a forma or variety after, it will apply to any of the branching Porites from the West Indian region with the special septal arrangement later described. Usually, however, the particular forma of the species will be indicated.

I had hoped to find in the U. S. National Museum a specimen of Porites from Curação that would be practically a duplicate of the specimen figured by Seba, but could find none, though there are some from Florida. We have from Curação a specimen that agrees fairly well with Seba's figures, except the branches are more crowded. It is represented on pl. xxviii by illustrations from photographs. It can scarcely be referred to any one of the three formae recognized in the Porto Rican collection, but resembles furcata more closely than it does clavaria. The calicular structure is more pronouncedly of the furcata type. There are either five or six pali, but without taking a precise census five seems to be the more common number. Six is the usual number on the lower portion of the living part of the corallum, while five is the usual number on the ends of the branches. The calices are superficial except near and on the ends of the branches, where they are fairly deep. Twelve seems to be the constant number of septa. The calices show a bilateral symmetry. At one end of the plane of symmetry is a free septum joining directly the "columellar tangle," at the other is a septum with a septum on each side of it and bending toward it. There are four other septa on each side of the plane of symmetry. They are fused together and to the "columella tangle" in pairs. This arrangement is not constant. In one calice there are two groups of three septa each and three groups of two septa each, without apparent bilateral symmetry, but this arrangement can be easily derived from the usual condition by the solitary directive septum joining to an adjacent pair of septa. This would make the asymmetry apparent but not real. There is a palus before each group of septa, and often there is also a palus before the solitary directive. The columella shows three conditions—the columellar axis may be open, there may be a spongy columella, or the columella may be terminated above by a tubercle. The wall is wide and flattish on the older portions of the colony and thin and acute on the younger portions on the ends of the branches. The usual diameter of the calices is 1.5 to 2 mm.

This specimen has been described in considerable detail, because it may be regarded as something like a type of the species—it is a topotype.

The calicular structure of this Curaçãoan specimen and that of the three formae subsequently recognized show the same range in variation, i. e., number and arrangement of septa, characteristics of pali, and character of columella. Usually forma clavaria has the columella terminated above by a tubercle, but not always; in forma furcata there may or may not be a columellar tubercle; the same is true of forma divaricata. These notes on variation are based not upon comparing different specimens but upon comparing the calices of the same specimen.

The description of the calicular structure will not be repeated in discussing the formae.
Gregory has omitted the names of three species that should be placed in this synonymy. *Porites polymorphus* Link¹ is simply a new name for *Madrepora porites* of Pallas. Reference is made to pl. xxI of Esper, which belongs in the *Porites clavaria* group of Lamarck, pl. xxI A is different. The genus *Porites* does not date from Lamarck 1816, but from Link 1807. The type species is *Madrepora porites* Pallas, here restricted and called *Porites porites* (Pallas). Lamarck did not use *Porites* in his *Système des Animaux sans Vertèbres*, 1801. The other species omitted by Gregory are *Porites valida* Duchassaing & Michelotti,² and *Porites nodifera* Klunzinger.³ Rehberg in his “Neue und wenigbekannte Korallen”⁴ says that Klunzinger’s *P. nodifera* is probably the same as *P. clavaria*, and that the locality, Red Sea, as given by Ehrenberg and Klunzinger, is erroneous. I studied carefully the figured type of *nodifera* in the Museum für Naturkunde, Berlin, and in my opinion *nodifera* and *clavaria* are the same, and it seems to me most probable that Rehberg’s suggestion as to the wrong locality label becoming attached to the specimen is correct.

I have divided this species, as represented by Porto Rican specimens, into three forms, viz, *clavaria* and *furcata*, both of Lamarck, and *divaricata* Le Sueur. The Porto Rican specimens do not show intergradation between the three forms, but the splendid suites in the United States National Museum show the perfect passage of one form into another.

### Porites porites forma clavaria Lamarck

Pl. xxix and Pl. xxxi, fig. 2.

There are five specimens of the form, either complete colonies or fragments. Pl. xxxix, represents one of the specimens and pl. xxxi, fig. 2, the calices enlarged. There are no indications in these specimens of an intergradation with forma *furcata*, the larger size and especially the more swollen and blunter ends of the branches being the most salient difference from the latter. But the calices also are usually different. They are shallower, deeper on the ends of the branches, and are usually 2 mm. in diameter. A columella, represented by a tubercle and surrounded by six pali, is usually present. On the ends of the branches, where the calices are deeper, the pali are not so well developed.

The septa are perforate lamellae, as Bernard has described them.⁵ The height to which the epitheca rises is so variable that no importance is attached to it.

From Ensenada Honda, Culebra.

### Porites porites forma furcata Lamarck

Pl. xxx and Pl. xxxi, fig. 1.

The branches of this species are more slender than in *clavaria*. The calices are smaller, 1.5 mm. in diameter. No absolute distinction can be made based on the calicular structure, but usually in *furcata* there are only five pali.

From Ensenada Honda, Culebra.

### Porites porites forma divaricata Le Sueur

Pl. iv, figs. 4, 4a, 4b.

Twenty specimens of a delicate species of *Porites* were collected at station 6087, off Culebra, Point Mula light-house, in 15½ fathoms of water. These at first appeared to me so different from the other specimens that I thought they certainly belonged to a distinct species. From a comparison with the large suites of forma *furcata* in the United States National Museum they now seem to me to intergrade with forma *furcata*, *divaricata* being much more delicate. The figures show the characters well. The most salient characteristic is the small diameter of the branches, the largest being only 6 mm. in diameter. The diameter, too, is almost the same at the distal end as at the origin of the branch. The calices are very shallow, 2 mm. in diameter. The wall is narrow, flattish, or subacute.

The specimens were associated with *Oculina diffusa*, *Azhelia mirabilis*, and *Meandrina maxandrii* young.

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³ Die Korallenfhiere des Rothen Meeres, pl. ii, p. 41.
Porites astreoides Lamarck. Pls. xxxii, xxxiii, xxxiv.

1866. Porites michelini, Duchassaing & Michelotti, op. sup. cit., p. 98, pl. x, figs. 9, 10.
1866. f Porites subtilis, Duchassaing & Michelotti, op. sup. cit., p. 98, pl. x, figs. 7, 8.
1866. Cosmoporites lavignata, Duchassaing & Michelotti, op. sup. cit., p. 99, pl. x, figs. 12, 16.

Ehrenberg's Madrepora (Porites) astreoides is not a Porites but is a Stylophora, St. ehrenbergti Milne-Edwards & Haime.¹

The only point in the synonymy of this species demanding especial consideration is the treatment accorded the species of Duchassaing & Michelotti. I found in Turin the types of five of the eight species described by these authors, viz, litoralis, superficialis, gaudalpensis, inconerta, and agaricus. I could not discover differences of sufficient importance to establish even varieties. There remain Neoporites michelini, N. subtilis, and Cosmoporites lavignata, all of which are figured; besides, the names are accompanied by poor, brief Latin descriptions. Neither the descriptions nor figures show any characters of value, unless it be in the figure of the calice of subtilis showing a greater number of septa than in the other species.


Two species grouping with astreoides remain to be considered, viz, Porites solida Verrill (non solida Forskal)=P. verrilli Rehberg,² and Porites branneri Rathbun. The former, P. verrilli Rehberg, must in my opinion be placed in the synonymy of P. astreoides. There are several excellent specimens in the United States National Museum from Rio Formosa, Pernambuco, Brazil (collected by the Hartt Expedition, 1875). These specimens have the same general appearance as astreoides. The only feature that could be used for specific differentiation is the usually constant presence of a solid columella, which may have a small slight styliform projection in the center. There are twelve septa, no palli, and the wall is as in astreoides. The difficulty about using the difference of the columella as of specific value is that in the specimens of verrilli it shows variation in the degree of compactness, while in astreoides we can find in the same specimen the typical verrilli condition or a weak style with very little or no basal deposit around it. There can be no varietal difference.

Porites branneri Rathbun seems to be a distinct species. There are in the United States National Museum several specimens from Pernambuco, Brazil (Hartt Exp., collector). The species grows in small, incrusting masses. The calices are smaller than is common in astreoides, but the distinguishing feature is the constant presence of five palli; they are rather slender and erect. The columella space is usually vacant, sometimes a "columellar tangle" is present. The species needs further study, for it suggests the young colony of Porites porites (Pallas).

In P. astreoides the usual number of septa is twelve, but sometimes rudimentary septa are present between the larger.

There are six excellent specimens of this species, which may be divided into two forms.

Forma α, Pl. xxxii and Pl. xxxiv, fig. 1.—To this form four of the specimens belong. It is especially characterized by the surface of the corallum possessing numerous gibbosities. Certain features of the specimens belonging to this form may with propriety be described in some detail. The edge of the wall between the corallites is acute; the calices are rather deep. The diameter of the calices is 1.5 to 2 mm. There are usually twelve large septa with rudimentary or smaller septa quite

¹ Hist. Nat. Cor., t. ii, p. 150.
often between them. The septal margins are dentate; the septa themselves are perforate.\(^1\) The
columella is represented by a small tubercle or lamina.

*Forma \(\beta\)*, Pl. xxxiii and xxxiv, fig. 2.—This form is represented by two specimens. Its most
striking peculiarity is the fewness of gibbosities, but correlated with this character are others. When
the surface is gently rounded, the calices are smaller than in *forma \(\alpha\)*, being only 1 mm. in diameter,
the walls separating the corallites are often not so acute as in *forma \(\alpha\)*, and the calicular fossa resembles
a pit with a perpendicular boundary. It at first sight seems that two distinct species are represented,
but there are gibbosities present in *forma \(\beta\)*, and upon these the calicular characters of *forma \(\alpha\)*
appear. The calices here are larger, between 1.5 and 2 mm. in diameter, the separating wall between
adjoining calices acute, etc. These specimens are a good illustration of the possibility of dividing one
species into two, should only portions of the surface of the coralla be studied. They illustrate, too,
the influence of form of growth upon the size and other characters of the calices. While the calices
on the gibbosities are large, those situated in the depressions between them are small, only a millimeter or even less in diameter.

The actual arrangement of the septa of *Porites astreoides* *forma \(\alpha\)* is similar to that of *P. porites*, i.e.,
there is a solitary directive septum with a group of three septa opposite, and besides these there are
four pairs of septa, two pairs on each side of the plane of symmetry, except that the septa of the
group of three remain free one from another and are prolonged to the columella each independently;
the outer two septa of those three bend toward the included one. Twelve is the usual number of septa,
though sometimes there may be a few more. The arrangement of the septa, columella, etc., are
frequently the same in both *forme \(\alpha\)* and \(\beta\). As the calices of the latter are usually deeper than in
the former, a photograph did not bring out the structural features clearly. Pali are poorly developed
or absent.

Classifying the calicular structure according to Bernard's\(^2\) scheme, which has been already referred
to, the usual plan is represented by his fig. 2 or is intermediate between figs. 1 and 2.

In *forma \(\alpha\)* the condition represented by fig. 1, where the inner margins of all septa are free one
from another, was not found, but in some calices the fusion was slight; fig. 2 represents the usual
condition; the condition represented in fig. 4 was found in a few instances, but the pali were poorly
developed. In *forma \(\beta\)* the condition represented by fig. 1 is frequently approached very closely, if not
actually present; that of fig. 2 is represented; and that of fig. 4 is hinted at, but not clearly present.

Bernard has published some notes on the calicular structure of *P. astreoides* in his paper already
cited on the calices of the genus.\(^3\)

**Class HYDROZOA.**

**Order HYDROCORALLINÆ Moseley.\(^4\)**

**Family MILLEPORIDÆ L. Agassiz.**

**Genus MILLEPORA Linnaeus, 1758.**


Hickson (op. et loc. sup. cit) has given a lengthy discussion of the synonymy of this species.
Following him I have not recognized more than one species of *Millepora* in the West Indies. Two
distinct forms, as determined by the shapes of the coralla, are represented in the collection; one
possesses a solid and palmate corallum, and the other has the corallum dissected, with some digitiform
projections. Both forms are shown in the plates.

From Mayaguez and Culebra.

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\(^1\) Bernard's characterization of the septa of *Porites* as "perforate lamellate septa" (Jour. Linn., vol. xxvi, 1899, p. 137) is correct.
\(^3\) These, although they are not corals, are included because they are among the commonest of the reef-building animals of the Porto Rican waters.
THE STONY CORALS OF THE PORTO RICAN WATERS.

EXPLANATION OF PLATES.

PLATE I:
Figs. 1, 1a, Paragracanthus de filippii Duchassaing & Michelotti. Fig. 1, upright view of corallum; height, 7 mm. Fig. 1a, calicular view; greater diameter of calice, 6.5 mm.

Figs. 2, 2a, Deltocyclus italicus (Michelotti), var. color Porruales. Copied from Lindstrom. [Actinology of the Atlantic Ocean, pl. 1, fig. 13, and pl. 11, fig. 14.] Fig. 2, view of base. Fig. 2a, calicular view. Lindstrom does not give the size of the specimen or indicate the magnification of his figures; judging from his text, the diameter is probably 8 mm. (exclusive of the horns).

Figs. 3, 3a, Astelia morabilis (Duchassaing & Michelotti). Fig. 3, general view of a branch; greatest length, 45 mm. Fig. 3a, view of a calice; greater diameter, 2 mm. The surface of the corallites is covered with elongate granules, which show a decided tendency to be arranged in striae.

Fig. 4, Astelia asperula (M.-Edw. & H.). Several calices enlarged; distance between columnellar styles of the two calices farthest apart, 2.5 mm.; figure enlarged 8 times. The septal margins are exsert and on the tips of the branches the calicular margins are frequently considerably elevated.

Figs. 5, 5a, Oculina diffusa Lam., var. Fig. 5, general view of a branch; greatest length, 70 mm. Fig. 5a, calicular view of a corallite; greater diameter, 3 mm.

Figs. 6, 6a, b, Astrangia solidaria (Le Sueur)' var. portoricensis var. nov. Fig. 6, upright view of a single corallite; height, 13.5 mm. Fig. 6a, costa and exsert portion of several septa enlarged. Fig. 6b, calicular view; greater diameter of calice, 7 mm.

Figs. 7, 7a, b, "Diaseris" crispa Pournales. Fig. 7, upright view of corallum; diameter, 9 mm. Fig. 7a, 1/2 systems of septa, seen from above, enlarged; the Arabic figures 1 and 2 denote septa of the first and second cycles, respectively. Fig. 7b, view of the base.

PLATE II:
Figs. 1, 1a, b, c, Cyathoceras portoricensis, sp. nov. Fig. 1, upright view of corallum; height, 22 mm. Fig. 1a, calicular view; greater diameter, 10 mm. Fig. 1b, profile of a large septum. Fig. 1c, costa and exsert portions of several septa enlarged.

Figs. 2, 2a, b, Astrangia ostreiformis M.-Edw. & H. Fig. 2, general view of a corallum; greatest distance across, 21.5 mm.; calicular view of a corallite; greater diameter, 5 mm. Fig. 2a, costa enlarged; the costa usually are more granulate and the septal margins are alternately more and less exsert.

Figs. 3, 3a, Cadicora arbacea (Le Sueur). Fig. 3, general view of a portion of a corallum; greatest length, 33.5 mm. Fig. 3a, calicular view of a corallite; greater diameter of calice, 3.5 mm. (of corallite 4.5 mm.).

Figs. 4, 4a, b, Porites porites forma diversicula Le Sueur. Fig. 4, general view of a corallum; greatest length, 30 mm. Fig. 4a, two calices enlarged, distance across the two, 4 mm.; the letter a corresponds to letter a in fig. 4b; this calice possesses 5 pali and no columnellar tubercle; the septal arrangement and the mode of occurrence of pali are diagrammatically represented by fig. 4b; the other calice possesses 5 pali and a columnellar tubercle; between the pali and the wall on several septa are prominent septal granules, so it is not easy to distinguish the pali and columnellar tubercle in the figure; the septal arrangement is the same in both calices.

PLATE III: Meandrina meandrites (Linn.) ? Young. View from above; greatest length, 70 mm.

PLATE IV:
Fig. 1, Meandrina meandrites (Linn.) ? Young. Upright view of corallum; greatest length, 79 mm.


PLATE VI: Orbicella acropora (Linn.) var. General view of a corallum; 18.7 cm. high.

PLATE VII: Orbicella acropora (Linn.) var. Calices enlarged; usual diameter of calices about 4.5 mm.; enlarged about 5 times.

PLATE VIII: Favia fragum (Esper). Lower figure, view of a corallum from side; upper figure, view from above, more enlarged; greater transverse diameter of specimen, 2.85 cm.

PLATE IX: Platygyra viridis (Le Sueur). General view of a large head; height, 35 cm.

PLATE X: Platygyra viridis (Le Sueur). Valleys enlarged.

PLATE XI: Platygyra viridis (Le Sueur). Portion of valleys represented by pl. x more highly enlarged.

PLATE XII: Platygyra viridis (Le Sueur). Meandritiform valleys enlarged.

PLATE XIII: Platygyra viridis (Le Sueur). Portion of the valleys, represented by pl. xii more highly magnified.
PLATE XIV: Siderastrea siderea (Ell. & Sol.):
Fig. 1, General view of a large specimen; greater horizontal diameter, 20.2 cm.
Fig. 2, "view of the same specimen, from above.

PLATE XV: Siderastrea radians (Pallas). View of a specimen from above; greatest diagonal, 14 cm.

PLATE XVI:
Fig. 1, Siderastrea siderea (Ell. & Sol.). Calices enlarged.
Fig. 2, Siderastrea radians (Pallas). Calices enlarged.

PLATE XVII:
Fig. 1, Agaricia elepeliolus (Pallas). View of a corallum from above; greatest width, 36 mm.
Fig. 2,  

PLATE XVIII: Agaricia a. General view of a specimen; height, 34.5 mm.

PLATE XIX: Agaricia sp. Portions of valleys, enlarged.

PLATE XX: Agaricia cailleti (Duch. & Mich.). General view of a specimen; height, 7.7 cm.

PLATE XXI: Isopora muricata (Linn.) s. s. (= crecicornis Lamarck). Height of specimen, 37.5 cm.

PLATE XXII:
Fig. 1, Isopora muricata forma prolife Lam. End of a branch; height, 9 cm.
Fig. 2, Isopora muricata forma prolife Lam. Height, 20.5 cm.

PLATE XXIII: Isopora muricata forma prolife Lam., from Dry Tortugas, Florida. Height, 35.5 cm.

PLATE XXIV: Isopora muricata forma prolife Lam., from Dry Tortugas, Florida. Height, 39.5 cm.

PLATE XXV: Isopora muricata forma prolife Lam., from Dry Tortugas, Florida. Height, 51.3 cm.

PLATE XXVI: Isopora muricata forma palmata Lamarck. Greatest breadth, 23.2 cm.

PLATE XXVII: Isopora muricata forma palmata Lamarck. Breadth, 14.8 cm.

PLATE XXVIII: Porites porites (Pallas). Specimen from Curacao. Height, 13.3 cm.; greatest breadth, 16 cm.
Fig. 1, General view of a corallum. Calices enlarged.

PLATE XXIX: Porites porites forma clavaria Lam. Height of specimen, 14.5 cm.

PLATE XXX: Porites porites forma furcata Lam. Extreme breadth of specimen, 26 cm.

PLATE XXXI:
Fig. 1, Porites porites forma furcata Lam. Calices enlarged.
Fig. 2, Porites porites forma clavaria Lam. Calices enlarged.

PLATE XXXII: Porites astreoides Lam., forma a. Horizontal diameter of specimen, 17.6 cm.

PLATE XXXIII: Porites astreoides Lam., forma b. Greater horizontal diameter, 20.6 cm.

PLATE XXXIV:
Fig. 1, Porites astreoides Lam., forma a. Calices enlarged.
Fig. 2, Porites astreoides Lam., forma b. Calices enlarged.

PLATE XXXV: Millepora alcicornis Linn. Digitiform variety; greatest breadth, 35.5 cm.

PLATE XXXVI: Millepora alcicornis Linn. Variety with fabellate fronds; height of specimen, 28.5 cm.

PLATE XXXVII: Millepora alcicornis Linn. A small digitiform corallum; height, 19 cm.

PLATE XXXVIII: Millepora alcicornis Linn. A portion of the surface of the specimen represented by pl. xxxvii, enlarged.
MAEANDRITES (Linn.) YOUNG. VIEW FROM ABOVE, GREATEST LENGTH, 79 MM.
FIG. 1. MEANDRINA MAEANDRITES (LINN.) YOUNG. UPRIGHT VIEW OF CORALLUM, GREATEST LENGTH, 79 MM.
FIG. 1. SIDERASTREA SIDERE A (ELL. & SOL.). GENERAL VIEW OF A LARGE SPECIMEN, GREATER HORIZONTAL DIAMETER 20.2 CM.
1. SIDERASTREA SIDEREA (ELL. & SOL.). CALICES ENLARGED.

1. SIDERASTREA SIDEREA (ELL. & SOL.). CALICES ENLARGED.
FIG. 1. ISOPORA MURICATA FORMA PROLIFERA LAM. END OF A BRANCH, HEIGHT 9 CM.
ISOPORA MURICATA FORMA PALMATA LAMARCK. GREATEST BREJRICATA FORMA PALMATA LAMARCK. GREATEST BREADTH, 23.2 CM.
RITES (PALLAS). SPECIMEN FROM CURAÇAO. HEIGHT 13.3 CM.; GREATEST BREADTH 16. CM.
GENERAL VIEW OF CORALLUM AND VIEW OF PORTION WITH CALICOF CORALLUM AND VIEW OF PORTION WITH CALICES ENLARGED.
ORITES FORMA FURCATA LAM. EXTREME BREADTH OF SPECIMEN, 26 CM.
FIG. 1. PORITES ASTREOIDES LAM. FORMA $\alpha$. CALICES ENLARGED.
CICORNIS LINN. DIGITIFORM VARIETY. GREATEST BREADTH, 35.5 CM.