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THE STONY CORALS OF THE PORTO RICAN WATERS.

BY

T. WAYLAND VAUGHAN.

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## INTRODUCTION.

In the following account of corals collected around Porto Rico by the U. S. Fish Commission steamer *Fish Hawk* 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 Curaçao, Arube, and Bonaire."<sup>1</sup> 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 *formæ* 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:

Name.	Locality.	Depth (fathoms).	Bottom.
<i>Caryophyllia berteriana</i> Duchassaing? .....	Not given.		
<i>Cyathoceras portoricensis</i> , sp. nov. ....	Station 6051.	43.	Sand, mud, shells.
<i>Paracyathus de filippi</i> Duchassaing & Michelotti. ....	Stations 6062, 6075 .....	31 to 30 .....	Do.
<i>Deltocyathus italicus</i> (Michelotti) .....	Station 6067 .....	97 to 120 .....	Coral sand.
<i>Oculina diffusa</i> Lamarck, var. ....	Stations 6087, 6092, 6097 .....	10 to 16 .....	Do.
<i>Axhella asperula</i> (M. Edw. & H.) .....	Station 6087 .....	15½ .....	Do.
<i>mirabilis</i> (Duchassaing & Michelotti) .....	Station 6051.	43.	Sand, mud, shells.
<i>Meandrina meandrites</i> (Linn.)? young .....	Stations 6090, 6087 .....	15½ to 20 .....	Coral sand.
<i>Cladocora arbuscula</i> (Le Sueur) .....	Station 6087 .....	15½ .....	Do.
<i>debilis</i> M. Edw. & H. ....	Not given.		
<i>Astrangia solitaria</i> ? var. <i>portoricensis</i> , var. nov. ....	Not given.		
<i>astroiformis</i> M. Edw. & H. ....	Station 6090 .....	16.	Coral sand.
<i>Orbicella acropora</i> (Linn.) var. ....	Mayaguez .....		Reef.
<i>Favia fragum</i> (Esper) .....	Playa de Ponce .....		Do.
<i>Manicina areolata</i> (Linn.) .....	Ensenada Honda, Mayaguez, Aguadilla.		Reef.
<i>Platygyra viridis</i> (Le Sueur) .....	Mayaguez .....		Do.
<i>Siderastrea radians</i> (Pallas) .....	do .....		Do.
<i>siderea</i> (Ellis & Sojander) .....	Culebra .....		Do.
<i>Agaricia elephantotus</i> (Pallas) .....	Station 6090 .....	16.	Coral sand.
<i>Agaricia</i> sp. ....	do .....	16.	Do.
<i>cailloti</i> (Duchassaing & Michelotti) .....	Station 6079 .....	20 to 23 .....	Do.
" <i>Diaseris</i> " <i>crispa</i> Pourtales .....	Station 6069 .....	225 to 231 .....	Sand, mud.
<i>Isopora muricata</i> (Linn.) ss. ( <i>forma cervicornis</i> Lam.) ..	Mayaguez, etc. ....	to 10 .....	Reef.
<i>prolifera</i> Lam. ....	Culebra .....		Do.
<i>palmata</i> Lam. ....	Mayaguez, Culebra .....		Do.
<i>Porites porites</i> (Pallas) <i>forma clavaria</i> Lam. ....	Culebra, Ensenada Honda .....		Do.
<i>furcata</i> Lam. ....	do .....		Do.
<i>divaricata</i> Le Sueur. ....	Station 6087 .....	15½ .....	Coral sand.
<i>Porites astreoides</i> Lamarck .....	Mayaguez, Culebra .....		Reef.
<i>Millepora alcicornis</i> Linn .....	do .....		Do.

<sup>1</sup> Samml. des Geologisch. Reichs. Museum, Leiden, ser. II, Bd. II, Heft 1, pp. 1-81, 1901.

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 ACTINIÆ.

##### Suborder SCLERACTINIÆ.

##### Family CARYOPHYLLIDÆ Verrill.

##### Genus CARYOPHYLLIA Lamarck, 1801.

##### *Caryophyllia berteriana* Duchassaing?

1850. *Caryophyllia berteriana*, Duchassaing, Anim. Rad. Ant., p. 15.  
 1868. *Caryophyllia formosa*, Pourtalès, Bull. Mus. Comp. Zool., vol. I, No. 6, p. 113.  
 1871. *Caryophyllia formosa*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 7, pl. I, fig. 16; also *C. berteriana*, *ibid*, p. 8.  
 1874. *Caryophyllia berteriana*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 32, pl. VI, figs. 1, 2.  
 1878. *Caryophyllia formosa*, Pourtalès, Bull. Mus. Comp. Zool., vol. V, No. 9, p. 199.  
 1880. *Caryophyllia berteriana*, Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, pp. 96, 99.  
 1881. *Caryophyllia berteriana*, Moseley, Deep-Sea Corals, Challenger Reports, p. 134.

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. I, figs. 1, 1a.

1861. *Paracyathus de filippii*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 60 (of reprint), pl. IX, figs. 2, 3.  
 1866. *Paracyathus de filippii*, Duchassaing & Michelotti, Sup. Mém. Corall. Ant., p. 65 (of reprint).  
 1869. *Paracyathus confertus*, Pourtalès, Bull. Mus. Comp. Zool., vol. I, No. 7, p. 134.  
 1871. *Paracyathus confertus*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 11, pl. VI, figs. 11, 12, 13.  
 1874. *Paracyathus de filippii*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 38.  
 1878. *Paracyathus confertus*, Studer, Monatsber. Akad. Wissen. Berlin for 1877, p. 628.  
 1878. *Paracyathus de filippii*, Pourtalès, Bull. Mus. Comp. Zool., vol. V, No. 9, p. 200.  
 1880. *Paracyathus de filippii*, Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, pp. 96, 105.  
 1881. *Paracyathus de filippii*, Moseley, Deep-Sea Corals, Challenger Reports, p. 144.

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,  $8\frac{1}{2}$  to 30 fathoms.

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. Costæ 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 costæ 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 columella. 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 striæ, along which granulations are arranged. The striæ diverge inwardly and outwardly from a vertical line corresponding in position with the wall. The striæ 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 striæ 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 columella, 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.  $\frac{1}{2}$  W.,  $1\frac{1}{4}$  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 Pourtalès 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 columellas in every respect resembling those of the *Caryophyllias*."<sup>1</sup> 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 *Caryophyllia*. 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 *Ceratotrochus*, as represented by *C. duodecimcostatus* (Goldfuss), the difference between the two genera consisting in *Ceratotrochus* 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.*Deltocyathus italicus* (Michelotti). Pl. I, figs. 2, 2a. (Copied from Lindström).

One dead, worn specimen of this species was obtained. It is the variety *calcar* of Pourtalès, possessing six horns corresponding to the six primary septa.<sup>2</sup>

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

<sup>1</sup> Deep-Sea Corals, Challenger Reports, Zool., vol. II, pt. VII, 1881, p. 156.

<sup>2</sup> Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, 1880, p. 102, pl. I, fig. 5. Moseley, Deep-Sea Corals, Challenger Reports, p. 145, lower two figures, "Stellate variety of Pourtalès."

## Family OCULINIDÆ Milne-Edwards &amp; Haime.

## Genus OCULINA Lamarck, 1816.

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

1816. *Oculina diffusa*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 285.

1880. *Oculina diffusa*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, pl. III, figs. 10, 11, 12.

A number of specimens of this species are in the collection from stations 6097, off Humaçao, village of Humaçao; 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 pallens* 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. pallens* 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. pallens*. The same is true of the costæ. 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 &amp; Haime, 1849. (+ MADRACIS Milne-Edwards &amp; Haime.)

Type species: *Axhelia myriaster* Milne-Edwards & Haime.

Type species of *Madracis*: *Madracis asperula* Milne-Edwards & Haime.

1849. *Axhelia*, Milne-Edwards & Haime, Compt. Rend., t. XXIX, p. 69.

1849. *Madracis*, Milne-Edwards & Haime, *ibid.*, t. XXIX, p. 70.

1861. *Reussia*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 63 (of reprint).

1871. *Pentalophora*, Saville-Kent, Proc. Zool. Soc. London for 1871, p. 283.

1884. *Madracis*, Duncan, Jour. Linn. Soc. Lond., vol. XVIII, p. 45.

I am unable to discover any criterional differences for the separation of *Axhelia* (subsequently spelled *Azohelia*) from *Madracis*. Milne-Edwards & Haime<sup>1</sup> 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 à peu près semblables; mais leur cœnenchyme, quoique très dense, est d'une structure différente, et les chambres des polypières 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 & Haime are from a young specimen.<sup>2</sup>

*Axhelia asperula* (Milne-Edwards & Haime). Pl. I, fig. 4, and Pl. XVII, fig. 2.

1849. *Madracis asperula*, Milne-Edwards & Haime, *nom. nud.*, Compt. Rend., t. XXIX, p. 70.

1850. *Madracis asperula*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XIII, p. 100, pl. IV, figs. 2, 2a.

1857. *Madracis asperula*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 139.

1871. *Madracis asperula*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 27.

1880. *Madracis asperula*, Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, p. 108.

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

<sup>1</sup> Ann. Sci. Nat., 3ième sér., t. XIII, 1850, p. 100.

<sup>2</sup> Ann. Sci. Nat., t. sup. cit., pl. IV, figs. 2, 2a.

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

1861. *Stylophora mirabilis*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 62 (of reprint), pl. ix, figs. 6, 7.  
 1874. *Axohelia mirabilis*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 41, pl. VIII, fig. 4.  
 1880. *Axohelia mirabilis*, Pourtalès, Bull. Mus. Comp. Zool., vol. vi, No. 4, p. 107.

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

Portalès 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 & Haime. He seemed doubtful concerning his own *Axohelia schrammi*.<sup>1</sup> 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 Pourtalès 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 cœnenchyma. The echinulations may be tall and coarse, or delicate.

The principal difference between the specimens 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 mæandrites* Ellis & Solander, Nat. Hist. Zooph., p. 161, tab. XLVIII, fig. 1).

1801. *Meandrina*, Lamarck, Syst. Anim. s. Vert., p. 372.  
 1815. *Pectinia* (pars), Oken, Lehrb. Naturgesch., p. 68.  
 1815. *Mæandra* (pars), Oken, op. cit., p. 70, pl. II, second column, bottom fig. (= pl. IV A, Esper, reduced).  
 1816. *Meandrina* (pars), Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 244.  
 1846. *Ctenophyllia*, Dana, Zooph. Wilkes Expl. Exp., p. 169.  
 1848. *Ctenophyllia*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. X, p. 276.  
 1851. *Pectinia*, Milne-Edwards & Haime, Arch. Mus. Hist. Nat., t. V, p. 56.  
 1857. *Pectinia*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 206.  
 1884. *Pectinia*, Duncan, Jour. Linn. Soc. London, vol. XVIII, p. 86.  
 non  
 1820. *Meandrina*, Schweigger, Handb. Naturgesch., p. 420.  
 1846. *Meandrina*, Dana, Zooph. Wilkes Expl. Exped., p. 252.  
 1848. *Meandrina*, Milne-Edwards & Haime, Comptes Rendus, t. XXVII, p. 493.  
 1857. *Meandrina*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 388. Not *Mæandrina* of subsequent authors.

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 mæandrites* of Linnæus 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 *Mæandra*, which was defined "Mündungen als Furchen vielfältig hin und hergewunden wie hirnwindungen, unverzweigt, in Klumpen."<sup>2</sup> He included in the genus *M. areola* (= *Manicina areolata* (Linn.)), and *M. mæandrites*, which he divides into two varieties, (a) Gemeines Hirnkorall, *Matrepora mæandrites* Pallas, *labyrinthiformis* Linn. Blätter gezähnet. Das gewöhnliche, das man in Kabinetten antrifft." This is partly *Diploria labyrinthiformis*, but quite surely a considerable number of species are here confused. "(b) Irrgarten, *M. labyrinthiformis* Pallas, *mæandrites* Linn.; Blätter ungezähnet. Sehr selten, Amerika, auch im Mittelmeer," u. s. w. This is *Meandrina mæandrites* (Linn.). "Hieher *Matrepora gyrosa*, *dædalea*, *natans*."

<sup>1</sup>Bull. Mus. Comp. Zool., vol. VI, No. 4, 1880, p. 107.

<sup>2</sup>Lehrb. Naturg., p. 70.

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 mæandrites* Linn. = *Meandrina mæandrites* (Linn.). I think it best to consider the figured species as the type of the genus. This would make *Mæandra* Oken a synonym of *Meandrina* Lamarck. Lamarck in 1816 included nine species in his *Meandrina*, the last one being the *Madrepora filograna* of Esper (= *clivosa* of Ellis & Solander). Dana's *Ctenophyllia* covers precisely the same ground as Lamarck's original *Meandrina*. In 1848 Milne-Edwards & Haime, in the Ann. Sci. Nat., t. x, use *Ctenophyllia* for Lamarck's original *Meandrina* (following Dana), and in the Comptes Rendus, t. XVII, make *filograna* 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 *Polypiers des Terrains Paléozoïques*, *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* can not be the type, because it was already the type of *Meandrina*; therefore *lactuca* must become the type of *Pectinia*, and *Tridacophyllia* of Milne-Edwards & Haime must become a synonym of *Pectinia*. *Mæandra* becomes a synonym of *Meandrina*. *Ctenophyllia* is an exact synonym of *Meandrina*. A new name must be used for what Milne-Edwards & Haime have called *Mæandrina*. The name *Platygyra* of Ehrenberg,<sup>1</sup> 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:

Present names.	Name used by Milne-Edwards & Haime, 1857.
<i>Meandrina</i> .....	<i>Pectinia</i> .
<i>Pectinia</i> .....	<i>Tridacophyllia</i> .
<i>Platygyra</i> .....	<i>Mæandrina</i> .

***Meandrina mæandrites* (Linn.)? Young. Pl. III; Pl. IV, fig. 1.**

1758. *Madrepora mæandrites*, Linnæus, Syst. Nat., ed. x, p. 794.  
 1766. *Madrepora mæandrites*, Pallas (as applied to Seba, t. III, pl. cxi, fig. 8), Elench. Zooph., p. 292.  
 1766. *Madrepora labyrinthica*, Pallas (non-Linnæus), op. cit., p. 297. Synonymy given by Pallas, not of *Madrepora mæandrites* Linnæus.  
 1797. *Madrepora lamellosa*, Humphreys, Mus. Calonn., p. 66.  
 1801. *Meandrina pectinata*, Lamarck, Syst. Anim. s. Vert., p. 372.  
 1815. *Pectinia pectinata*, Oken, Lehrb. Naturgesch., p. 68.  
 1815. *Mæandra labyrinthiformis*, b, Oken, op. cit., p. 70.  
 1834. *Manicina pachyphylla*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 326.  
 1846. *Ctenophyllia mæandrites*, Dana, Zooph. Wilkes Expl. Exp., p. 170, pl. xiv, fig. 13.  
 1846. *Ctenophyllia quadrata*, Dana, op. cit., p. 170, pl. xiv, fig. 14.  
 1851. *Pectinia mæandrites*, Milne-Edwards & Haime, Arch. Mus. Hist. Nat. Paris, t. v, p. 57.  
 1851. *Pectinia quadrata*, Milne-Edwards & Haime, op. sup. cit., p. 57.  
 1861. *Pectinia disticha*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 66 (of reprint), pl. IX, fig. 16.  
 1861. *Pectinia elegans*, Duchassaing & Michelotti, op. sup. cit., p. 66.  
 1861. *Pectinia caribæa*, Duchassaing & Michelotti, op. jam cit., p. 67.  
 1890. *Manicina areolata*, A. Agassiz, Bull. Mus. Comp. Zool., vol. xx, No. 22, pl. III. Non *Manicina areolata* (Linn.).

*Ctenophyllia profunda* and *pachyphylla* Dana (1848) probably should be included in the above synonymy. Twelve species of *Meandrina* (*Pectina* auct.) have been described or named, viz, *mæandrites* by Linnæus; *lamellosa* by Humphreys; *pectinata* by Lamarck; *pachyphylla* by Ehrenberg; *quadrata* and *profunda* by Dana; *brasiliensis*, *danæ*, and *sebw* by Milne-Edwards & Haime; *disticha*, *elegans*, and *caribæa* by Duchassaing & Michelotti. My study of the synonymy of *mæandrites* has resulted in the identical conclusion of Gregory, except that I have also included Dana's *profunda* as questionable.

<sup>1</sup>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 *meandrites* 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 arcolata*.

The granulations on the faces of the septa and the septal dentations in *Meandrina brasiliensis* are coarser than in *Meandrina meandrites*. 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*" *meandrites*.<sup>1</sup> The dentations are small but perfectly distinct.

The following species are included in *Meandrina meandrites*: *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); *quadrata* Dana; *disticha*, *elegans*, and *caribaea* Duchassaing & Michelloti. The types of Duchassaing & Michelloti's species were studied in Turin. Their *Pectinia quadrata* and *P. elegans* are the same thing. The width of the valleys is from 13 to 15 mm. The specimen called *P. quadrata* 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 *caribaea* 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 *caribaea* 8 to 10. They are narrower than in the specimens called *quadrata* and *elegans*. A specimen in the U. S. National Museum, from Belize, Honduras (A. E. Morlan, 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 *meandrites*. Dana's description is not sufficient to base a positive opinion upon, and I have not seen the type.

*Pectinia sebae* Milne-Edwards & Haime seemed to be based upon Seba's pl. cviii, figs. 3 and 5, and Ellis & Solander's pl. 14, fig. 1 (Lamouroux, Exp. Méth., also pl. 14, fig. 1). All of these figures appear to me to be *Colpophyllia gyrosa*.

*Pectinia danae* (Milne-Edwards & Haime) groups with their *brasiliensis*. The salient distinguishing features are, *danae* possesses an epitheca; 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. meandrites* and *M. brasiliensis*. "*Pectinia sebae*" is a doubtful species, as is also *profunda* of Dana. The locality of *danae* is unknown, but is probably from the Caribbean Sea.

Two young specimens which appear to be *M. meandrites* 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 36 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 danae* 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 meandrites* probably is.

Photographic reproductions of the type of *Pectinia danae* 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 danae*, because the formation of subsidiary valleys begins earlier in the former, and the costae of *danae* show small spines above the epitheca and just below the calicular edge.

From station 6080, off St. Thomas, Sail Rock; station 6087, off Culebra, Point Mula light-house. Bathymetric occurrence, 15½ to 20 fathoms.

<sup>1</sup> Ill. Cat. Mus. Comp. Zool., No. 1v (Mem., vol. 11), 1871, p. 68.

## Family ASTRANGIDÆ Verrill.

## Genus CLADOCORA Ehrenberg, 1834.

*Cladocora arbuscula* (Le Sueur). Pl. II, figs. 3, 3a.

1820. *Caryophyllia arbuscula*, Le Sueur, Mém. Mus. d'Hist. Nat., Paris, t. VI, p. 275, pl. xv, fig. 2.  
 1834. *Cladocora cæspitosa*, var.  $\beta$ , *microstoma*, p. 310, and *Cladocora candelabrum*, p. 311, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, pp. 310, 311.  
 1857. *Cladocora arbuscula*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 595.  
 1861. *Cladocora unipedalis*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 79 (of reprint), pl. x, figs. 5, 6.  
 1866. *Cladocora parvistella*, Duchassaing & Michelotti, Suppl. Mém. Corall. Ant., p. 91 (of reprint), pl. x, figs. 1, 2.  
 1880. *Cladocora arbuscula*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, pl. III, figs. 1-7.

A large number of specimens of this species was collected at station 6087, off Culebra, Point Mula light-house, in 15½ 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. cæspitosa* var.  $\beta$  and his *Cl. candelabrum* in the synonymy of *arbuscula*. I have studied Ehrenberg's types in the Museum für 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.

1849. *Cladocora debilis*, Milne-Edwards & Haime, Ann. Sci. Nat., 31ème sér., Zool., t. XI, p. 308.  
 1857. *Cladocora debilis*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 599.  
 1871. *Cladocora debilis*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 30.

One specimen, here referred to this species, was collected; the locality is not given. The specimen is in bad condition, being incrustated 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 merger of the two forms. Pourtalès 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 patriarca* Pourtalès, 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 &amp; Haime, 1848.

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

1820. *Caryophyllia solitaria*, Le Sueur, Mém. Mus. Hist. Nat. Paris, t. VI, p. 274, pl. xv, fig. 1.  
 1861. *Astrangia neglecta*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 79 (of reprint), pl. x, figs. 3, 4.  
 1861. *Astrangia granulata*, Duchassaing & Michelotti, *ibid.*, p. 79, pl. ix, figs. 13, 14.  
 1871. *Astrangia solitaria*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 79.  
 1880. *Astrangia solitaria*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. XII, figs. 8-12.

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.

Externally ornamented by low, flat, equal, densely granulate costæ, which are distinct to the base; immediately below the calicular edge the costæ 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 columella. 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 papillæ on the upper surface of the columella. 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:

*Phyllangia americana* Milne-Edwards & Haime (+ *Stellangia reptans* Duch. & Mich. + *Astrangia phyllangoides* Duch. & Mich.).

*Astrangia solitaria* (Le Sueur) (+ *Astrangia neglecta* Duch. & Mich. + *Astrangia granulata* Duch. & Mich.).

*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 (*Cænangia*) *bella* (Conrad), Chesapeake Miocene, of the Southern Atlantic slope of the United States.

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

*Astrangia expansa* Vaughan, Jacksonian, Eocene. *A. ludoviciana* Vaughan, Jacksonian, Eocene. *A. harrisi* Vaughan, Jacksonian, Eocene. *A. wilcoxensis* Vaughan, Midwayan, Eocene.

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 costæ are more prominent, and the margins of the septa of the first cycle are not so exsert. The pali and columella 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).

Pourtalès<sup>1</sup> 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. Duerden 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 dentate. Occasionally the crenations may be faint, and very rarely a septum appears to possess an entire margin.

*Astrangia astreiformis* Milne-Edwards & Haime, var. Pl. II, figs. 2, 2a, 2b.1850. *Astrangia astreiformis*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XII, p. 181.1857. *Astrangia astreiformis*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 614.

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, costæ 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 columella 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<sup>1</sup> 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 6090, 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 columellar 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<sup>2</sup> 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 *Astreidæ* altogether. The old *Astreid* corals of those found in Porto Rico are distributed in four families, viz: *Eusmilidæ* Verrill, *Astrangidæ* Verrill, *Orbicellidæ* nom. nov., and *Favidæ* Gregory. The reasons for proposing the latter new name will appear later.

## Genus ORBICELLA Dana, 1846.

1846. *Orbicella*, Dana, Zooph. Wilkes Expl. Exped., p. 205.1857. *Heliastræa*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 456.

Attention has several times been called to the fact that Dana understood by *Orbicella* what Milne-Edwards & Haime meant by their later described *Heliastræa*.<sup>3</sup>

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 lamellæ, and therefore cells appearing tubular and separated by interstices." From his characterization and subsequent treatment of the species, it is evident that *Orbicella 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 *Heliastræa*; 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.<sup>4</sup> 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 Pflanzenz. Fortsetz. I, Madr., t. 44-46—*F. cavernosus*, Linn. Gmel. Syst. Nat., p. 3767, Esp. Fortsetz. I, Madr., t. 37—and *F. pentagonus*, Esp. Fortsetz. I, Madr., t. 39." Link's *Favites astrinus* includes a species of *Favia* (Esper, t. XLIV) and species of *Prionastrea*. *Favites cavernosus* is *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 favosa* of Esper (pl. XLIV); *Orbicella* Dana takes in *F. cavernosa*. *Fissicella* Dana, 1846, contains a conglomeration of

<sup>1</sup> Ann. Sci. Nat., 3ième sér., Zool., t. X, pl. VII, fig. 5.<sup>2</sup> Mon. U. S. Geol. Surv., No. XXXIX, pp. 154-155.<sup>3</sup> Pourtales, Ill. Cat. Comp. Zool., No. IV, 1871, p. 76. Verrill, in Dana's Corals and Coral Islands, 1872, p. 388. Quelch, Reef Corals, Challenger Exp., 1886, p. 106. Gregory, Jour. Geol. Soc. Lond., vol. LI, 1895, p. 270.<sup>4</sup> Beschreibung der Naturalien-Sammlung der Universität zu Rostock, 3te Abth., Rostock, 1807, p. 162.

forms, *Favia*, *Dichocenia*, *Prionastrea*, etc. The name in my opinion should be discarded, as it is a sort of renaming of Oken's *Favia*. Milne-Edwards & Haime, 1848,<sup>1</sup> proposed *Goniastrea*, which equals a part of Link's *Favites*, and proposed at the same time *Prionastrea*, which takes in the residue of *Favites*. *Favites* should be used instead of *Goniastrea* or *Prionastrea*. Since the greater portion of *Madrepora fuvosa* of Esper is *Prionastrea*, as this is the first name in the list of Link's species, and as *Prionastrea* occurs after the characterization of *Goniastrea*, in my judgment *Favites* should supplant *Prionastrea*.

*Tubastrée* de Blainville<sup>2</sup> 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.

***Orbicella acropora* (Linn.), var. Pls. VI and VII.**

1766. *Madrepora acropora*, Linnæus, Syst. Nat., ed. XII, p. 1276.  
 1786. *Madrepora annularis*, Ellis & Solander, Nat. Hist. Zooph., p. 169, pl. LIII, figs. 1, 2.  
 1786. *Madrepora favcolata*, Ellis & Solander, op. cit., p. 166, pl. LIII, figs. 5, 6.  
 1797. *Madrepora acropora*, Esper, Fortsetz. Pflanzenth., i, p. 21, tab. xxxviii, figs. 1, 2.  
 1846. *Astræa (Orbicella) annularis*, Dana, Zooph. Wilkes Expl. Exped., p. 214, pl. X, fig. 6.  
 1857. *Heliastrea annularis*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 473.  
 1857. *Heliastrea acropora*, Milne-Edwards & Haime, op. sup. cit., p. 477.  
 1861. *Heliastrea lamarckii*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 76 (of reprint). Determined by examination of the specimens of Duchassaing & Michelotti in Turin; probably not *Heliastrea lamarckiana* Milne-Edwards & Haime.  
 1863. *Phyllocenia sculpta*, Duncan, Quart. Journ. Geol. Soc. London, vol. XIX, p. 432.  
 1863. *Phyllocenia limbata*, Duncan, op. sup. cit., p. 433.  
 1863. *Cyphastræa costata*, Duncan (the type from Barbuda), op. jam cit., p. 443.  
 1863. *Astræa barbadensis*, Duncan, op. jam cit., pp. 421 and 444, pl. XV, figs. 6a, 6b.  
 1864. *Plesiastrea ranea*, Duncan, Quart. Jour. Geol. Soc. London, vol. XX, p. 39.  
 1880. *Orbicella annularis*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. IV, all figs.  
 1890. *Orbicella annularis*, A. Agassiz, Bull. Mus. Comp. Zool., vol. XX, No. 2, p. 61, pls. I, II.  
 1895. *Orbicella acropora*, Gregory, Quart. Journ. Geol. Soc. London, vol. LI, p. 272.  
 1895. *Cyphastræa costata*, Gregory, op. sup. cit., p. 274.  
 1895. *Echinopora franksi*, Gregory, op. jam cit., p. 274, pl. XI, figs. 2a, 2b, 2c, and 3.

Gregory has published notes on the synonymy of this species.<sup>3</sup> He bases his placing of *annularis* under the synonymy of *acropora* upon finding in some calices no septa corresponding to the last cycle of costæ, 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. The figure of the enlarged corallites given by Esper (pl. xxxviii) shows three complete cycles of septa and costæ, and from his description and figure there can be no doubt about his having had the common small-celled *Orbicella* of the West Indies, and that it is the same as the *Madrepora annularis* of Ellis & Solander.

H. Stanley Gardiner<sup>4</sup> identified a coral from Rotuma Island in the South Pacific as *Orbicella 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<sup>5</sup> "Sie kommen von den südlichen amerikanischen Meeren." We can be sure that what is here called *Orbicella acropora* is what Esper called *Madrepora acropora*, and I suspect that Gardiner's *Orbicella 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.

*Cyphastræa oblita* Duchassaing & Michelotti. The specimen so labeled in Turin is a rounded-head possessing the general aspect of *Orbicella acropora*; the calices are small, usually 2 mm. in diameter; the septa are in three complete cycles, the third cycle being very small; the costæ are as in *Orbicella acropora*. A specimen labeled *Cyphastræa oblita* 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 *Heliastrea*

<sup>1</sup> Comptes Rendus Acad. Sci., t. xxvii, p. 495.

<sup>2</sup> Man. Actin., 1834, p. 368.

<sup>3</sup> Quart. Jour. Geol. Soc. Lond., vol. LI, 1895, p. 272.

<sup>4</sup> Proceed. Zool. Soc. Lond. for 1899, pt. III, p. 752.

<sup>5</sup> Op. cit., p. 23.

*abdita* 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 cribriform almost to the corallite wall, while others extend as solid lamellæ far into the corallite cavity joining the columella by septal processes; in fact, the columella 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 Barbados as *Cyphastræa costata* are *Orbicella acropora*. The material studied by him is in the British Museum.

*Orbicella hyades* is, according to Pourtalès,<sup>1</sup> probably a *Solenastrea*. The *Solenastrea hyades* of Duchassaing 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 *Heliastrea rotulosa* in Turin, and as the work of Duchassaing & 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 Curaçao (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, columella, exotheca, and endotheca as commonly in *O. acropora*. (Type, coll. Geol. Soc. Lond.; duplicate in U. S. National Museum.) Gregory's *Echinopora franki* 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 exsert margins.

From Mayaguez.

#### Family FAVIDÆ Gregory.

Type genus, *Favia* Oken.

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

A large number of genera belong here, e. g., *Goniastrea*, *Prionastrea* (= *Favites* Link, pro parte), *Platygyra*, *Leptoria*, *Stiboria*, *Manicina*, etc.

Verrill's *Mæandrinidæ*,<sup>2</sup> in my opinion, is equal to *Favidæ*. It has been shown in this paper that the original *Mæandrina* of Lamarck is not the *Mæandrina* 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), *Isophyllia*, *Mussa*, etc., probably should be grouped in another, but closely related, family, or in a subfamily.

<sup>1</sup> Mus. Comp. Zool., Ill. Cat. No. IV, 1871, p. 77.

<sup>2</sup> Proc. Essex Inst., vol. IV, No. IX, 1865, p. 147.

Genus *FAVIA* Oken, 1815.*Favia fragum* (Esper). Pl. VIII.

1766. *Madrepora ananas*, Pallas, Elench. Zooph., p. 321 (non-Linnæus, Syst. Nat., ed. x, 1758, p. 797).  
 1767. *Madrepora ananas* (pars), Linnæus, Syst. Nat., ed. XII, t. I, p. 1275.  
 1797. *Madrepora fragum*, Esper, Pflanzenth., Fortsetz., Th. I, p. 79, pl. LXIV, figs. 1 and 2. (Non *Madrepora ananas*, Esper, Pflanzenth., pp. 126-131, pl. XIX.)  
 1815. *Favia ananas* (pars), Oken, Lehrb. Naturgesch., Bd. I, p. 67.  
 1816. *Astrea ananas*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 260.  
 1834. *Favia uva* (pars), Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss., Berlin for 1832, p. 369.  
 1847. *Parastreia ananas*, Milne-Edwards & Haime, Comptes Rendus, t. XXVIII, p. 495.  
 1850. *Parastreia fragum*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XII, p. 173.  
 1861. *Favia incerta*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 75 (of reprint), pl. X, figs. 13, 14.  
 1861. *Favia coarctata*, Duchassaing & Michelotti, op. sup. cit., p. 76, pl. X, figs. 17, 18.  
 1871. *Favia ananas*, Pourtalès, III. Cat. Mus. Comp. Zool., No. IV, p. 75.  
 1895. *Favia ananas*, Gregory, Quart. Jour. Geol. Soc. Lond., vol. LI, p. 260.

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 Linnæus had already applied it to a palæozoic coral from Gothland, now known as *Acerularia ananas*. Professor Lindström has discussed the name as applied to the fossil species in his "On the Corallia Baltica of Linnæus."<sup>1</sup> 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 Linnæus 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 *Dichocænia* from the East Indies, now known as *Dichocænia porcata*. The *Explariaria ananas* of Ehrenberg is, as shown by an examination of his material in the Museum für Naturkunde at Berlin, *Dichocænia 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 Pourtalès, 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:

<i>Favia incerta</i> D. & M. ....	Wall between corallites not thick; calicular margin not elevated.
<i>Favia coarctata</i> D. & M. ....	Wall between corallites not thick; calicular margin elevated.
<i>Favia ananas</i> Lamarck. ....	Wall between corallites thick; calicular margin elevated.

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 capuli-form 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 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

<sup>1</sup>Öfvers. K. Svensk. Vet. Akad., Förhandl., Årg. LII, 1895, pp. 628, 629.

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 exsertness 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 columella an irregular, jagged, paliform tooth. Costæ 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 costæ being more regular than those on the septa. The columella 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 incerta* D. & M. It is an irregularly capuliform mass with a greater diameter of 50 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 specimen 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 columella. 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 Hart's Brazilian collections.<sup>1</sup> They are *Favia leptophylla*, *Favia gravida*, 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. gravida*. . . . .Margins elevated the same as *F. leptophylla*, except that there are four complete cycles of septa.

*F. conferta*. . . . .Possesses narrow, long meandriform calices, usually series, with several calicinal 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, *gravida* and *conferta*, applied to the Brazilian species, *conferta* be suppressed and *gravida* 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.

<sup>1</sup> Trans. Conn. Acad. Sci., vol. 1, 1868, pp. 353, 355.

Genus *MANICINA* Ehrenberg, 1834.*Manicina areolata* (Linn.). Pl. iv, figs. 2 and 3.

1758. *Madrepora areolata*, Linnæus, Syst. Nat., ed. x, p. 795.  
 1789. *Madrepora mæandrites* (pars), Esper, Pflanzenth., p. 76 (bis = 81) -84, pl. iv, non iv A.  
 1815. *Mæandra areolata*, Oken, Lehrb. Naturgesch., Bd. I, p. 70.  
 1816. *Mæandrina areolata*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 247.  
 1834. *Manicina hispida*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 327.  
 1834. *Manicina prærupta*, Ehrenberg, op. sup. cit., p. 327.  
 1834. *Manicina manica*, Ehrenberg, op. sup. cit., p. 327. Non *Manicina areolata* Ehrenberg = *Trachyphyllia geoffroyi* (Audouin), *ſide* Milne-Edwards & Haime.  
 1849. *Manicina valenciennesi*, Milne-Edwards & Haime, Ann. Sci. Nat., 8ième sér., Zool., t. XI, p. 287.  
 1861. *Manicina crispata*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 74 (of reprint), species of Milne-Edwards & Haime.  
 1861. *Manicina danai*, Duchassaing & Michelotti, op. sup. cit., p. 74, species of Milne-Edwards & Haime.  
 1871. *Manicina areolata*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 72.  
 1880. *Manicina areolata*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. v, figs. 1-22 (all figs.), and pl. vi, figs. 1-7 (all figs.).  
 1888. *Manicina areolata*, Wilson, Jour. Morph., vol. II, No. 2, pp. 191-252; pls. I-VII.  
 1895. *Manicina areolata*, Gregory, Quart. Jour. Geol. Soc. Lond., vol. LI, pp. 264-265.  
 1895. *Manicina pliocenica*, Gane, Johns Hopkins Univ. Circ., vol. XV, No. 121, p. 10.  
 1900. *Manicina pliocenica*, Gane, Proc. U. S. Nat. Mus., vol. XXII, pp. 192, 193.  
 1900. *Manicina areolata*, Vaughan, Mon. U. S. Geol. Surv., No. XXXIX, pp. 38-40 pl. I, figs. 2, 3.

The types of 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 pliocenica* 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.

1815. *Mæandra* (pars), Oken, Lehrb. Naturgesch., pp. 68 and 70.  
 1816. *Mæandrina* (pars), Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 244.  
 1834. *Mæandra* (pars) (+ subgenus *Platygyra* (pars)) Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 323.  
 1845. *Mæandrina* (pars), Dana, Zooph. Wilkes Expl. Exped., p. 252.  
 1848. *Mæandrina* + *Cæloria*, Milne-Edwards & Haime, Comptes Rendus, t. XXVII, p. 493.  
 1857. *Mæandrina*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 388 + *Cæloria*, *ibid.*, p. 411.  
 1884. *Mæandrina*, Duncan, Jour. Linn. Soc. Lond., vol. XVIII, p. 88.

The names *Mæandrina* and *Mæandra* have been disposed of. The name *Platygyra* Ehrenberg remains to be considered. Ehrenberg placed the following species in the subgenus (as recognized by him), viz: *labyrinthica*, including the varieties  $\alpha$  *leptochila* and  $\beta$  *pachychila*; *lamellina*, sp. nov.; *cerebriformis* Lamarck, including the varieties  $\alpha$  and  $\beta$ ; *phrygia* 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 *Mæandra* (*Platygyra*) *labyrinthica*, but there appear to be four distinct species.

1. Specimens Nos. 682, 683, and 687 are *Cæloria labyrinthiformis* of Milne-Edwards & Haime.<sup>1</sup>
2. Specimen No. 668, var. *pachychila* Ehr. = *Cæloria forskællana* Milne-Edwards & Haime.<sup>2</sup>
3. Specimen No. 669. No locality is given. "*M. filograna* Esp." 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 sinuosities. 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 often much larger than the others. The columella is formed of septal trabeculæ and lobes; it is very often of a loose, spongy texture. This is not *filograna* Esper, but is probably *viridis* Le Sueur (= *strigosa* Dana).
4. Specimen No. 671, bears "*M. grandilobata* M. E." 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. Platygyra lamellina*.

<sup>1</sup> Hist. Nat. Corall., t. II, p. 413.

<sup>2</sup> Hist. Nat. Corall., t. II, p. 414.

*M. Platygyra cerebriformis* = *Diploria cerebriformis* (Lam.), which must be called *Diploria laby. inthiformis* (Linn).<sup>1</sup>

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

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

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

<i>Dendrogyra</i> Ehrenberg, 1834.	} Arranged according to sequence on the page.
<i>Diploria</i> Milne-Edwards & Haime 1848. <sup>2</sup>	
<i>Leptoria</i> Milne-Edwards & Haime 1848.	
<i>Cæloria</i> Milne-Edwards & Haime 1848.	

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 *Cæloria* comes last among those proposed by Milne-Edwards & Haime, I substitute *Platygyra* for *Cæloria*, following Dr. Brüggemann, who, in his "Corals of Rodriguez,"<sup>3</sup> shows that *Platygyra* should take the place of *Cæloria*, and remarks that the type species is the *Madrepora labyrinthica* from the Red Sea. His course, in my opinion, is the only logical one.

Portalès<sup>4</sup> was the first of whom I know to point out the difficulty or impossibility of separating *Cæloria* and *Mæandrina* (Milne-Edwards & Haime). Duncan places *Cæloria* as a subgenus of *Mæandrina*.<sup>5</sup> H. Stanley Gardiner has made some notes on the relations of the genera.<sup>6</sup> I can find no tangible differences between the two, the columellar characters being insufficient, therefore I merge *Cæloria* and *Mæandrina* 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. IX, X, XI, XII, XIII.

1786. *Madrepora labyrinthica*, Ellis & Solander, Nat. Hist. Zooph., p. 160, pl. XLVI, figs. 3, 4. Non *Madrepora labyrinthica*. Pa'las, 1766.
1797. *Madrepora mæandrites*, var., Esper, Pflanzenth. Fortsetz., Th. I, p. 101, pl. LXXXVII (fide Milne-Edwards & Haime).
1820. *Meandrina sinuosa* f. Le Sueur, Mém. Mus. Hist. Nat. Paris, t. VI, p. 278, pl. XV, fig. 4; + vars. *viridis*, p. 279, pl. XV, fig. 5; *appressa*, p. 280, pl. XV, fig. 6; *rubra*, p. 280, pl. XV, fig. 7; *vineola*, p. 280, pl. XV, fig. 8. Non *Madrepora sinuosa*, Ellis & Solander, 1786, nec *Meandrina sinuosa*, Quoy & Gaimard, 1833.
1820. *Meandrina dedalea*, Le Sueur, op. sup. cit., p. 281, pl. XVI, fig. 9.
1820. *Meandrina labyrinthica*, Le Sueur, op. sup. cit., p. 282, pl. XVI, fig. 10.
1834. *Meandra* (*Platygyra*) *labyrinthica* (pars), Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 323.
1846. *Meandrina strigosa*, Dana, Zooph. Wilkes Expl. Exped., p. 257, pl. XIV, figs. 4a, 4b.
1849. *Meandrina heterogyra*, Milne-Edwards & Haime, Ann. Sci. Nat., 31ème sér., Zool., t. XI, p. 281.
1849. *Meandrina sinuosissima*, Milne-Edwards & Haime, op. sup. cit., p. 281.
1849. *Meandrina serrata*, Milne-Edwards & Haime, op. sup. cit., p. 282.
1849. *Meandrina crassa*, Milne-Edwards & Haime, op. sup. cit., p. 282.
1861. † *Leptoria heteroglyphica*, Duchassaing & Michelotti, Mém. Cor. Ant., p. 75 (of reprint).
1861. *Leptoria fragilis*, Duchassaing & Michelotti, op. sup. cit., p. 75.
1880. *Meandrina strigosa*, Portalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. IX, figs. 6-9.
1880. *Meandrina labyrinthiformis*, Portalès, op. sup. cit., pl. IX, figs. 10-12.
1886. *Meandrina strigosa*, Quelch, Reef Corals, Challenger Exp., pp. 10, 92.
1886. *Meandrina sinuosissima*, Quelch, op. sup. cit., pp. 10, 91.
1886. *Meandrina labyrinthica*, Quelch, op. sup. cit., pp. 10, 12, 91.
1886. † *Meandrina sinuosa*, Quelch, op. sup. cit., p. 12.
1895. *Meandrina flograna*, Gregory, Quart. Jour. Geol. Soc. London, vol. LI, p. 265. The synonymy includes two species, *Platygyra viridis* and *Platygyra clivosa* (Ell. & Sol.)
1898. *Meandrina* + *flograna*, Vaughan, Bull. Mus. Comp. Zool., vol. XXVIII, No. 5, p. 275.
1901. *Meandrina labyrinthica* + *Ctenophyllia*, Whitfield, Bull. Amer. Mus. Nat. Hist., vol. XIV, pp. 221-222, pls. XXXI, XXXII.

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 Muséum d'Histoire Naturelle, Paris;

<sup>1</sup> See paper on "Some fossil corals from the elevated reefs of Curaçao, Arube, and Bonaire, pp. 45-48.

<sup>2</sup> Comptes Rendus, t. XXVII, 1848, p. 495.

<sup>3</sup> Phil. Trans. Royal Soc., vol. CLXVIII, 1879, p. 171.

<sup>4</sup> Ill. Cat. Mus. Comp. Zool., No. IV, 1871, p. 78.

<sup>5</sup> Jour. Linn. Soc. Lond., vol. XVIII, 1884, p. 89.

<sup>6</sup> Proc. Zool. Soc. Lond., vol. for 1898, p. 740.

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 *labyrinthica* of Ellis & Solander can not be used, as Pallas had applied it to *Madrepora meandrites* Linnæus. The *sinuosa* of Le Sueur is a misidentification of the *Madrepora sinuosa* of Ellis & Solander, so it can not be used. The next 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 & Haime'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 *Meandrina strigosa* Dana is referred to *Cæloria* 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 & Haime 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 & Haime 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 columella. 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 & Haime 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 & Haime 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 columella 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 *Mæandrina superficialis* of Milne-Edwards & Haime, 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 *Mæandrina strigosa*, and have added "septa 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 *Mæandrina 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 *Mæandrina labyrinthiformis* and *Mæandrina strigosa* figured by Pourtalès in the Florida Reefs Corals<sup>1</sup> 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 *Mæandrina labyrinthica*, *Mæandrina sinuosissima*, and *Mæandrina 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.

<sup>1</sup> Mem. Mus. Comp. Zool., vol. VII, No. 1, 1880.

## Family AGARICIDÆ 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.<sup>1</sup>

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

1766. *Madrepora radians*, Pallas, Elench. Zooph., pp. 322-323.  
 1767. *Madrepora astroites*, Linnæus, Syst. Nat., ed. XII, p. 1276, non Pallas, 1766.  
 1786. *Madrepora galaxea*, Ellis & Solander, Nat. Hist. Zooph., p. 168, pl. XLVIII, fig. 7.  
 1801. *Astrea galaxea*, Lamarck, Syst. Anim. s. Vert., p. 371.  
 1815. *Astrea radians* seu *astroites*, Oken, Lehrb. Naturgesch., Bd. 1, p. 65.  
 1830. *Astrea (Siderastrea) galaxea*, de Blainville, Dict. Sci. Nat., t. LX, p. 335.  
 1834. *Astrea astroites*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 319. Non *Explanaria galaxea* Ehrenberg = *Cyphastræa savignyi* Milne-Edwards & Haime.  
 1846. *Siderina galaxea*, Dana, Zooph. Wilkes Expl. Exped., p. 218, pl. x, figs. 12, 12b, 12c (non figs. 12a, 12d).  
 1880. *Siderastræa galaxea*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, pt. 1, pl. XI, figs. 14-21, pl. XV, figs. 1-12.  
 1895. *Astrea radians*, Gregory, Quart. Jour. Geol. Soc. Lond., vol. LI, p. 277.

Linnæus described a *Madrepora astroites* in Systema Naturæ, 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. XXI, *Lapis astroites* s. *stellaris*). I can not identify this figure. When Pallas's description of *M. radians* is taken together with Seba's figures (pl. CXII, figs. 12, 14, 17, 18), one can be reasonably sure of the identification being correct. The *Madrepora astroites* of the twelfth edition of Linnæus is the same as the *M. radians* of Pallas. It appears to me that *astroites* of Linnæus 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 explanate 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.

1786. *Madrepora siderea*, Ellis & Solander, Nat. Hist. Zooph., p. 168, pl. XLIX, fig. 2.  
 1816. *Astrea siderea*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 267.  
 1830. *Astrea (Siderastrea) siderea*, de Blainville, Dict. Sci. Nat., t. LX, p. 335.  
 1834. *Astrea tricophylla*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 319 (*sic* Milne-Edwards & Haime).  
 1846. *Pavonia siderea*, Dana, Zooph. Wilkes Expl. Exped., p. 331.  
 1850. *Siderastræa siderea*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XII, p. 141.  
 1857. *Astrea siderea*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 509, pl. D7, fig. 2.  
 1863. *Siderastræa crenulata* var. *antillarum* Duncan, Quart. Jour. Geol. Soc. London, vol. XIX, p. 435.  
 1863. *Siderastræa grandis*, Duncan, op. sup. cit., p. 441, pl. XVI, figs. 5a, 5b.  
 1871. *Siderastræa siderea*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 81.  
 1895. *Astrea siderea*, Gregory, Quart. Jour. Geol. Soc. London, vol. LI, p. 278.

Gregory places *Siderastræa globosa* Milne-Edwards & Haime 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*. *Siderastræa 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 *Siderastræa radians* and *Siderastræa siderea* is considered to be that the latter possesses four complete cycles of septa, whereas the former has the fourth cycle

<sup>1</sup> Mon. U. S. Geol. Sur., No. XXXIX, 1900, p. 154. See also "Some fossil corals from the elevated reefs of Curaçao," etc. Samml. des Geolog. Reichs. Mus., Leiden, ser. II, Bd. II, Heft 1, Leiden, 1901, pp. 60, 61.

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.

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

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.

1776. *Madrepora elephantotus*, Pallas, Elench. Zooph., p. 290.  
 1786. *Madrepora cucullata*, Ellis & Solander, Nat. Hist. Zooph., p. 157, pl. XLII (both figures).  
 1791. *Madrepora cucullata*, Esper, Pflanzenh. Fortsetz., Th. I, p. 83, pl. LXXVII (figs. copied from Ellis & Solander).  
 1801. *Agaricia cucullata*, Lamarck, Syst. Anim. s. Vert., p. 373.  
 1815. *Mycedium elephantotus*, Oken, Lehrb: Naturgesch., Zool., Th. I, p. 69.  
 1815. *Mycedium cucullatum*, Oken, op. sup. cit., p. 69.  
 1846. *Mycedia cucullata*, Dana, Zooph. Wilkes Expl. Exped., p. 339.  
 1851. *Mycedium elephantotus*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. xv, p. 131.  
 1860. *Mycedium elephantotus*, Milne-Edwards & Haime, Hist. Nat. Corall., t. III, p. 74.

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 corallite 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 agaricites* (Linnæus), and *Agaricia elephantotus* (Pallas). My opinion is that it should be referred to *A. agaricites* and probably placed in var. *undata* of Ellis & Solander.

The following is the description of *Madrepora undata*:

"*Madrepora foliacea explanata concatenata, stellis serialibus, ambulacris intra stellas elevatis: carinis rotundatis crassis. Tab. 40. Corallium latum, planum, elegantissimum, album, subtus subtilissime striatum. Stella oblongæ: centra oblonga, subsoluta, elevata. Ambulacra extra stellas depressa, planiuscula, tandem intra seriem stellarum elevata in carinas crassas rotundatas.*"

In the largest specimen the distance between calicular 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-costæ are usually rather regularly alternately larger and smaller,

around a calicinal 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 13 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 6090, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

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

1866. *Mycedium cailleti*, Duchassaing & Michelotti, Sup. Mém. Corall. Ant., p. 93 (of reprint).

1874. *Mycedium cailleti*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 44, pl. IX, figs. 1, 2.

Gregory<sup>1</sup> 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 calices 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.<sup>2</sup>**

***Bathyactis symmetrica* (Portalès). Pl. I, figs. 7, 7a, 7b.**

1871. *Fungia symmetrica*, Portalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 46, pl. VII, figs. 5, 6.

1881. *Bathyactis symmetrica*, Moseley, Deep Sea Corals, Challenger Reports, pp. 186-190, 2 figs. in text, pl. x, figs. 1-13 c.

The diameter of an average-sized specimen is 8.8 mm. The base is imperforate, horizontal, with distinct but not very prominent costae corresponding to all septa. The six costae 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 costae. 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 columella. The members of the third cycle fuse to the sides of those of the second quite near the columella, and those of the fourth fuse to the sides of the third a little nearer the wall than the columella. 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 synaptacula, but the synaptacula 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 Portalès's *Anthemiphyllia patera*, 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.

<sup>1</sup> Quart. Journ. Geol. Soc. London, vol. LI, 1895, p. 281.

<sup>2</sup> After this paper had gone to press it was discovered that *Bathyactis symmetrica* had been wrongly designated "*Diaseris*" *crispa*. 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. 290, line 16, for *Diaseris* read *Bathyactis*; p. 290, line 17, for "*Diaseris*" *crispa* read *Bathyactis symmetrica*; p. 291, line 22 in table, for *Diaseris crispa* Portalès read *Bathyactis symmetrica* (Portalès); p. 319, under pl. I, after fig. 7, 7a, 7b, for *Diaseris crispa* Portalès read *Bathyactis symmetrica* (Portalès); pl. I, in legend at bottom, for "*Diaseris*" read *Bathyactis*.

## Family ISOPORIDÆ, nom. nov.

This name is proposed to take the place of *Madreporidæ*.

## Genus ISOPORA Studer, 1878.

1758. *Millepora* (pars), Linnæus, Syst. Nat., ed. x, p. 790.

1766. *Madreporæ anomalæ* (pars), Pallas, Elench. Zooph., p. 279.

1767. *Madrepora* (pars), Linnæus, Syst. Nat., ed. xii, p. 1272.

Also, in part, of Esper, Pflanzenziethiere; Ellis & Solander, Natural History of Zoophytes; and Lamarck, Système des Animaux sans Vertèbres.

1816. *Madrepora*, Lamarck, Hist. Nat. Anim. s. Vert., t. ii, p. 277.

1834. *Heteropora*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 323 (non de Blainville).

1878. *Isopora* (as subgenus), Studer, Monatsber. Akad. Wiss. Berlin 1878, p. 535.

1893. *Eumadrepora*, *Odontocyathus*, *Polystachys*, *Lepidocyathus*, *Isopora*, *Tylopora*, *Conocyathus*, *Rhabdocyathus* (assubgenera), 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 Linnæan *Madrepora*. The *Madrepora muricata* was placed in *Millepora*. What we now call *Madrepora* was subsequently inserted in the original Linnæan 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 Linnæus, but I have not studied the generic history of all the species to determine the one to which the name *Madrepora* should be attached.

*Isopora muricata* (Linnæus). Pls. xxi-xxvii.

1758. *Millepora muricata* (pars), Linnæus, Syst. Nat., ed. x, p. 792.

1767. *Madrepora muricata* (pars), Linnæus, Syst. Nat., ed. xii, p. 1279.

1893. *Madrepora muricata* (with synonymy); Brook, Cat. Gen. Madrepora, pp. 23-30.

1895. *Madrepora muricata*, Gregory, Quart. Jour. Geol. Soc. London, vol. li, pp. 281-282.

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 *formæ* or varieties, viz, *muricata* s. s. (*cervicornis*,<sup>1</sup>Lam.), *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 Linnæus in his original synonymy of *Millepora muricata*<sup>1</sup> is "Sloan jam. 1, p. 51, 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 Jamaica corals. The figure to which Linnæus makes reference, pl. 18, fig. 3, is the typical *Madrepora cervicornis* of Lamarck. Pallas<sup>2</sup> divides the species into three varieties: ( $\alpha$ ) *Varietas ramosa*, under which reference is made to Browne's Jamaica, Sloane's Catalogus Plantarum Insulæ Jamaicae (London, 1891), and Sloane's Natural History of Jamaica. He also refers to Seba's Thesaurus. I do not know

<sup>1</sup>Syst. Nat., ed. x, 1756, p. 792.

<sup>2</sup>Elench. Zooph., 1766, pp. 327-331.

what pl. cviii, fig. 6, represents, but pl. cxiv, fig. 1, is the common *cervicornis*. Knorr's (*Deliciae Naturæ*) pl. aii, 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 *Corallium album porosum muricatum maximum* gevonden werd, etc." (Op. cit., p. 6.) ( $\beta$ ) Varietas *corymbosa*. Under this, reference is made to Browne's Jamaica, p. 391, 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. ( $\gamma$ ) Reference is made to Sloane's Natural History of Jamaica, vol. 1, p. 58, n. 5, tab. 17, fig. 3, which is what is usually denominated *Madrepora palmata*. Pallas states "Locus: Mare Americanum & Indicum."

Linnæus in Syst. Nat., ed. xii, 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 *muricata*. Their var.  $\alpha$  is *cervicornis* Lam.;  $\delta$  has for a synonym var.  $\beta$  of Pallas;  $\epsilon$  is the  $\gamma$  of Pallas, or *palmata* Lamarck. Esper's *Madrepora muricata*<sup>1</sup> was composed of several species, but included the West Indian forms. In the Museum Calonnianum 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.<sup>2</sup>

*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. Pourtalès has published excellent figures in Agassiz's Florida Coral reefs.<sup>3</sup>

Collected off Gallardo Bank, tang. of Morillos de Cabo Rojo, ESE.  $\frac{3}{4}$  E. 9  $\frac{1}{2}$  miles, in 10 to 10  $\frac{1}{2}$  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's<sup>4</sup> discussion of forma *palmata*.

"The majority of the specimens which have come under my notice do not suggest a very close affinity to the arborescent 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 arborescent, 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.

<sup>1</sup> Pflanzenth. Fortsetz., pp. 45-50.

<sup>2</sup> J. E. Duerden has some interesting observations on the polyps of this species in Jour. Inst. Jam., vol. 11, No. 6, 1899, pp. 621-622.

<sup>3</sup> Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. xviii, figs. 1-9 (all figs.), fig. 1 represents a typical branch.

<sup>4</sup> The 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 nariform, 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. xxii, 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 23.2 cm., which shows the courses 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* (*muricata* s. s.) stands at one extreme, and forma *palmata* stands at the other. The plates published by Pourtales<sup>1</sup> form an interesting series for comparison in this connection.<sup>2</sup>

#### Family PORITIDÆ Dana.

#### Genus PORITES Link, 1807.

#### *Porites porites* (Pallas).

1756. *Corallium, poris stellatis*, etc., Seba, Thes., t. III, p. 202, pl. cix, fig. 11.

1766. *Madrepora porites*, Pallas (pars), Elench. Zooph., p. 324.

1895. *Porites clavaria*, Gregory, Quart. Jour. Geol. Soc. London, vol. LI, p. 282, with synonymy.

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<sup>3</sup> place "*Madrepora porites* (pars) Pallas" in the synonymy of *Porites clavaria* Lamarck, and also place "*Corallium poris stellatis*, 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

<sup>1</sup> Mem. Mus. Comp. Zool., vol. VII, No. 1, pls. XVII-XIX.

<sup>2</sup> 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 1900, 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 Palæontology 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 Duerden 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. Duerden could find no difference in the polyps of the three forms.

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

<sup>3</sup> Hist. Nat. Corall., t. III, 1860, p. 175.

*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 Curaçao.

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.<sup>1</sup> Pourtalès states "*Porites clavaria* and *furcata* are \* \* \* rather difficult to distinguish by any constant characters derived from the calicle, as they vary considerably in the same specimen."<sup>2</sup> Gregory (op. et loc. sup. cit.) has combined what were divided into two species. I find the treatment accorded the species by Rathbun excellent, and invite especial attention to what he has written (sup. cit.). The variation of this species is enormous. By taking individual colonies or isolated specimens from separate localities, the number of "species" could be multiplied indefinitely. Pl. xxix, and pl. ii, fig. 4, represent almost the extremes. A considerable number of fairly well characterized varieties may be recognized. I have accordingly divided the specimens from Porto Rico into three "*formæ*," 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 Curaçao 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 Curaçao 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 formæ 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";<sup>3</sup> 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 Curaçaoan specimen and that of the three formæ 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 formæ.<sup>4</sup>

<sup>1</sup>Cat. Poritidæ, Proc. U. S. Nat. Mus., vol. x, 1887, pp. 356-357.

<sup>2</sup>Ill. Cat. Mus. Comp. Zool., No. iv, 1871, p. 85.

<sup>3</sup>This expression is borrowed from Bernard.

<sup>4</sup>Two interesting papers on the arrangement and development of septa in *Porites* should be cited: H. M. Bernard, "On the Structure of *Porites*, with Preliminary Notes on the Soft Parts," Journ. Linn. Soc. Lond., vol. xxvii, 1900, pp. 487-503, pl. 35 (fig. 5, p. 492, gives a diagram that applies to the septal arrangement of *Porites porites*); J. E. Duerden, "Order of Appearance of the Mesenteries and Septa in *Madreporaria*," Johns Hopkins Univ. Circ., vol. xix, No. 146, June, 1900, pp. 47-58.

Gregory has omitted the names of three species that should be placed in this synonymy. *Porites polymorphus* Link<sup>1</sup> 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,<sup>2</sup> and *Porites nodifera* Klunzinger.<sup>3</sup> Rehberg in his "Neue und wenigbekannte Korallen"<sup>4</sup> 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 formæ, viz, *clavaria* and *furcata*, both of Lamarck, and *divaricata* Le Sueur. The Porto Rican specimens do not show intergradation between the three formæ, 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. XXIX, 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 shallow, 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 lamellæ, as Bernard has described them.<sup>5</sup> 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. II, 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*, *Axelia mirabilis*, and *Meandrina meandrites*? young.

<sup>1</sup> Beschreib. Natur. Samml., Rostock, 1807, p. 162.

<sup>2</sup> Sup. Mém. Corall. Ant., p. 91 (of reprint), pl. x, fig. 13.

<sup>3</sup> Die Korallenthiere des Rothen Meeres, pt. II, p. 41.

<sup>4</sup> Abhandl. Naturwiss. Ver. Hamburg, Bd. XII, 1892, p. 47.

<sup>5</sup> Jour. Linn. Soc. London, vol. XXVII, 1899, p. 137.

**Porites astreoides** Lamarck. Pls. xxxii, xxxiii, xxxiv.

1816. *Porites astreoides*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 269.  
 1829. † *Porites conglomeratus*, Eichwald, Zool. Spec., p. 183.  
 1861. *Porites incerta*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 83 (of reprint).  
 1861. *Porites guadalupensis*, Duchassaing & Michelotti, op. sup. cit., p. 83.  
 1861. *Porites agaricus*, Duchassaing & Michelotti, op. sup. cit., p. 83.  
 1863. *Porites collegniana*, Duncan, Quart. Jour. Geol. Soc. London, vol. XIX, p. 437 (non Michelin, 1842).  
 1866. *Neoporites littoralis*, Duchassaing & Michelotti, Sup. Mém. Corall. Ant., p. 97 (of reprint).  
 1866. *Porites michelini*, Duchassaing & Michelotti, op. sup. cit., p. 98, pl. x, figs. 9, 10.  
 1866. † *Porites subtilis*, Duchassaing & Michelotti, op. sup. cit., p. 98, pl. x, figs. 7, 8.  
 1866. *Porites superficialis*, Duchassaing & Michelotti, op. sup. cit., p. 99.  
 1866. *Cosmoporites lævigata*, Duchassaing & Michelotti, op. sup. cit., p. 99, pl. x, figs. 12, 16.  
 1868. *Porites solida*, Verrill, Trans. Conn. Acad. Sci., vol. I, p. 358.  
 1880. *Porites astreoides*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. XVI, figs. 1-12.  
 1892. *Porites verrilli*, Rehberg, Abhandl. Naturwiss. Ver. Hamburg, Bd. XII, p. 48.

Ehrenberg's *Madrepora (Porites) astreoides* is not a *Porites* but is a *Stylophora*, *St. ehrenbergi* Milne-Edwards & Haime.<sup>1</sup>

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, *littoralis*, *superficialis*, *guadalupensis*, *incerta*, and *agaricus*. I could not discover differences of sufficient importance to establish even varieties. There remain *Neoporites michelini*, *N. subtilis*, and *Cosmoporites lævigata*, 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.

Pourtalès has published superb figures in Agassiz's Florida Reef Corals (Mem. Mus. Comp. Zool., vol. VII, No. 1, 1880).

Two species grouping with *astreoides* remain to be considered, viz, *Porites solida* Verrill (non *solida* Forskal) = *P. verrilli* Rehberg,<sup>2</sup> 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 pali, 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 pali; 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 formæ.

*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

<sup>1</sup> Hist. Nat. Cor., t. II, p. 139.

<sup>2</sup> Neue und wenig bekannte Korallen, Abhandl. Naturwiss. Ver. Hamburg, Bd. XII, pt. 1892, I, p. 48.

often between them. The septal margins are dentate; the septa themselves are perforate.<sup>1</sup> The columella is represented by a small tubercle or lamina.

*Forma β*, 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 α*, being only 1 mm. in diameter, the walls separating the corallites are often not so acute as in *forma α*, 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 β*, and upon these the calicular characters of *forma α* 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 α* 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 formæ *α* and *β*. 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<sup>2</sup> 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 α* 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 β* 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.<sup>2</sup>

## Class HYDROZOA.

### Order HYDROCORALLINÆ Moseley.<sup>3</sup>

#### Family MILLEPORIDÆ L. Agassiz.

##### Genus MILLEPORA Linnæus, 1758.

##### *Millepora alcicornis* Linnæus. Pl. xxxv-xxxviii.

1758. *Millepora alcicornis*, Linnæus, Syst. Nat., ed. x, p. 791.

1880. *Millepora alcicornis*, Pourtales, Mem. Mus. Comp. Zool., vol. vii, No. 1, pl. xx, figs. 1-6 (all figs.).

1898. *Millepora alcicornis*, Hickson, Proc. Zool. Soc. London, for 1898, p. 256 (*vide* pp. 245-257).

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.

<sup>1</sup> Bernard's characterization of the septa of *Porites* as "perforate lamellate septa" (*Jour. Linn.*, vol. xxvii, 1899, p. 137) is correct.

<sup>2</sup> *Op. sup. cit.*, p. 492.

<sup>3</sup> These, although they are not corals, are included because they are among the commonest of the reef-building animals of the Porto Rican waters.

## EXPLANATION OF PLATES.

## PLATE I:

- Figs. 1, 1a, *Paracyathus 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, *Deltocyathus italicus* (Michelotti), var. *calcar* Pourtalès. Copied from Lindström. [Actinology of the Atlantic Ocean, pl. i, fig. 13, and pl. ii, fig. 14.] Fig. 2, view of base. Fig. 2a, calicular view. Lindström 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, *Azohelia mirabilis* (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 cœnenchyma is covered with elongate granules, which show a decided tendency to be arranged in striæ.
- Fig. 4, *Azohelia asperula* (M.-Edw. & H.). Several calices enlarged; distance between columellar 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, 6b, *Astrangia solitaria* (Le Sueur)? var. *portoricensis* var. nov. Fig. 6, upright view of a single corallite; height, 13.5 mm. Fig. 6a, costæ and exsert portion of several septa enlarged. Fig. 6b, calicular view; greater diameter of calice, 7 mm.
- Figs. 7, 7a, 7b, "*Diasteris*" *crispa* Pourtalès. Fig. 7, upright view of corallum; diameter, 9 mm. Fig. 7a, 1½ 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, 1b, 1c, *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, costæ and exsert portions of several septa enlarged.
- Figs. 2, 2a, 2b, *Astrangia astreiformis* 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. 2b, costæ enlarged; the costæ usually are more granulate and the septal margins are alternately more and less exsert.
- Figs. 3, 3a, *Cladocora arbuscula* (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, 4b, *Porites porites* forma *divaricata* Le Sueur. Fig. 4, general view of a corallum; greatest length, 39 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 columellar 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 columellar tubercle; between the pali and the wall on several septa are prominent septal granules, so it is not easy to distinguish the pali and columellar tubercle in the figure; the septal arrangement is the same in both calices.

PLATE III: *Meandrina meandrites* (Linn.) ? Young. View from above; greatest length, 79 mm.

## PLATE IV:

- Fig. 1, *Meandrina meandrites* (Linn.) ? Young. Upright view of corallum; greatest length, 79 mm.
- Figs. 2, 3, *Manicina areolata* (Linn.). Fig. 2, calicular view. Fig. 3, upright view; greatest transverse measurement, 57 mm.

PLATE V: *Meandrina danae* (M.-Edw. & H.). Figures from photographs of the types in the Muséum d'Histoire Naturelle, Paris.

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). Meandriform 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 elephantotus* (Pallas). View of a corallum from above; greatest width, 36 mm.Fig. 2, *Azhelia asperula* (M.-Edw. & H.). General view of a specimen; height, 34.5 mm.PLATE XVIII: *Agaricia* sp. General view of a corallum from above; width between extremes of projecting portions, 18.8 cm.PLATE XIX: *Agaricia* sp. Portions of valleys, enlarged.PLATE XX: *Agaricia cailleti* (Duch. & Mich.). General view of corallum; height, 7.7 cm.PLATE XXI: *Isopora muricata* (Linn.) s. s. (= *cervicornis* Lamarck). Height of specimen, 37.5 cm.

## PLATE XXII:

Fig. 1, *Isopora muricata* forma *prolifera* Lam. End of a branch; height, 9 cm.Fig. 2, *Isopora muricata* Linn. Height, 20.5 cm.PLATE XXIII: *Isopora muricata* forma *prolifera* Lamk., from Dry Tortugas, Florida. Height, 35.5 cm.PLATE XXIV: *Isopora muricata* forma *prolifera* Lamarck, from Dry Tortugas, Florida. Height, 39.5 cm.PLATE XXV: *Isopora muricata* forma *prolifera* 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* Lam. Breadth, 14.8 cm.PLATE XXVIII: *Porites porites* (Pallas). Specimen from Curaçao. Height, 13.3 cm.; greatest breadth, 16 cm.:

Fig. 1, General view of corallum.

Fig. 2, Calices enlarged.

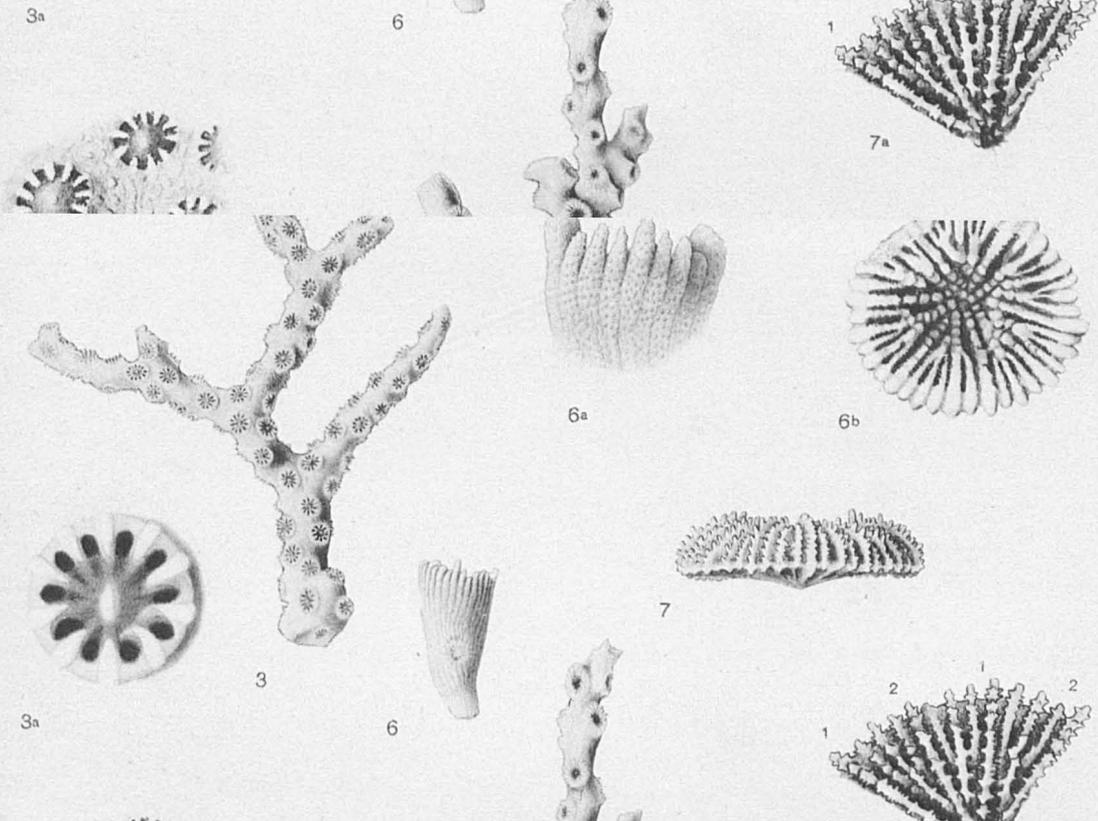
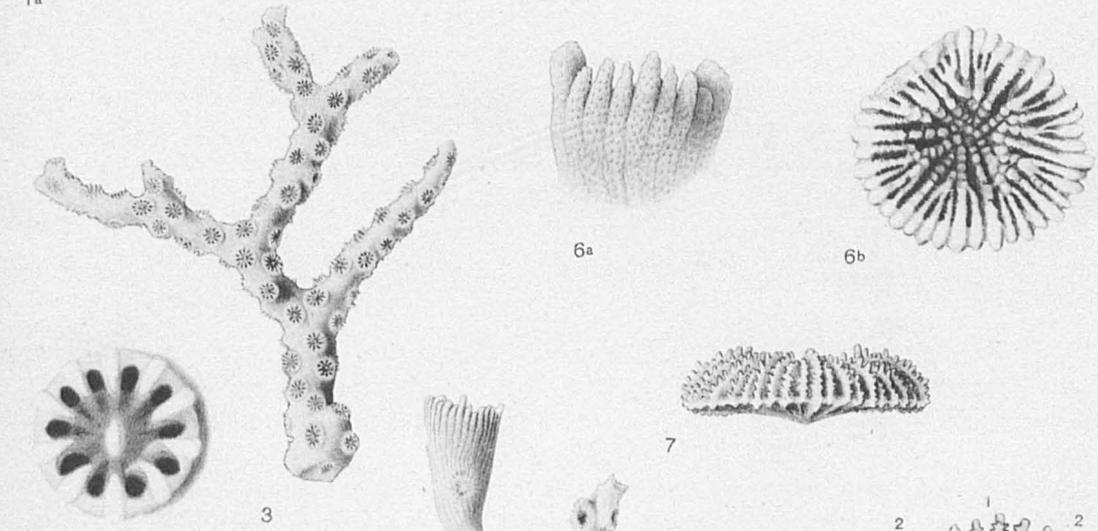
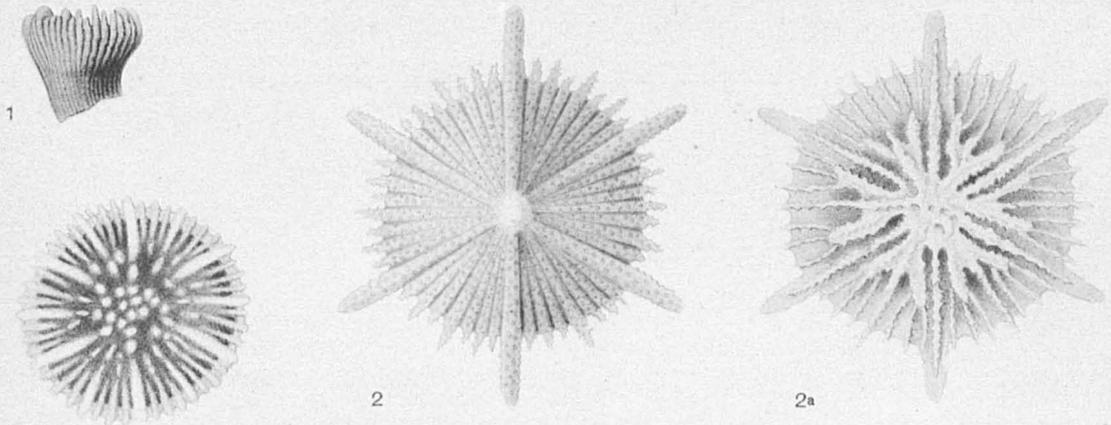
PLATE XXIX: *Porites porites* forma *clavaria* Lam. Height of specimen, 14.5 cm.PLATE XXX: *Porites porites* forma *furcata* Lam. Extreme breadth of specimen, 26 cm.

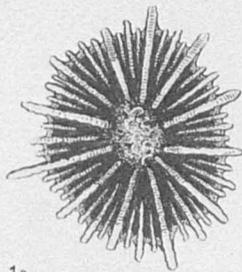
## PLATE XXXI:

Fig. 1, *Porites porites* forma *furcata* Lam. Calices enlarged.Fig. 2, *Porites porites* forma *clavaria* Lam. Calices enlarged.PLATE XXXII: *Porites astreoides* Lam., forma  $\alpha$ . Horizontal diameter of specimen, 17.6 cm.PLATE XXXIII: *Porites astreoides* Lam., forma  $\beta$ . Greater horizontal diameter, 20.6 cm.

## PLATE XXXIV:

Fig. 1, *Porites astreoides* Lam., forma  $\alpha$ . Calices enlarged.Fig. 2, *Porites astreoides* Lam., forma  $\beta$ . Calices enlarged.PLATE XXXV: *Millepora alcicornis* Linn. Digitiform variety; greatest breadth, 35.5 cm.PLATE XXXVI: *Millepora alcicornis* Linn. Variety with flabellate 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.

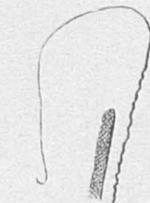




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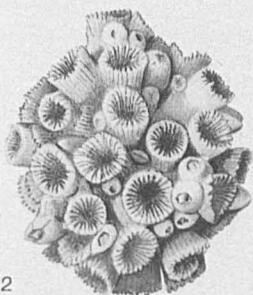
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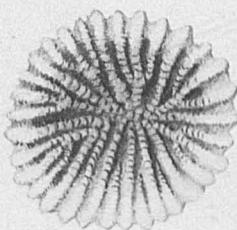
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1c



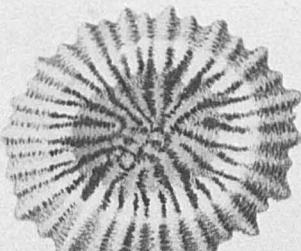
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2a



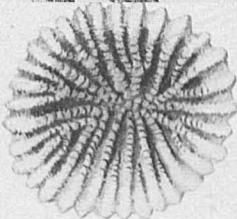
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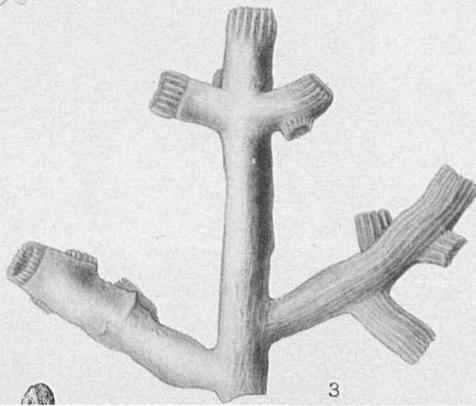
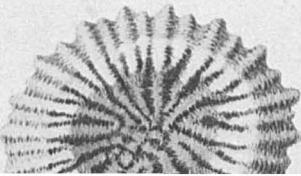
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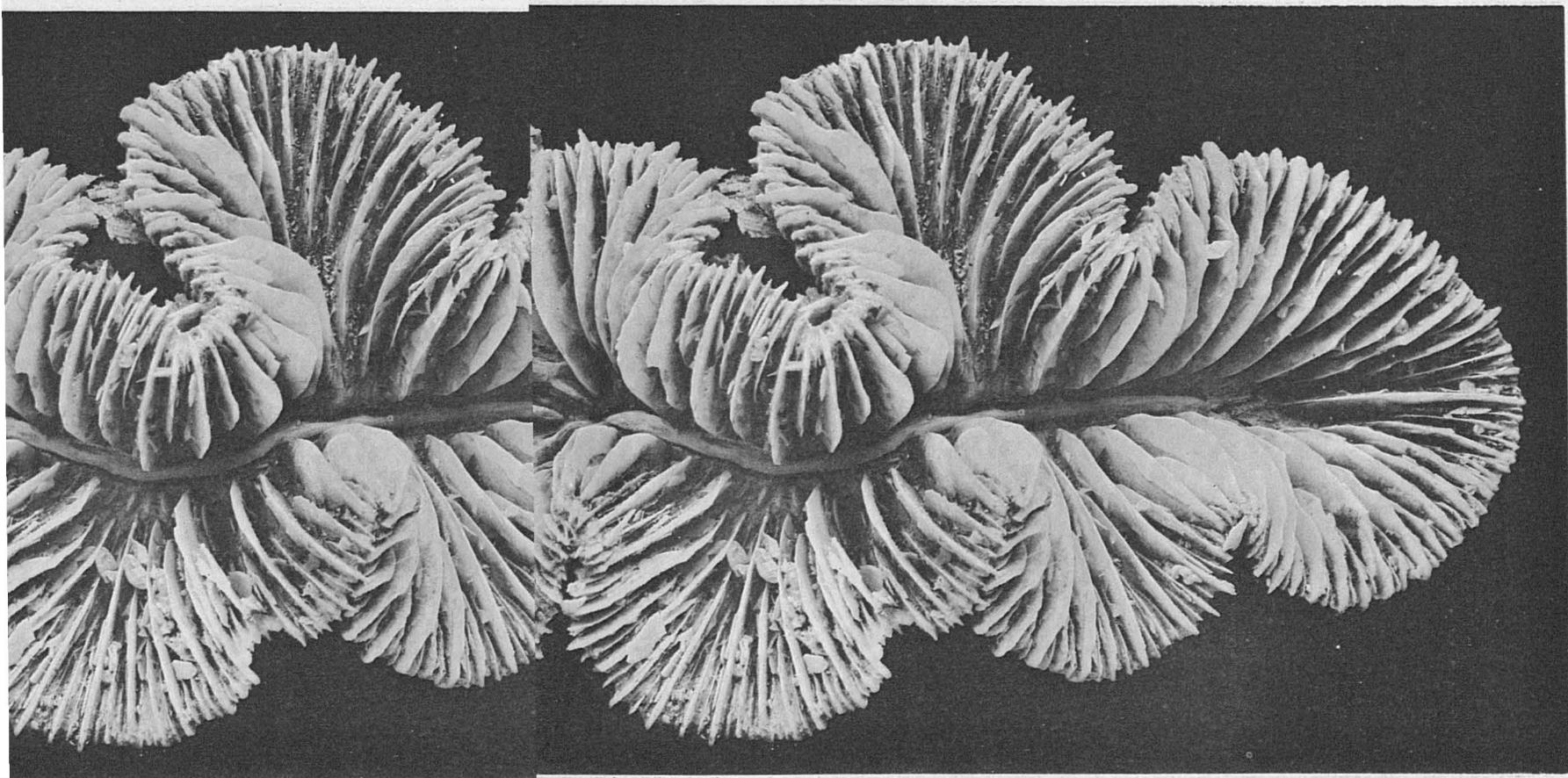
2a



2b



3



DRITES (LINN.) ? YOUNG. VIEW FROM ABOVE, GREATEST LENGTH, 79 MM. SCLERACTINIA MAEANDRITES (LINN.) ? YOUNG. VIEW FROM ABOVE, GREATEST LENGTH, 79 MM.

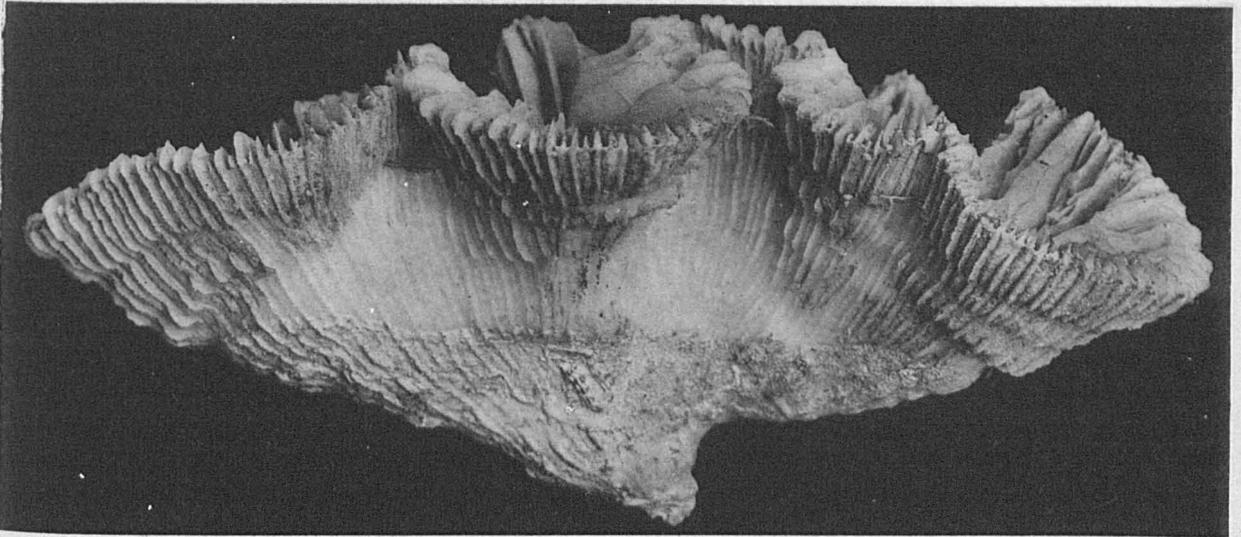


FIG. 1. MEANDRINA MAEANDRITES (LINN.) ? YOUNG. UPRIGHT VIEW OF CORALLUM, GREATEST LENGTH, 79 MM.

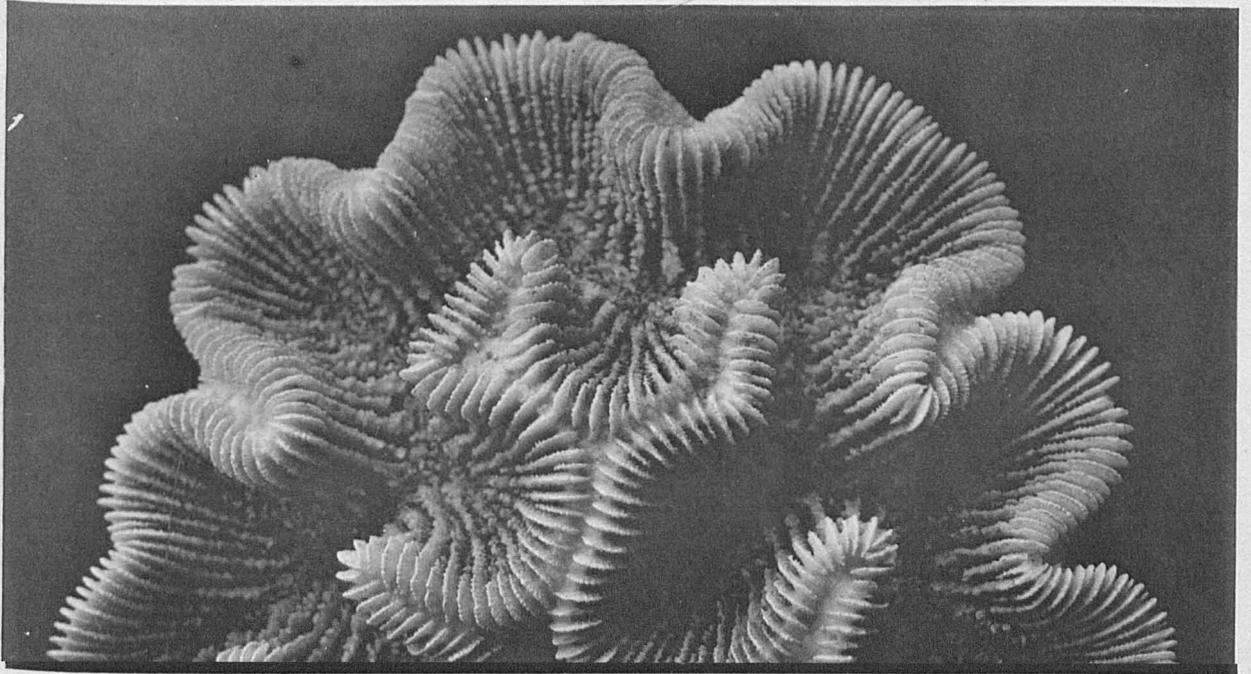
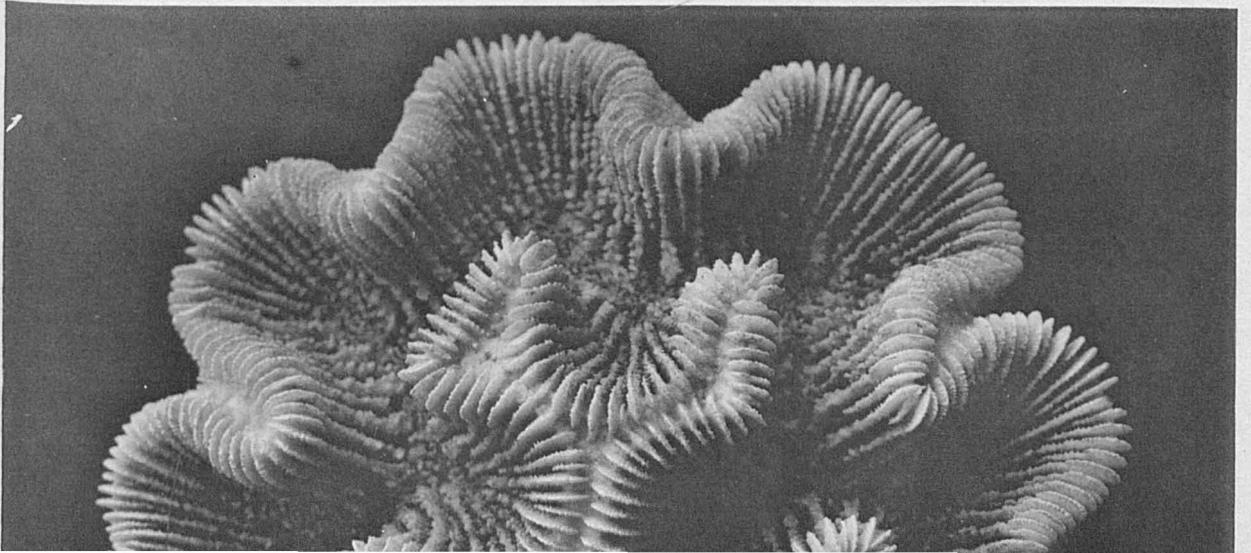
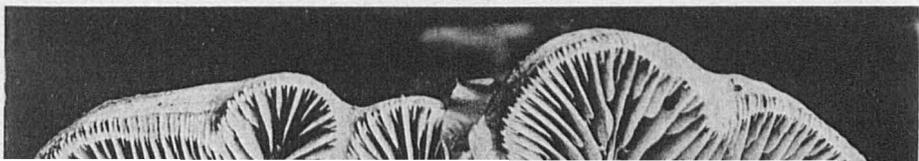
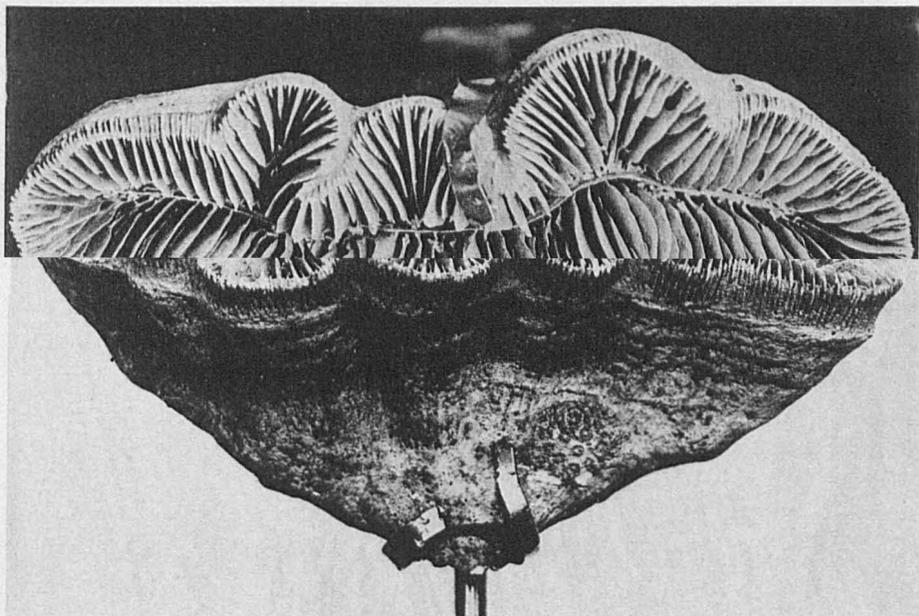
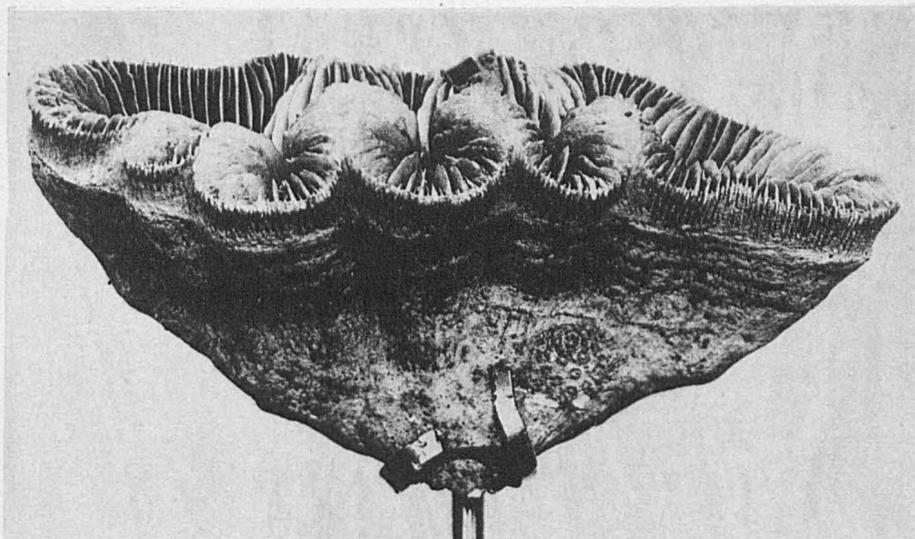
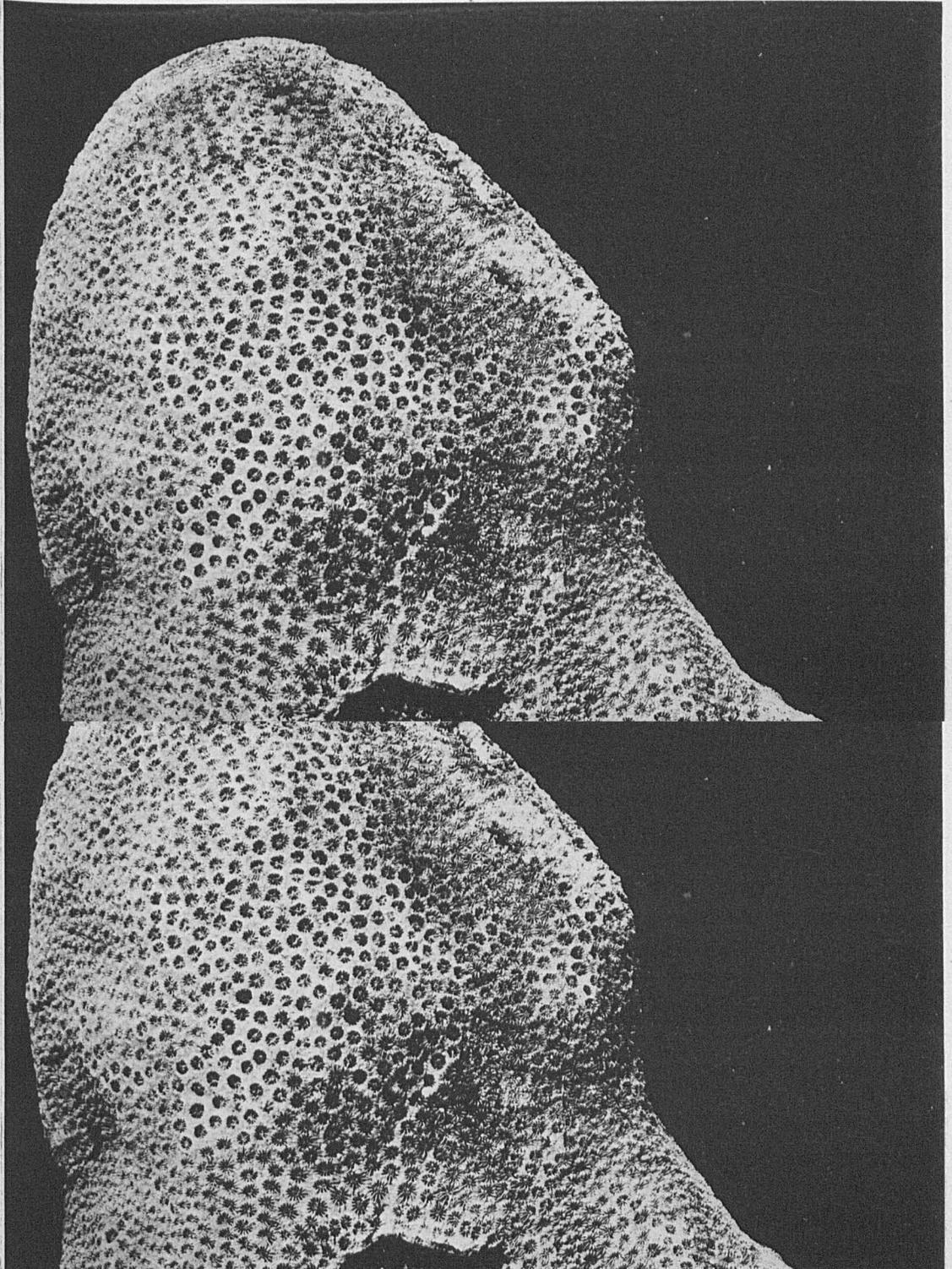
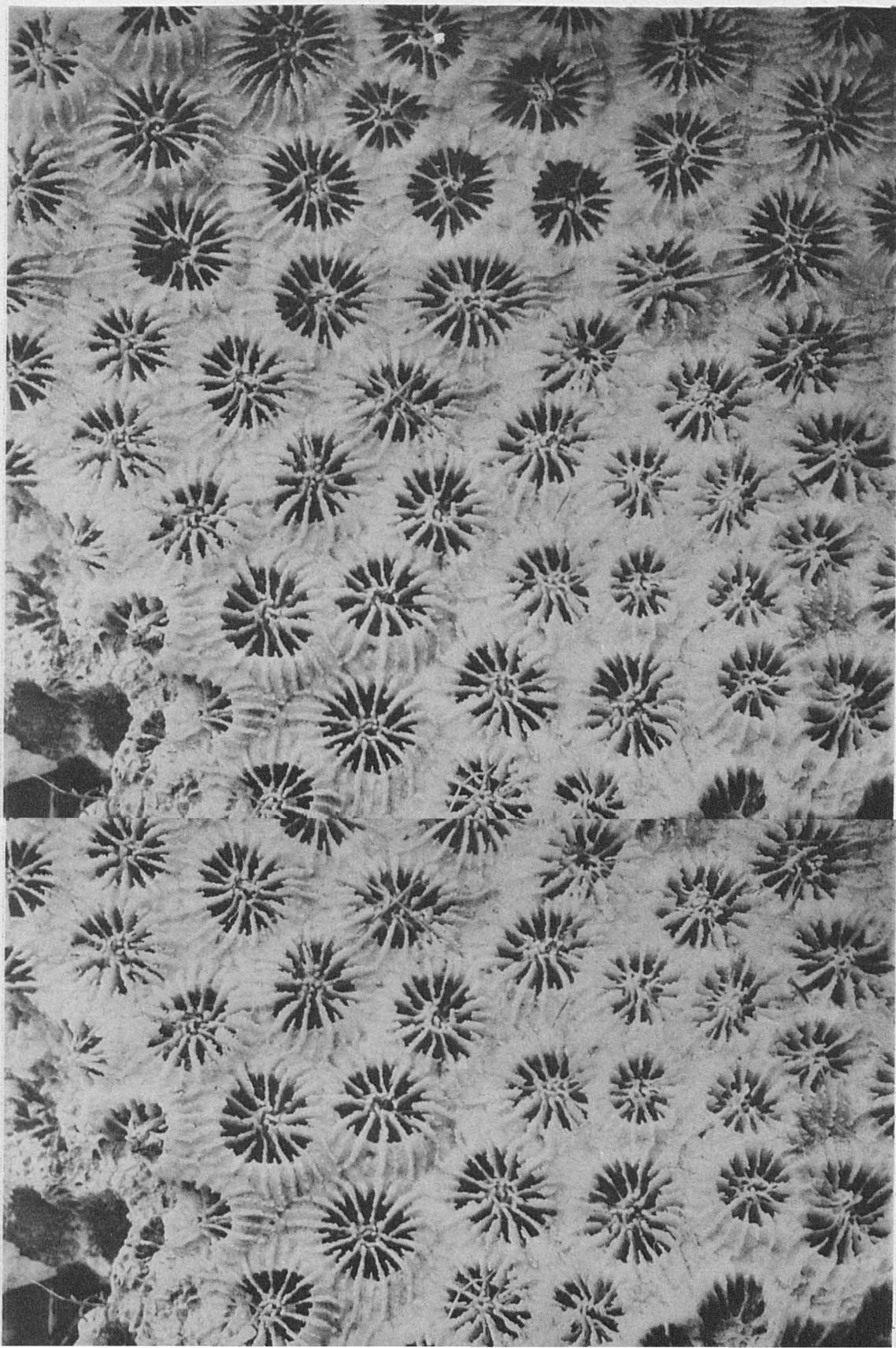


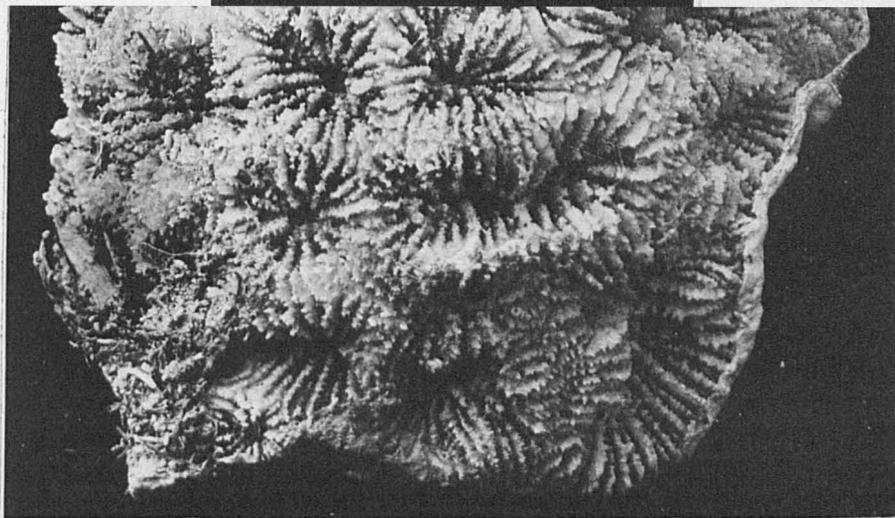
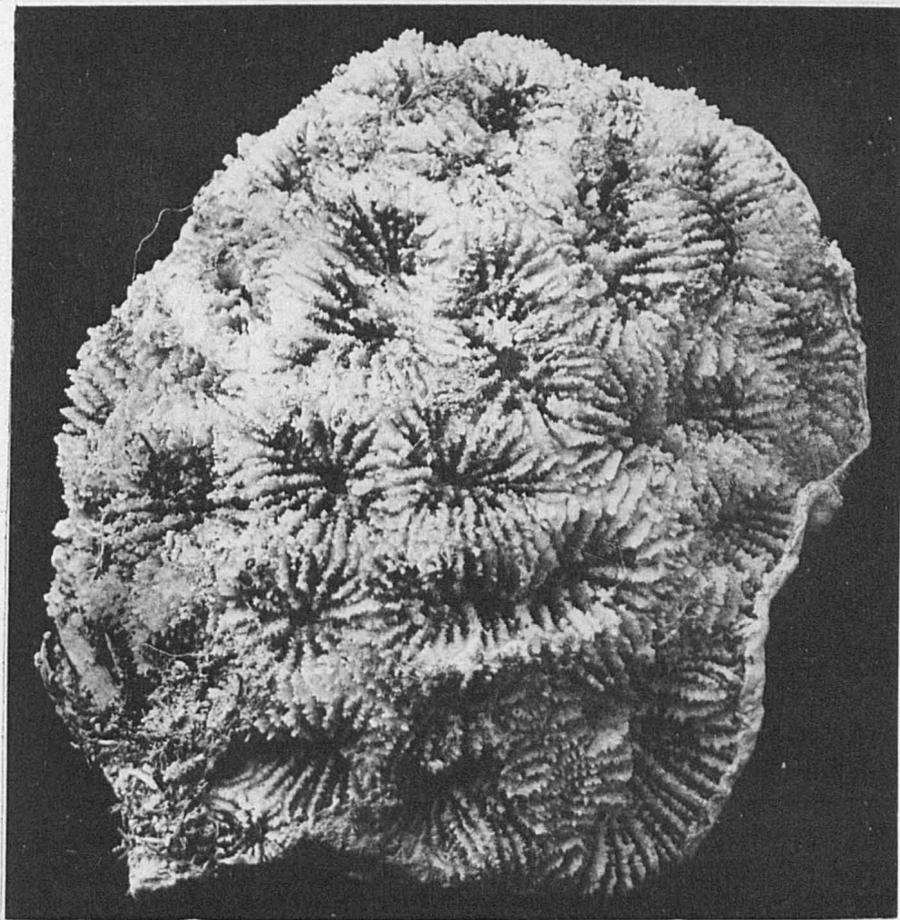
FIG. 1. MEANDRINA MAEANDRITES (LINN.) ? YOUNG. UPRIGHT VIEW OF CORALLUM, GREATEST LENGTH, 79 MM.

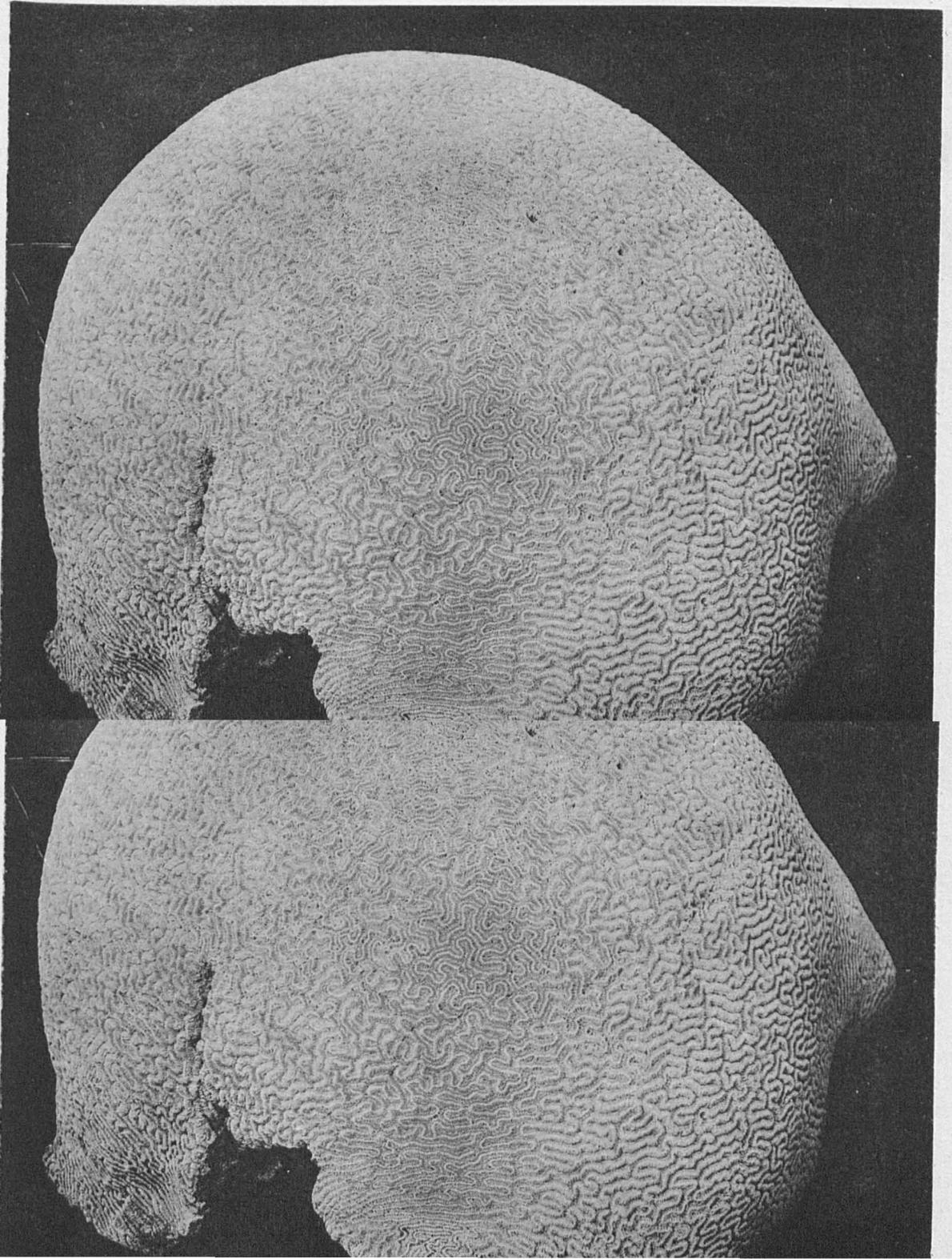


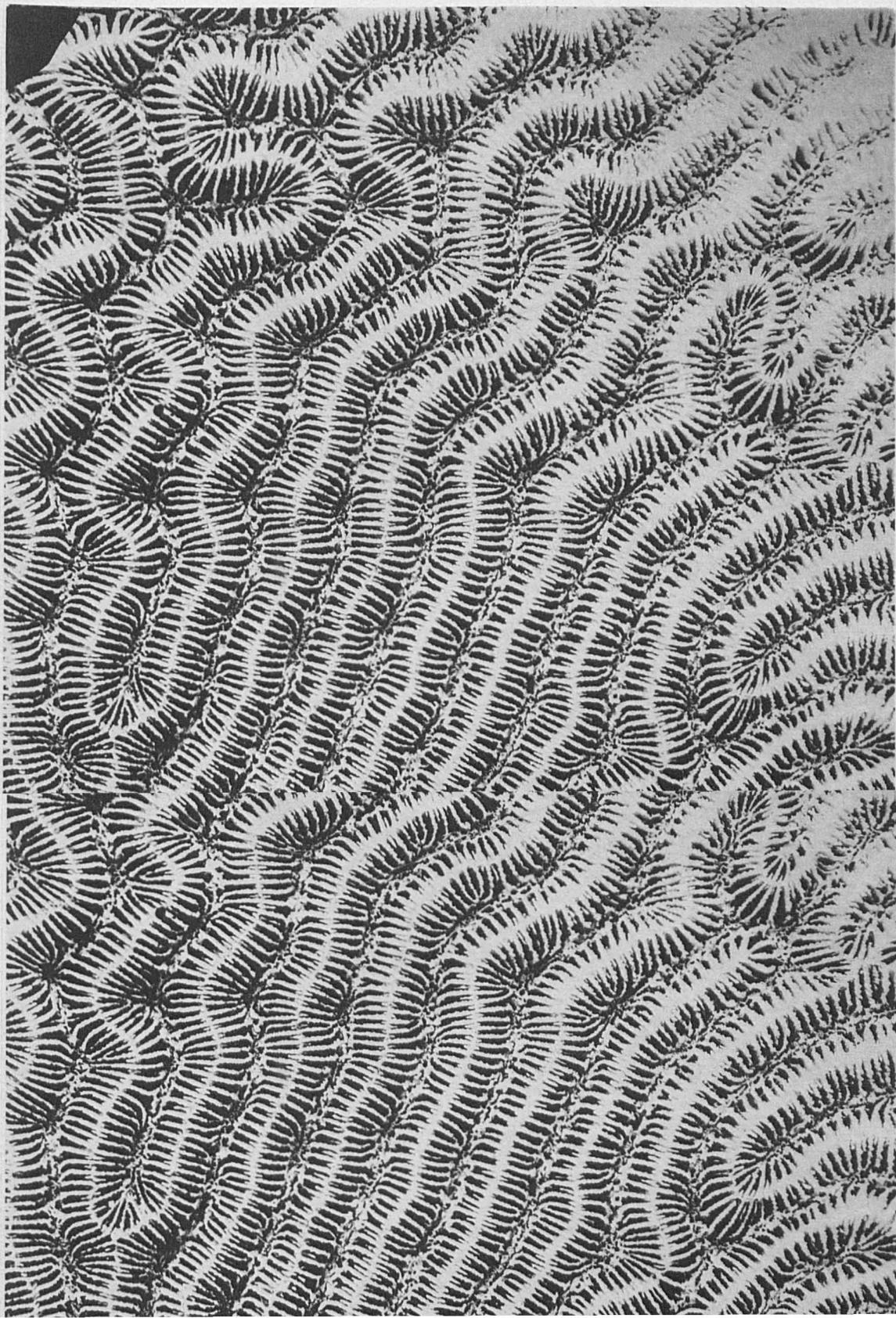


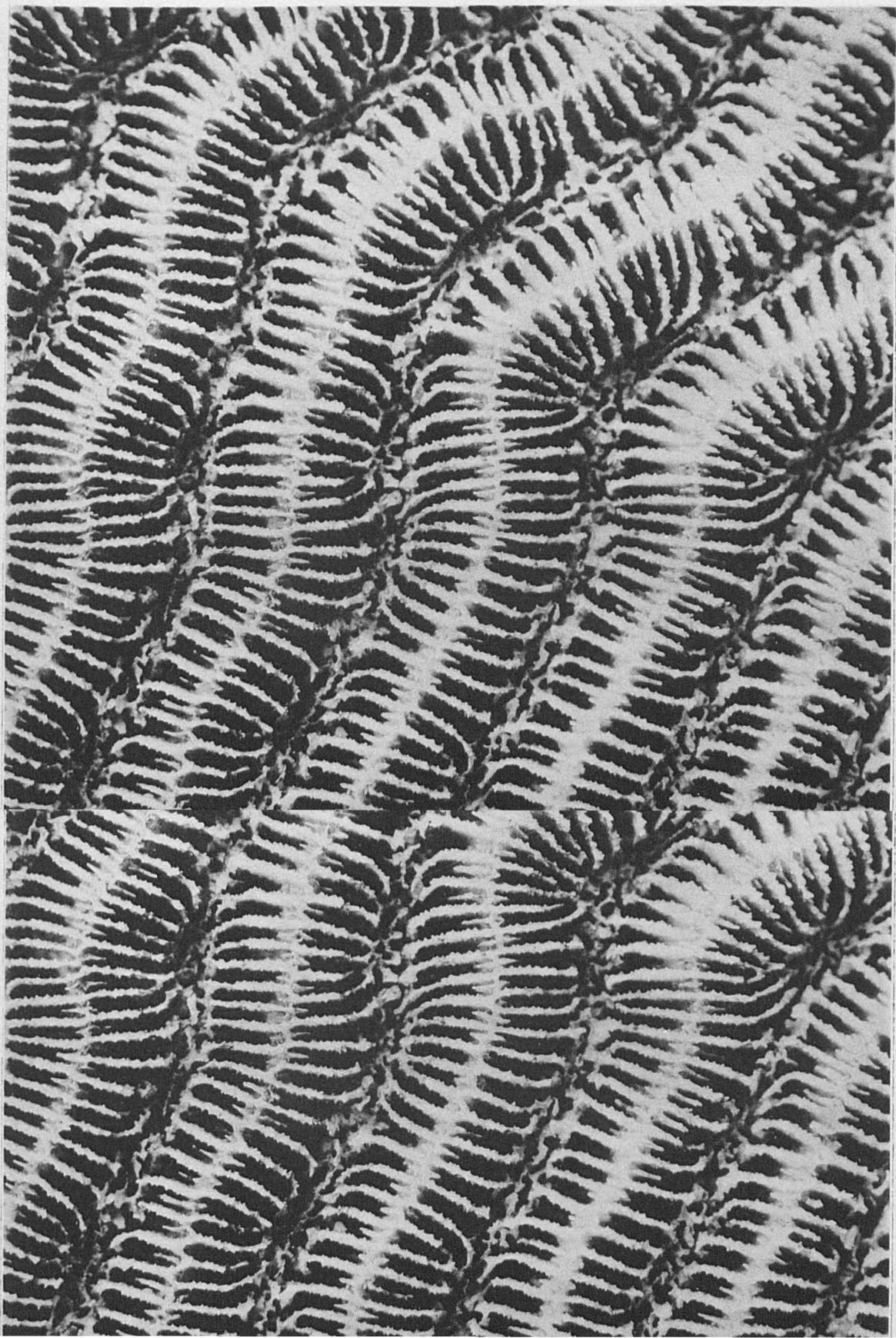


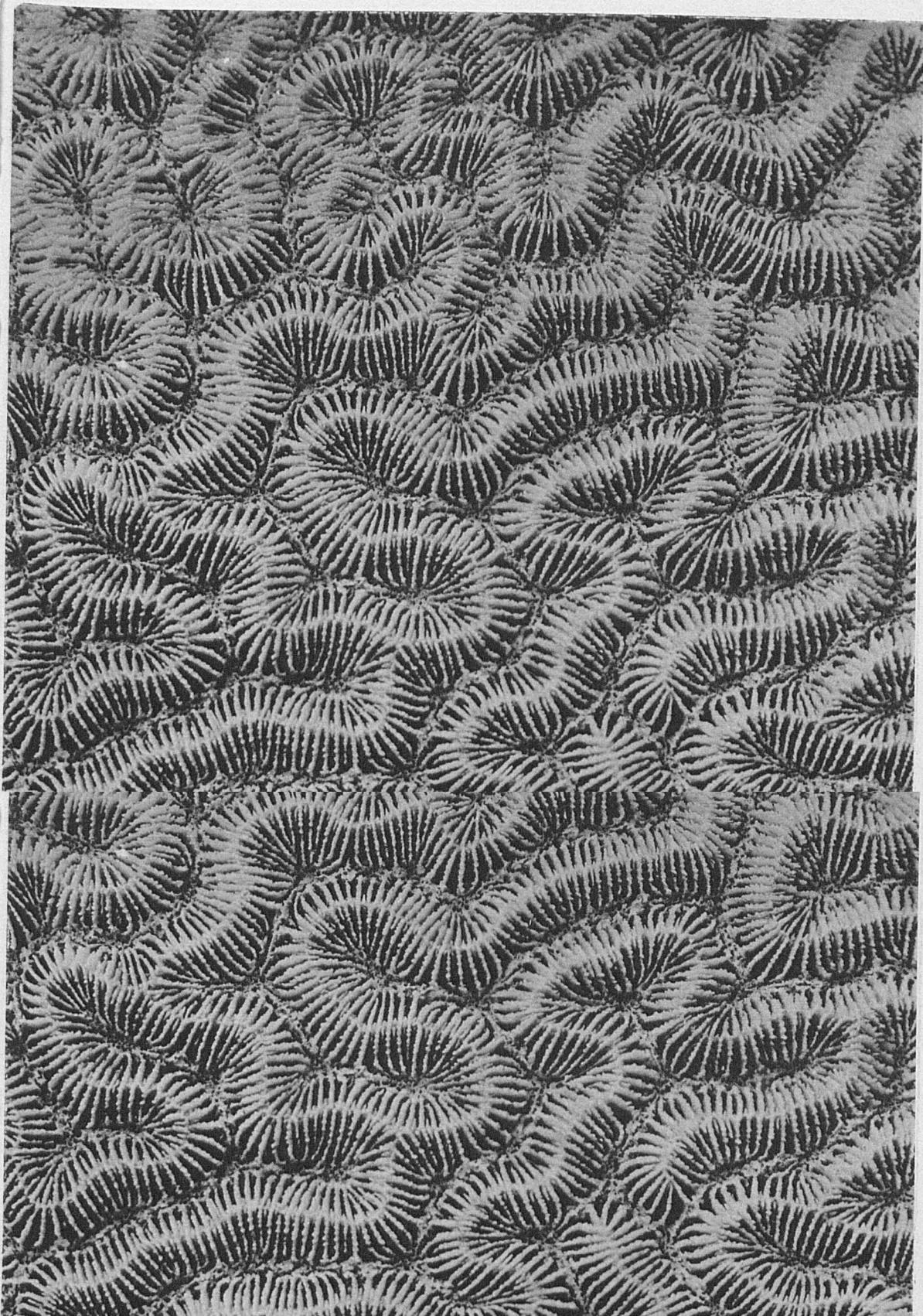


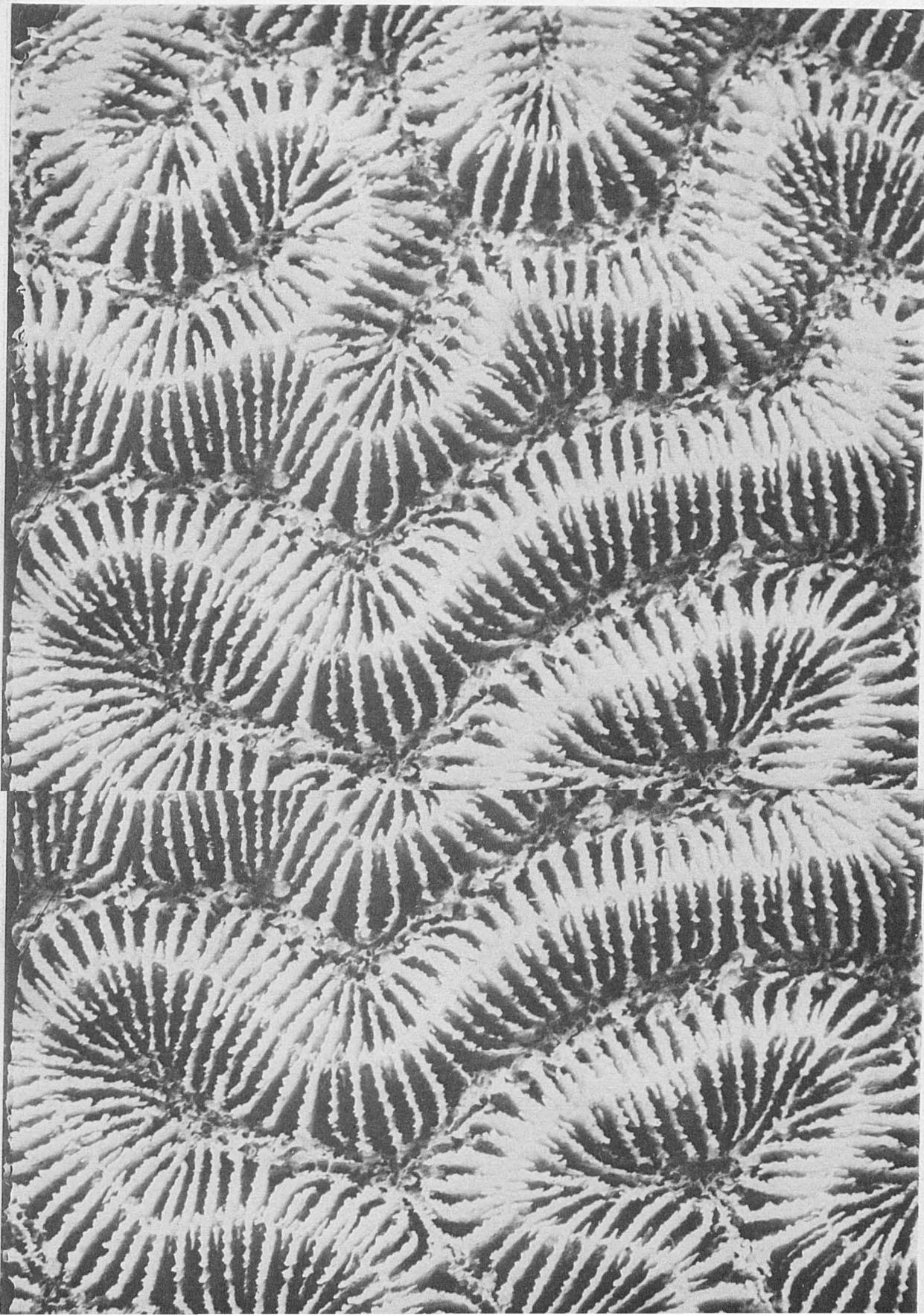












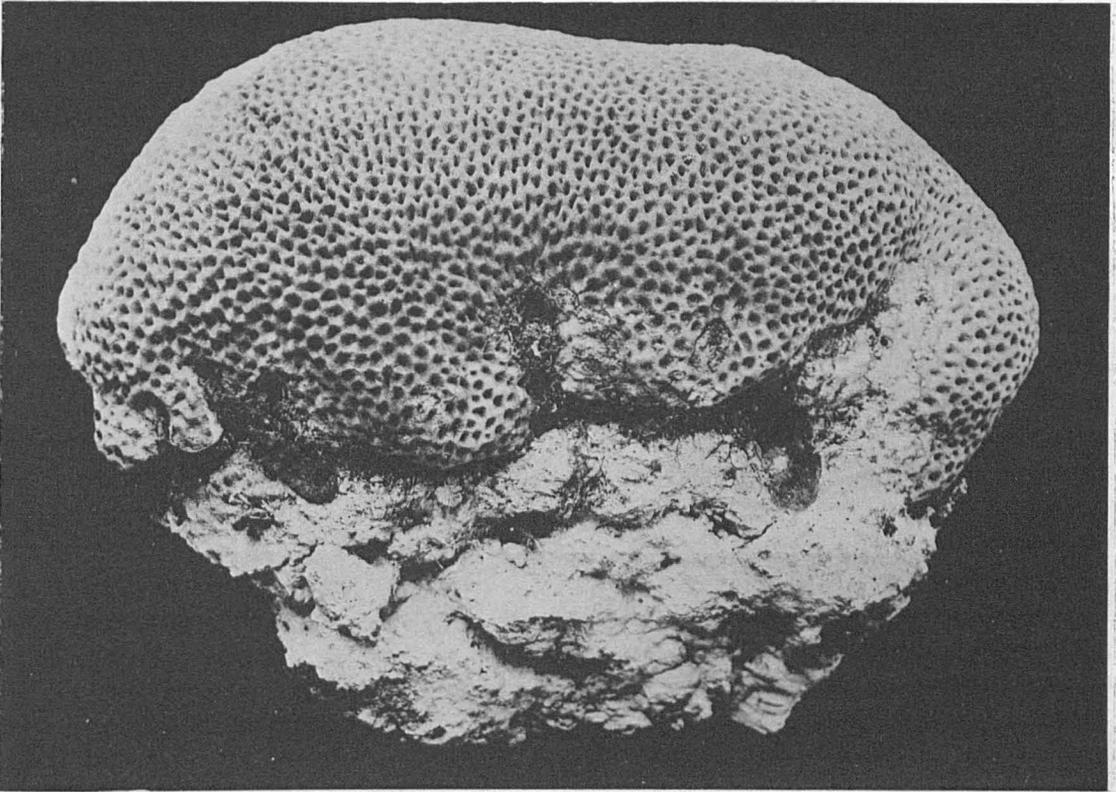


FIG. 1. *SIDERASTREA SIDEREA* (ELL. & SOL.). GENERAL VIEW OF A LARGE SPECIMEN, GREATER HORIZONTAL DIAMETER 20.2 CM.

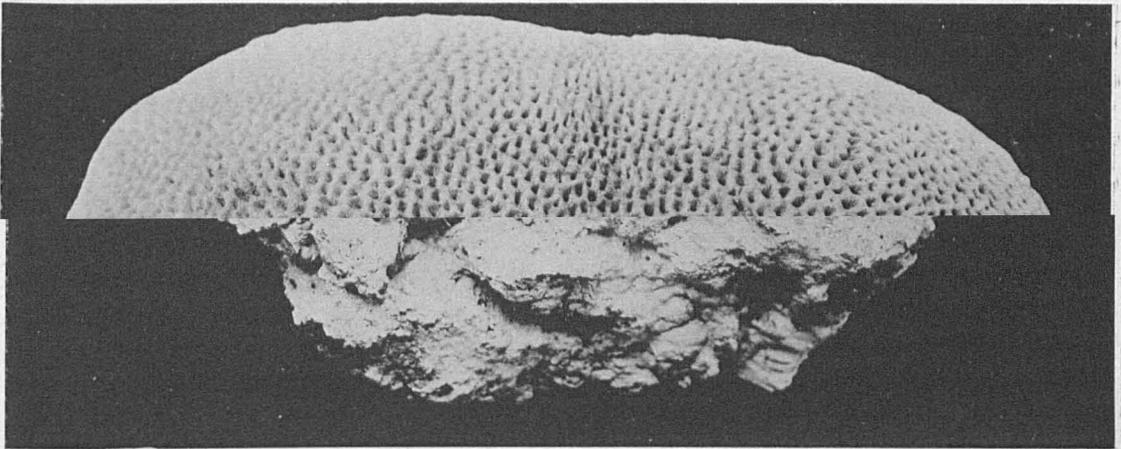
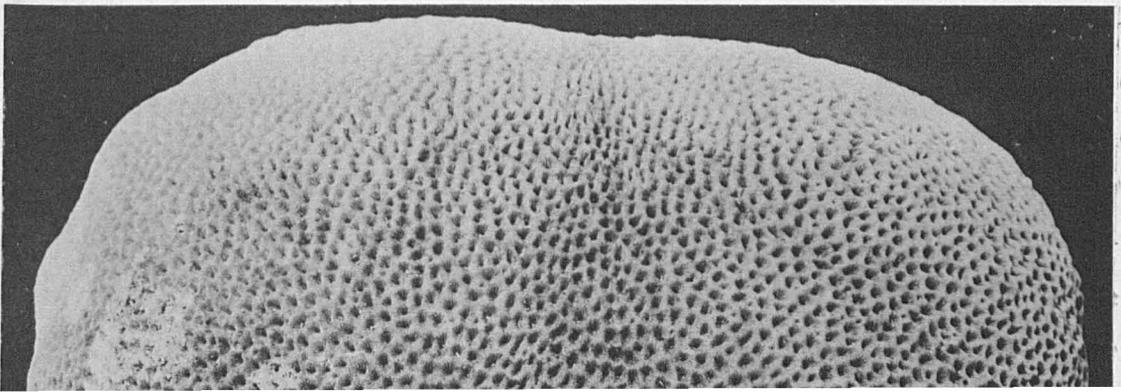
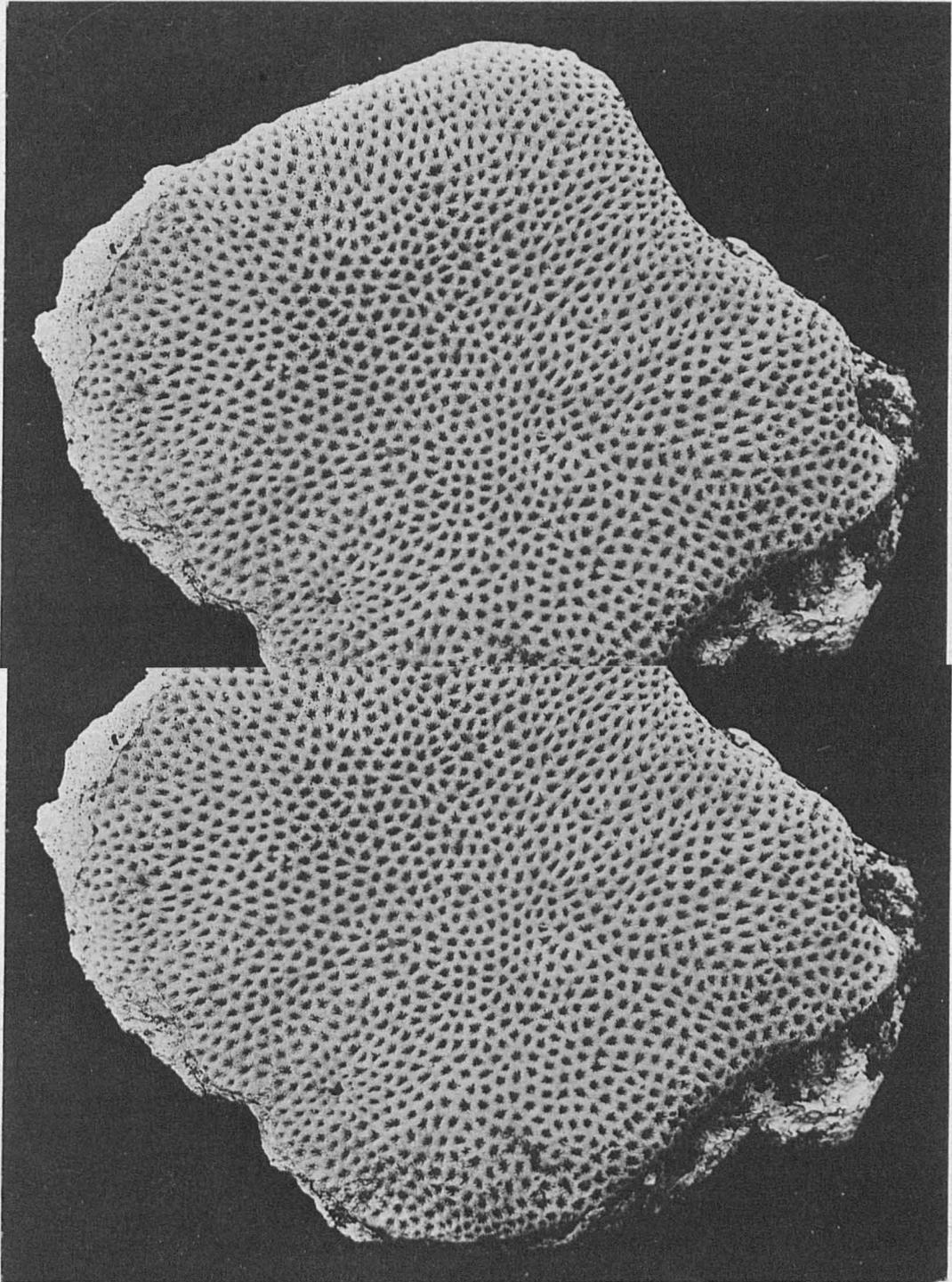
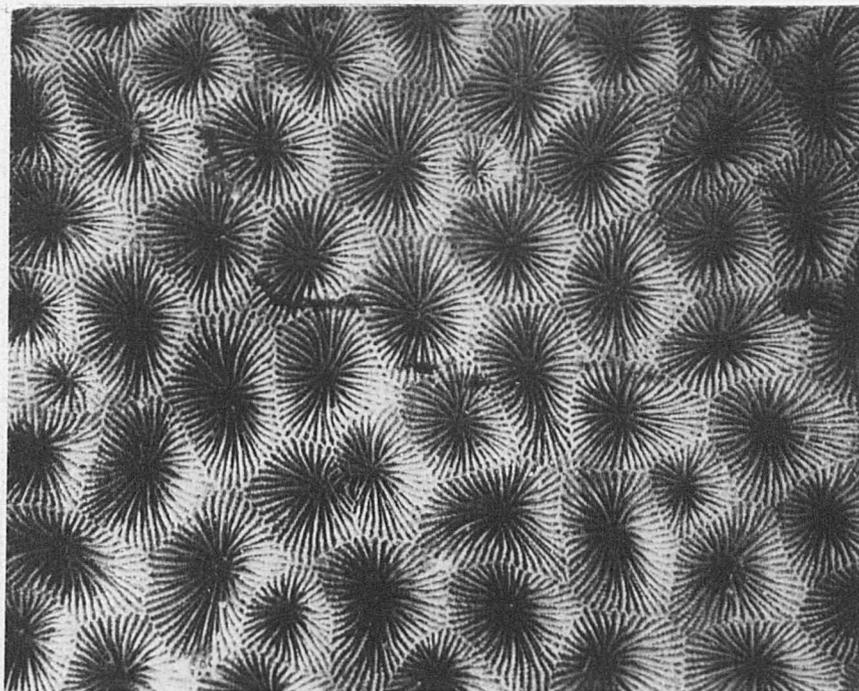


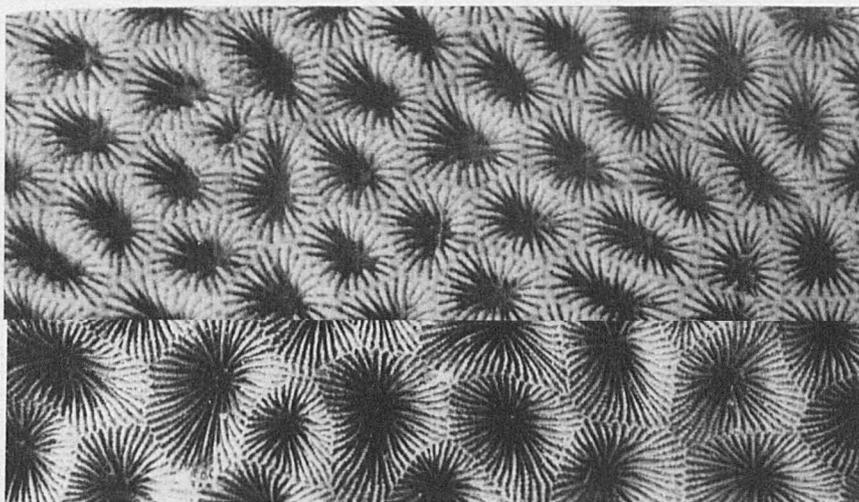
FIG. 1. *SIDERASTREA SIDEREA* (ELL. & SOL.). GENERAL VIEW OF A LARGE SPECIMEN, GREATER HORIZONTAL DIAMETER 20.2 CM.



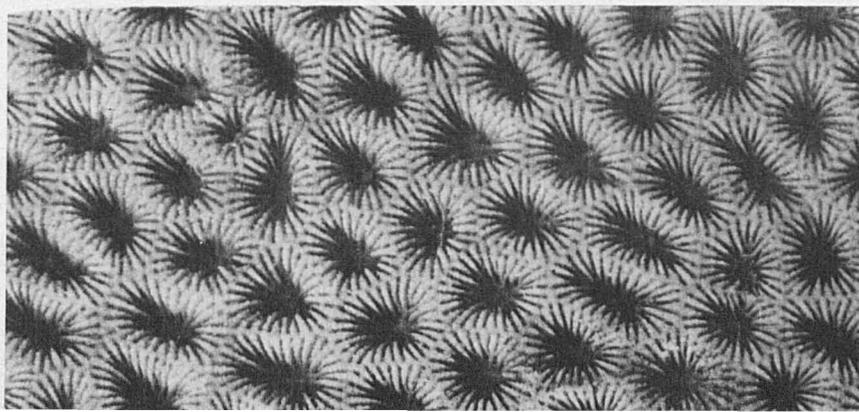


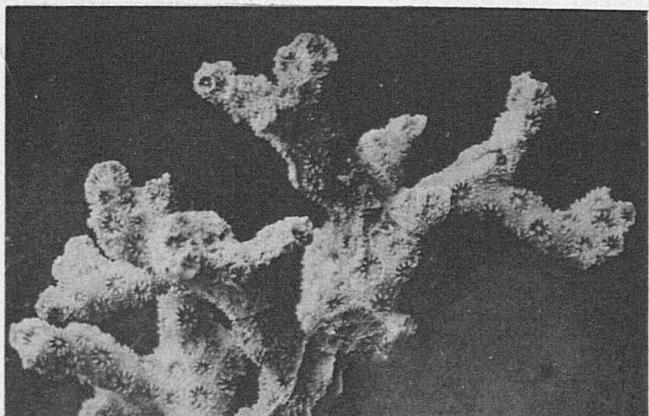
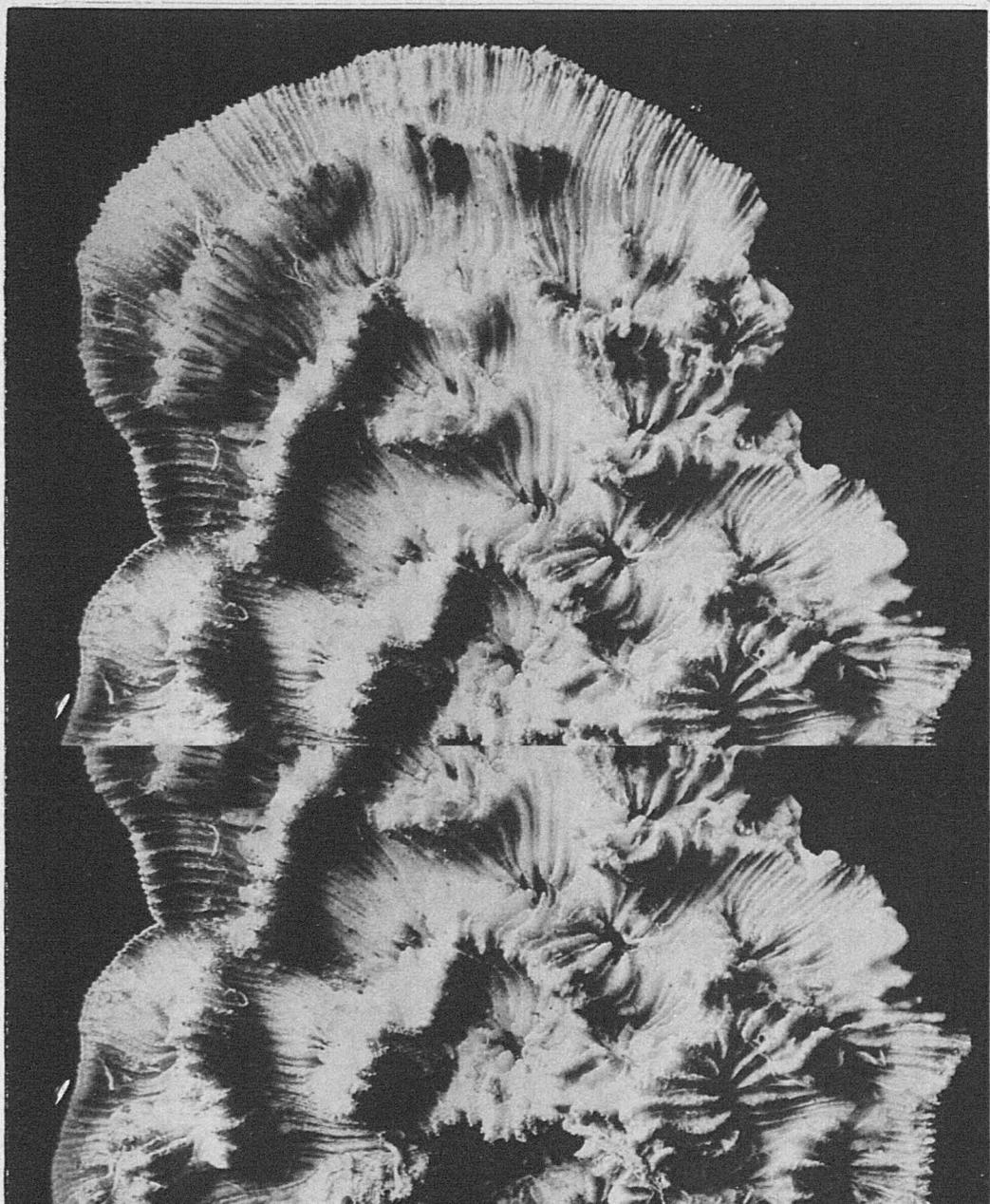


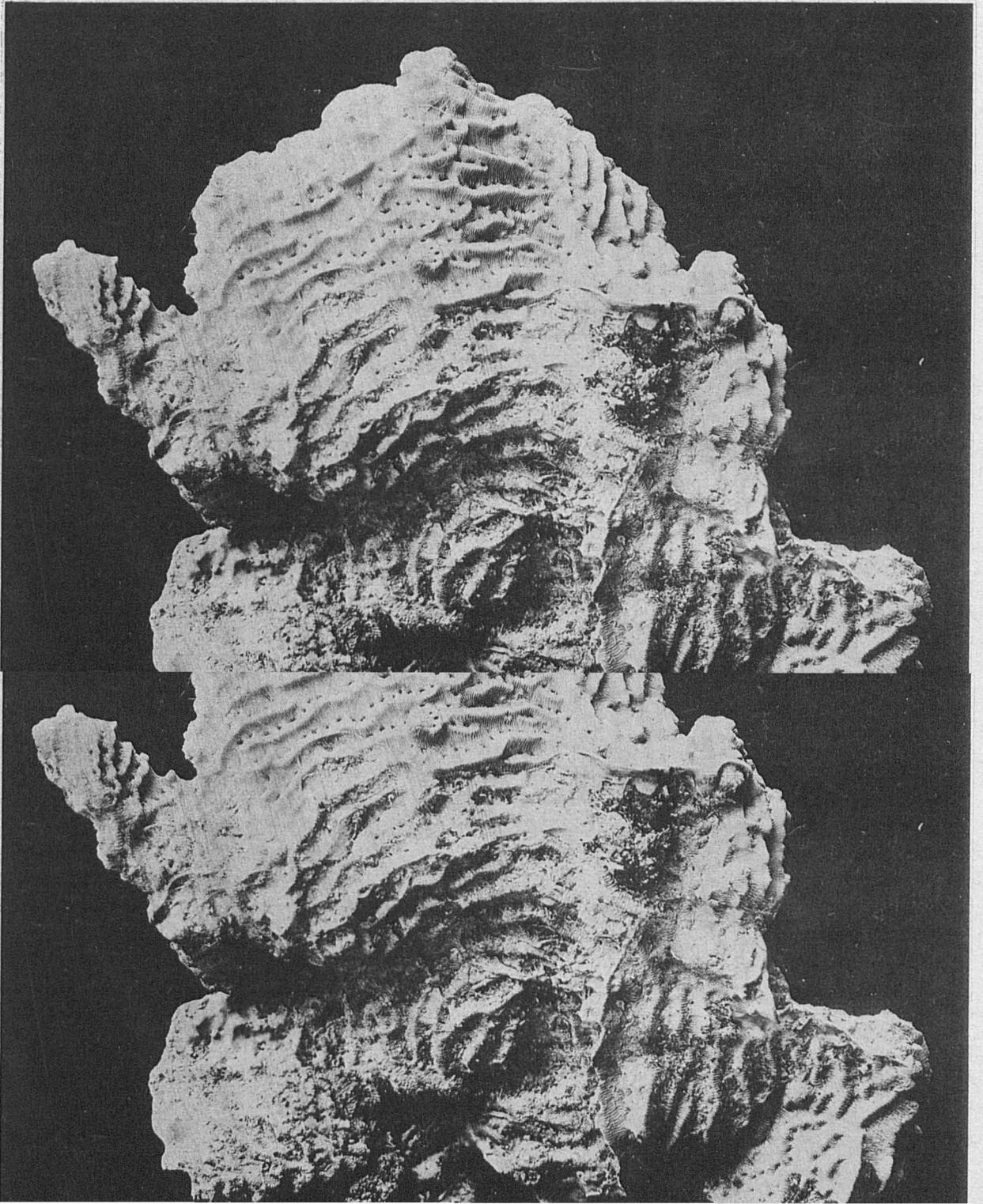
1. *SIDERASTREA SIDEREA* (ELL. & SOL.). CALICES ENLARGED.



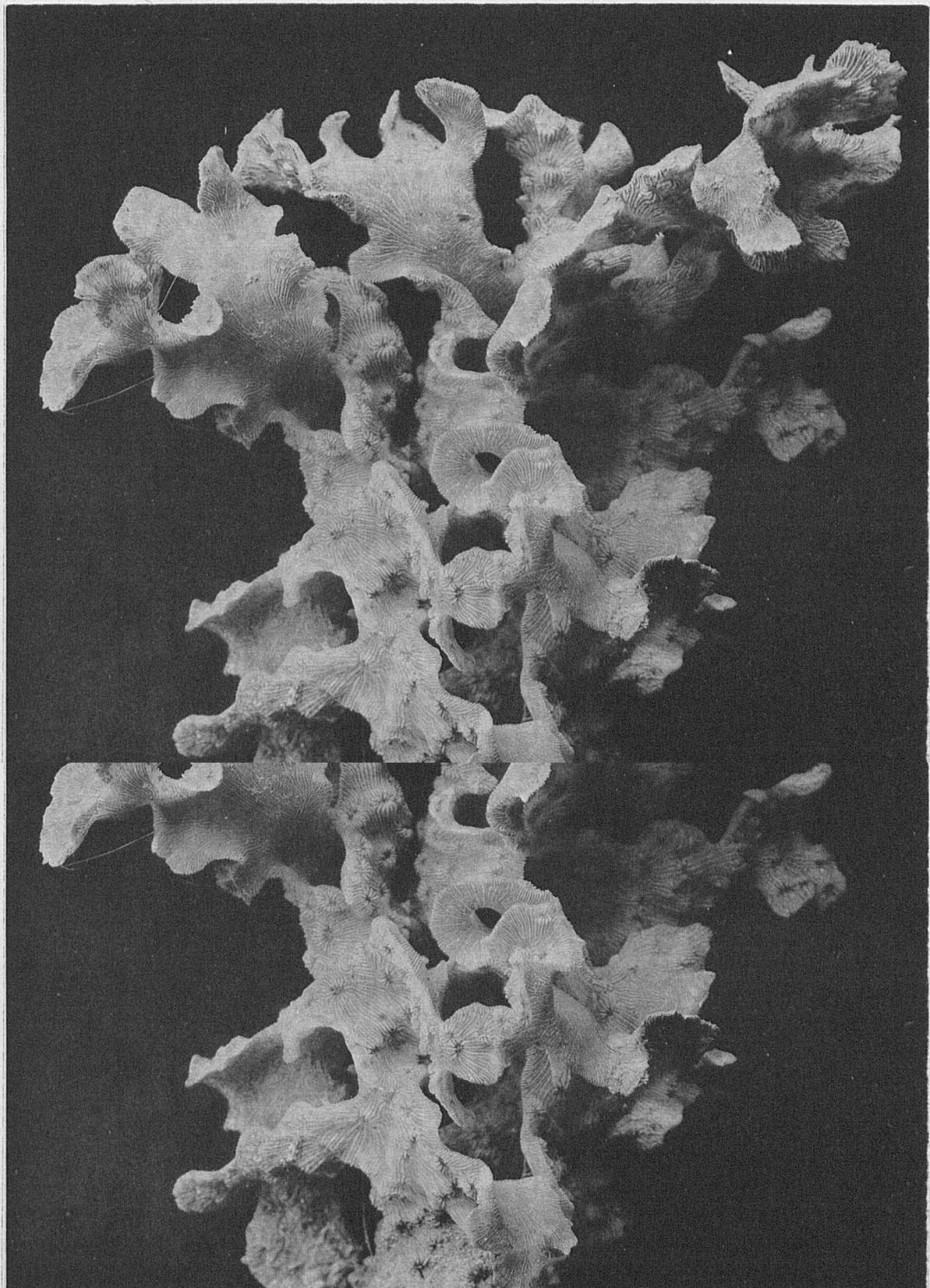
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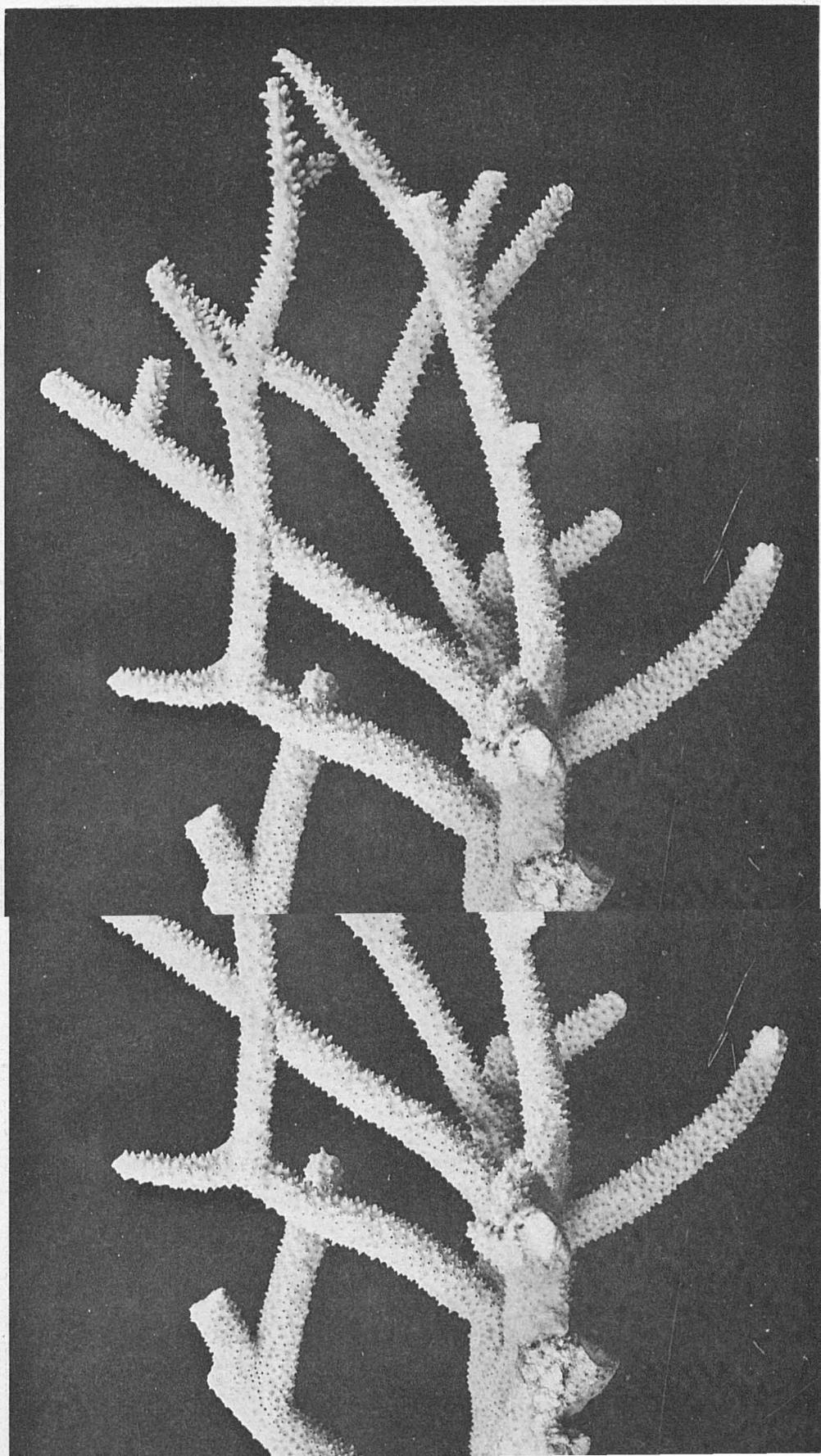












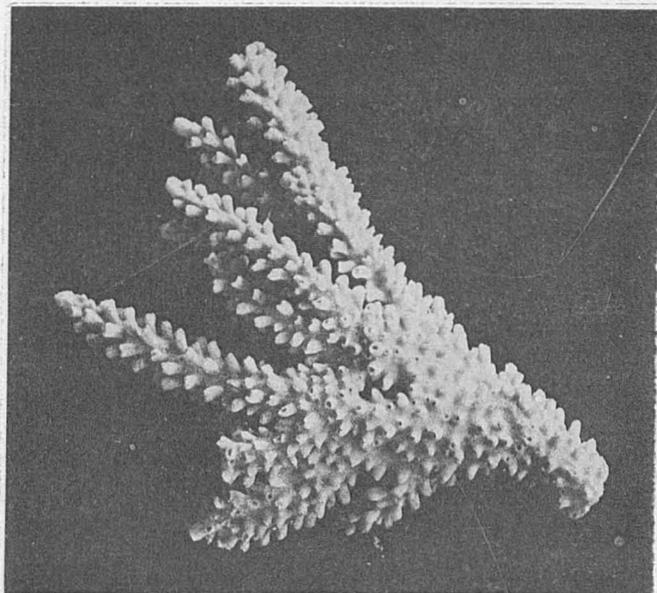


FIG. 1. ISOPORA MURICATA FORMA PROLIFERA LAM. END OF A BRANCH, HEIGHT 9 CM.

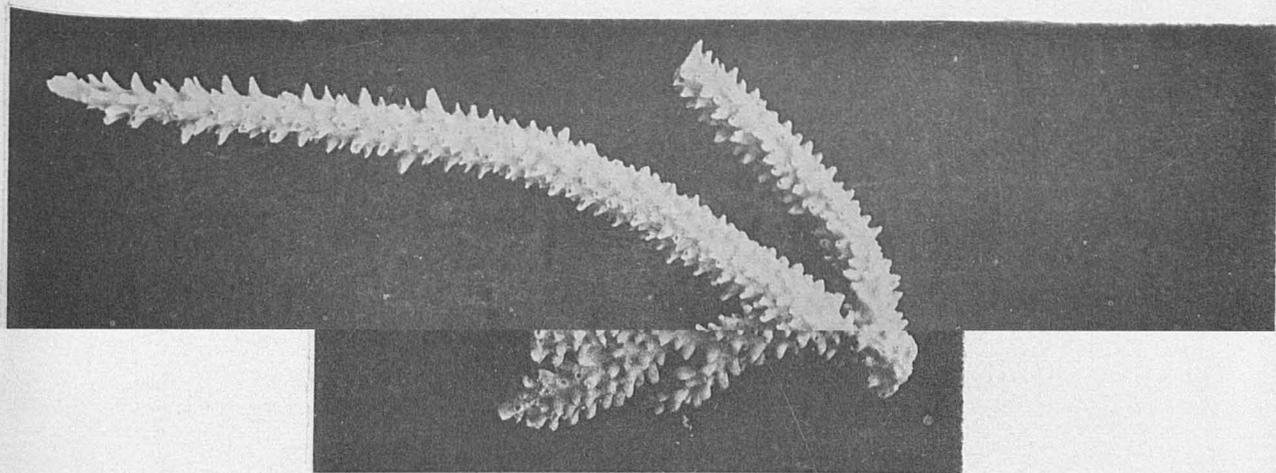
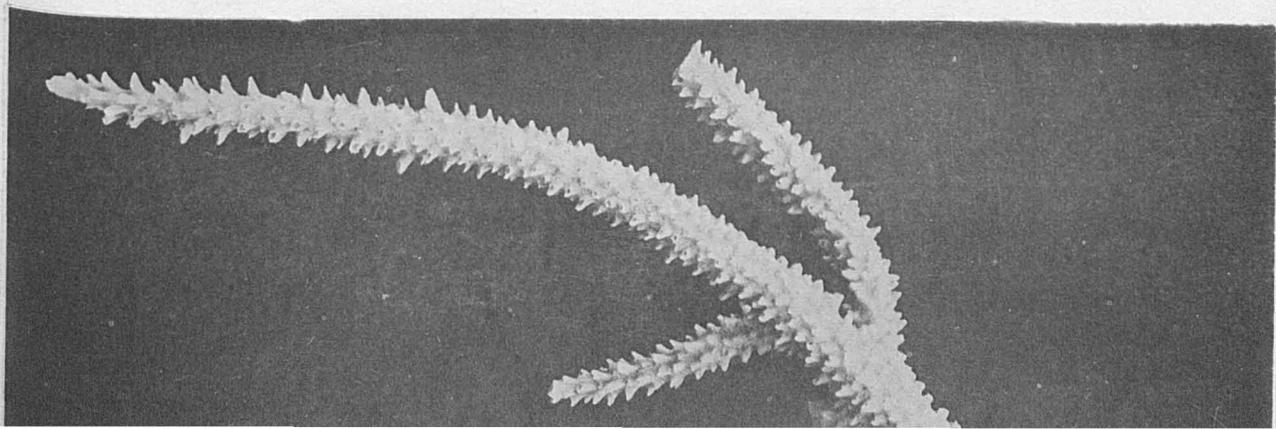
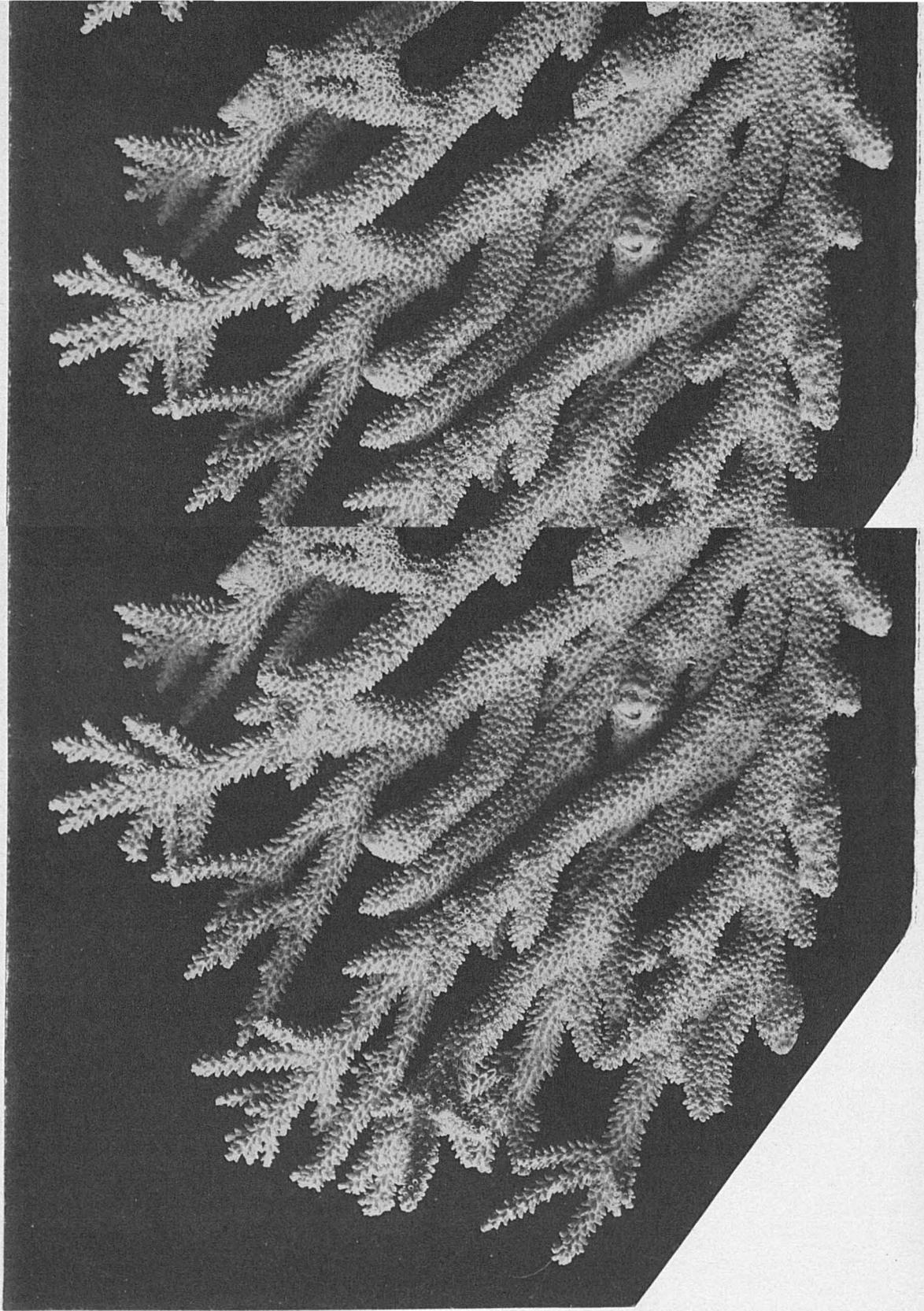
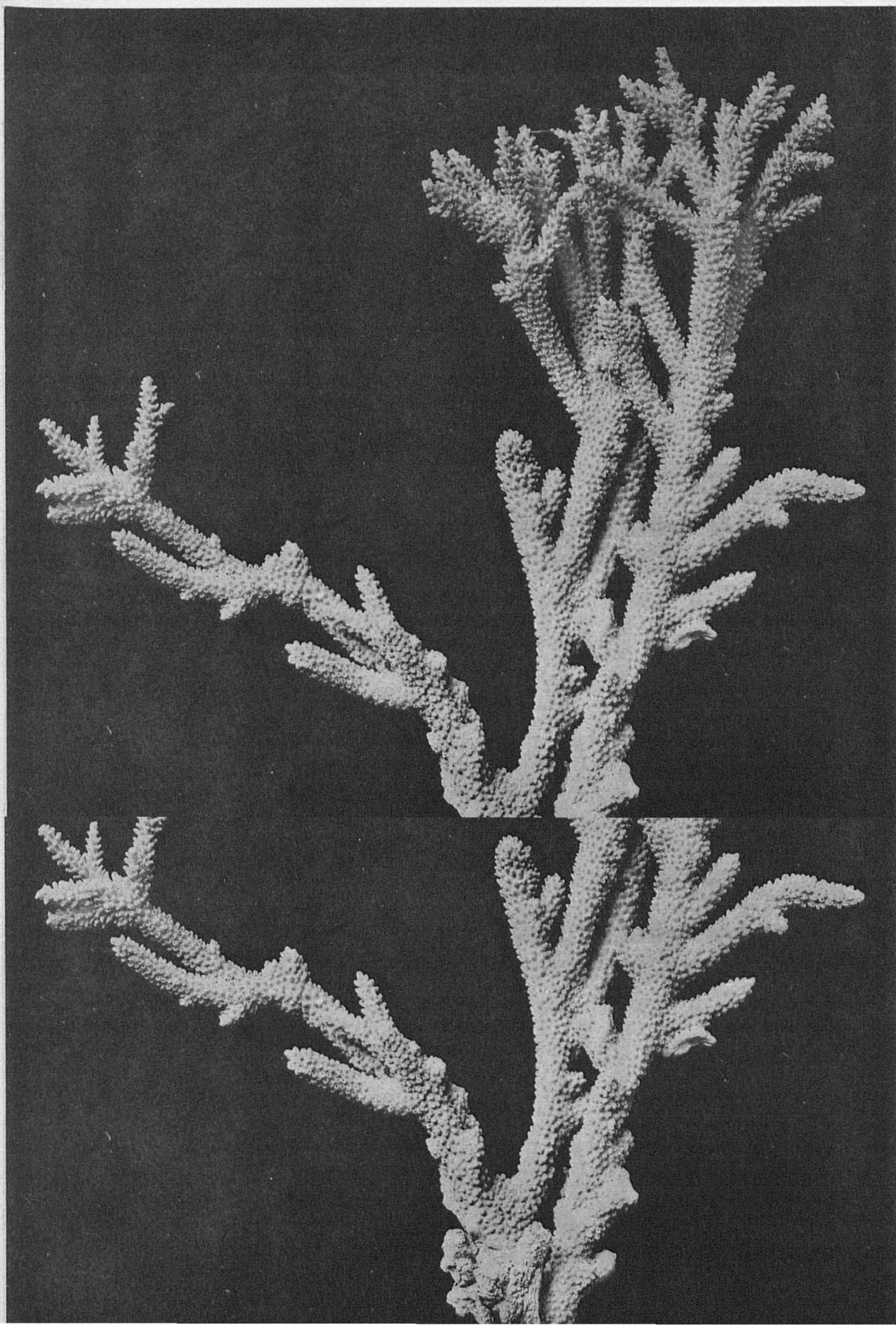
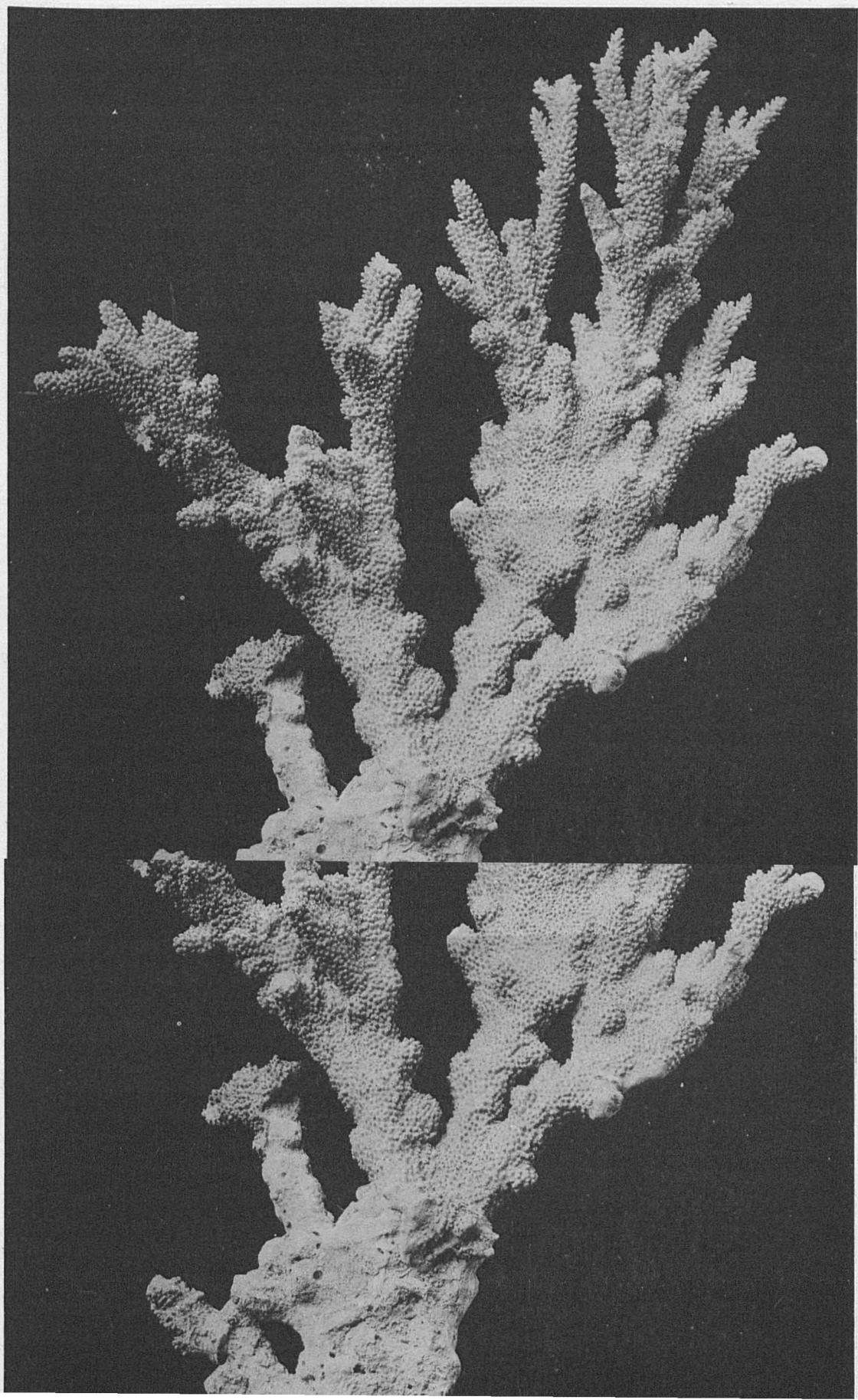


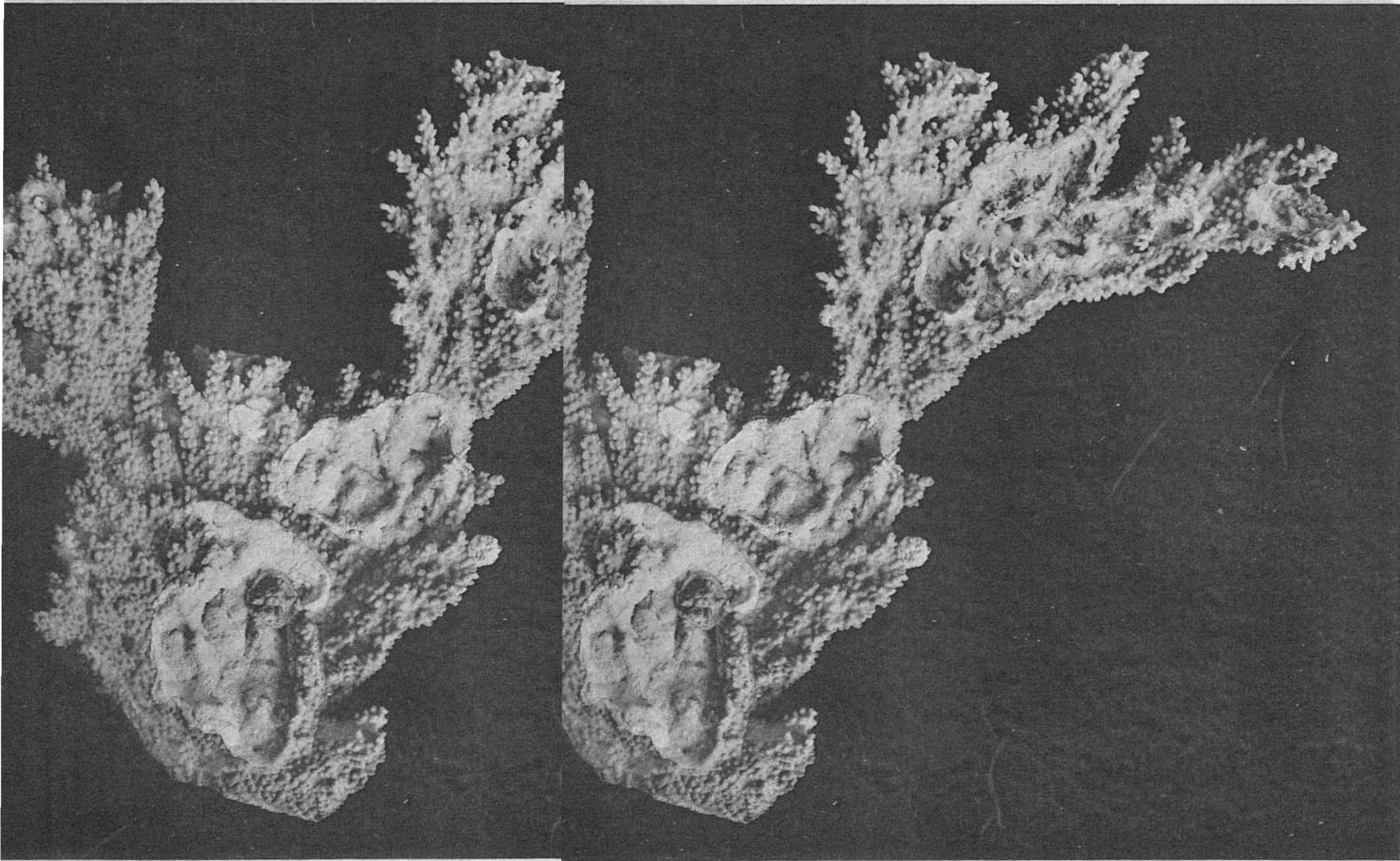
FIG. 1. ISOPORA MURICATA FORMA PROLIFERA LAM. END OF A BRANCH, HEIGHT 9 CM.



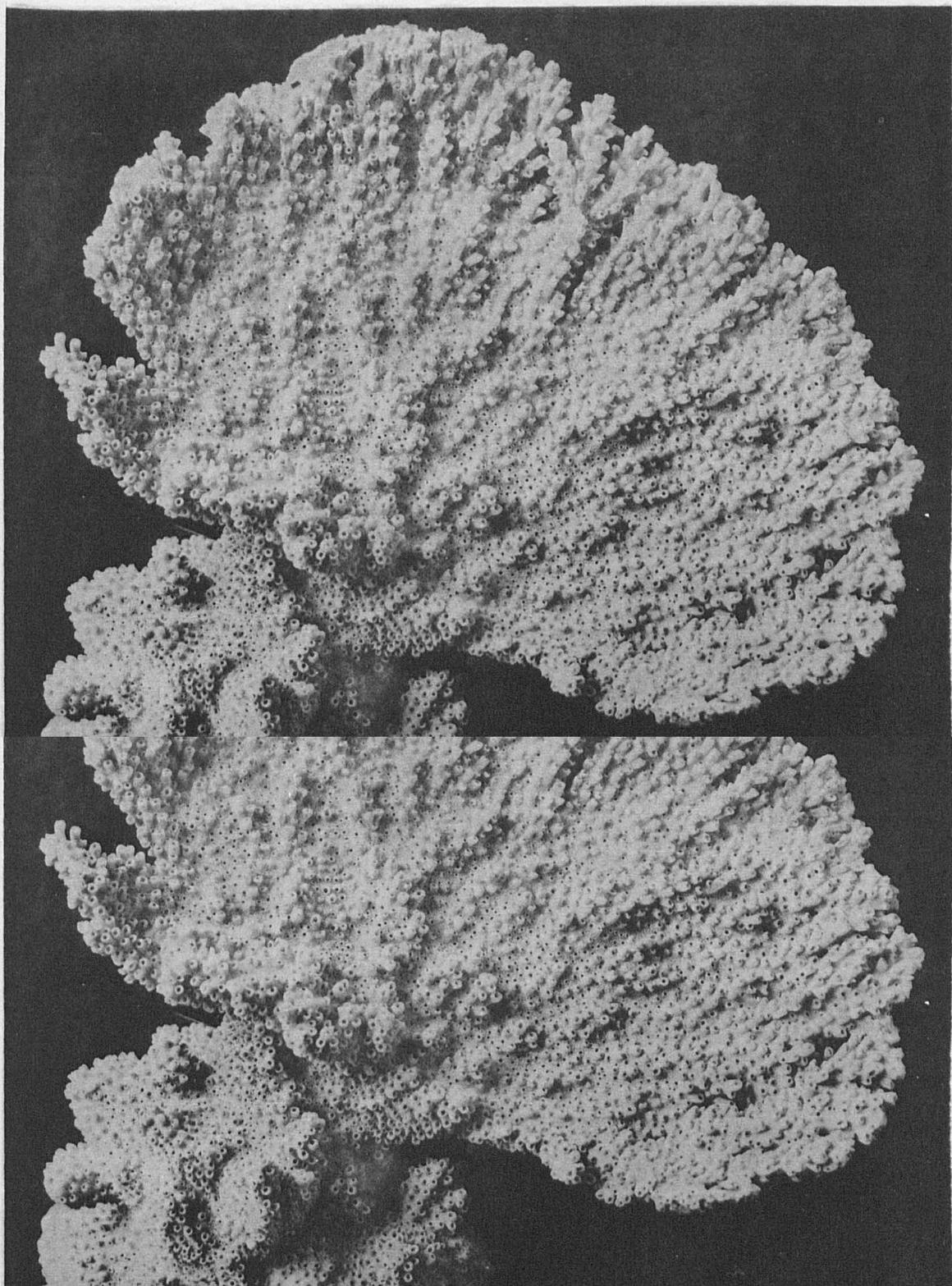


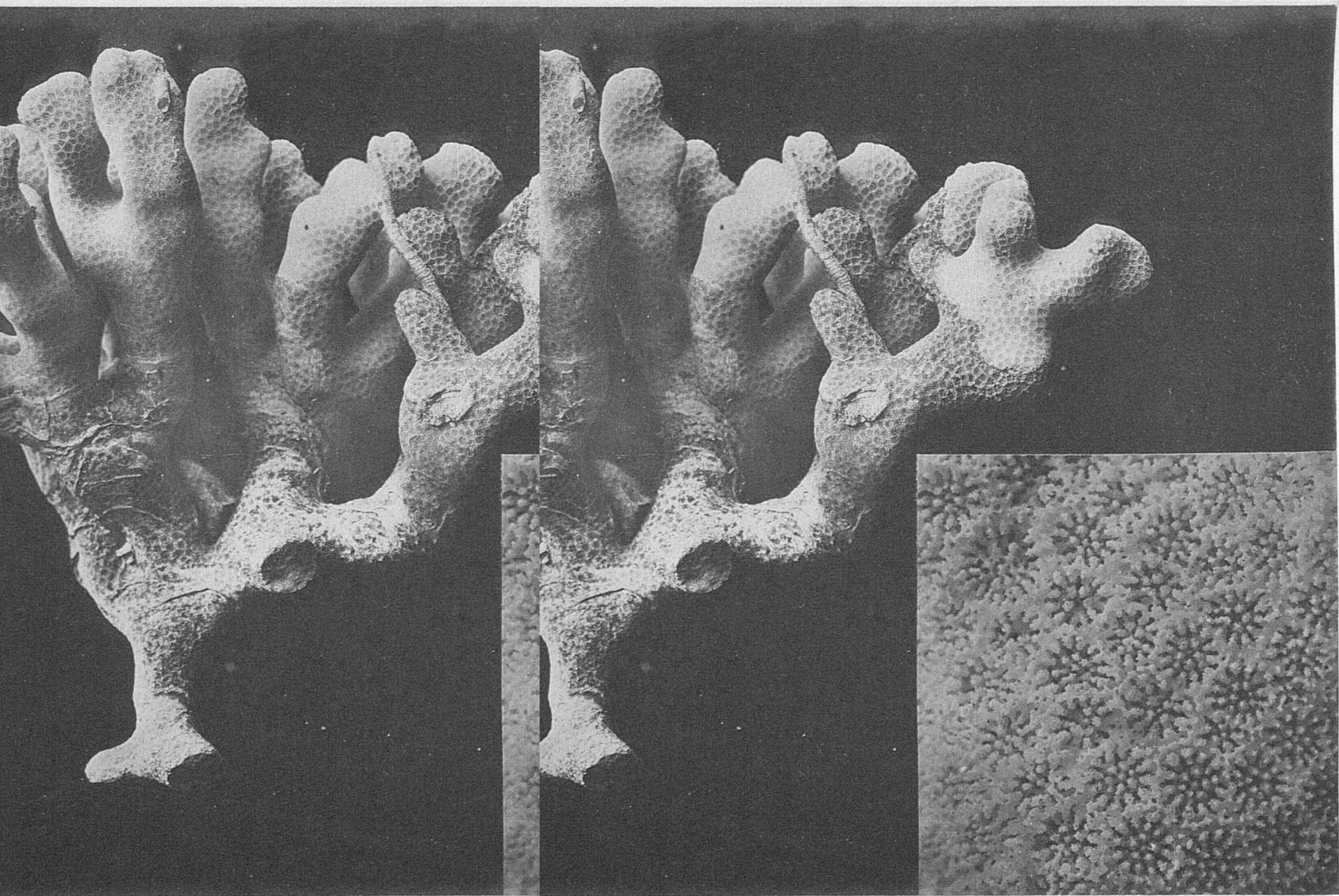




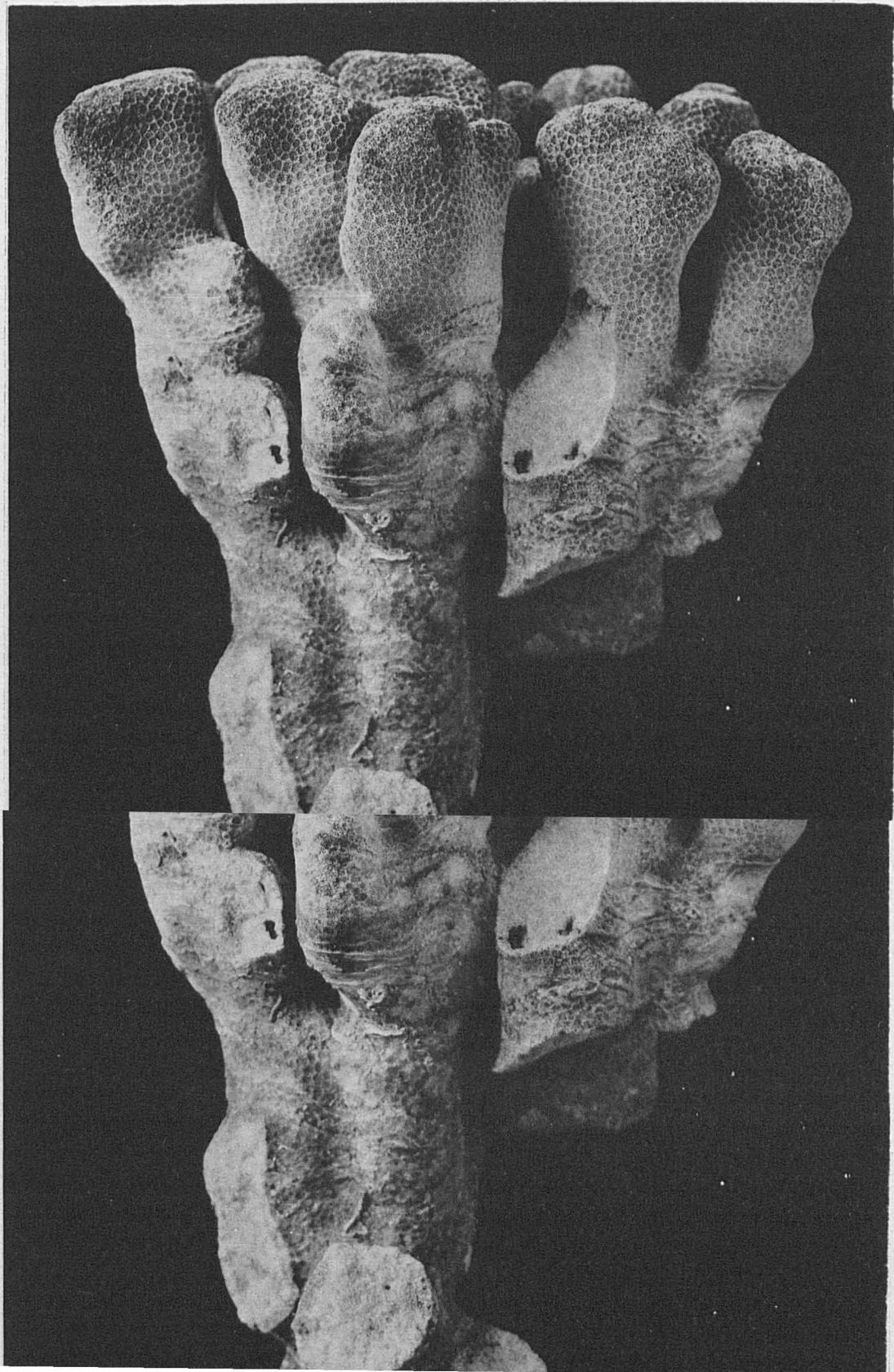


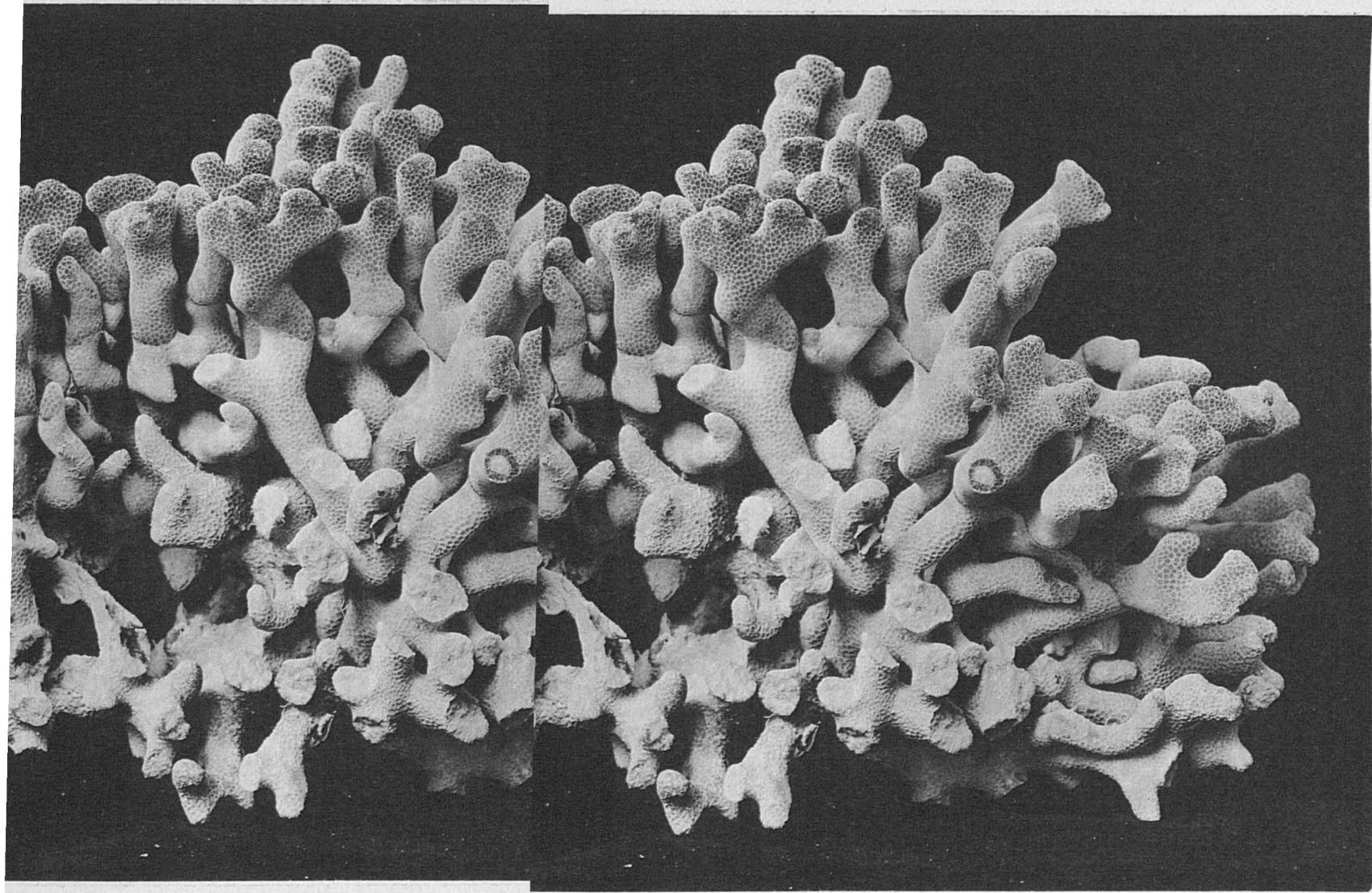
ISOPORA MURICATA FORMA PALMATA LAMARCK. GREATEST BREJRICATA FORMA PALMATA LAMARCK. GREATEST BREADTH, 23.2 CM.





CORALLITES (PALLAS). SPECIMEN FROM CURAÇAO. HEIGHT 13.3 CM.; GF. SPECIMEN FROM CURAÇAO. HEIGHT 13.3 CM.; GREATEST BREADTH 16. CM.  
GENERAL VIEW OF CORALLUM AND VIEW OF PORTION WITH CALICES OF CORALLUM AND VIEW OF PORTION WITH CALICES ENLARGED.



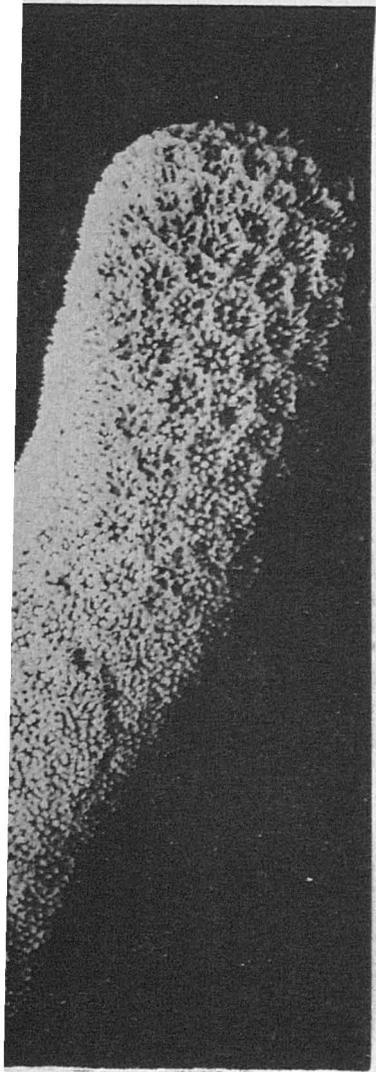


SCLERITES FORMA FURCATA LAM. EXTREME BREADTH OF SPECIMEN

SCLERITES FORMA FURCATA LAM. EXTREME BREADTH OF SPECIMEN, 26 CM.

HELIO TYPE PRINTING CO., BOSTON.

HELIO TYPE PRINTING CO., BOSTON.



ATA LAM. CALICES ENLARGED.

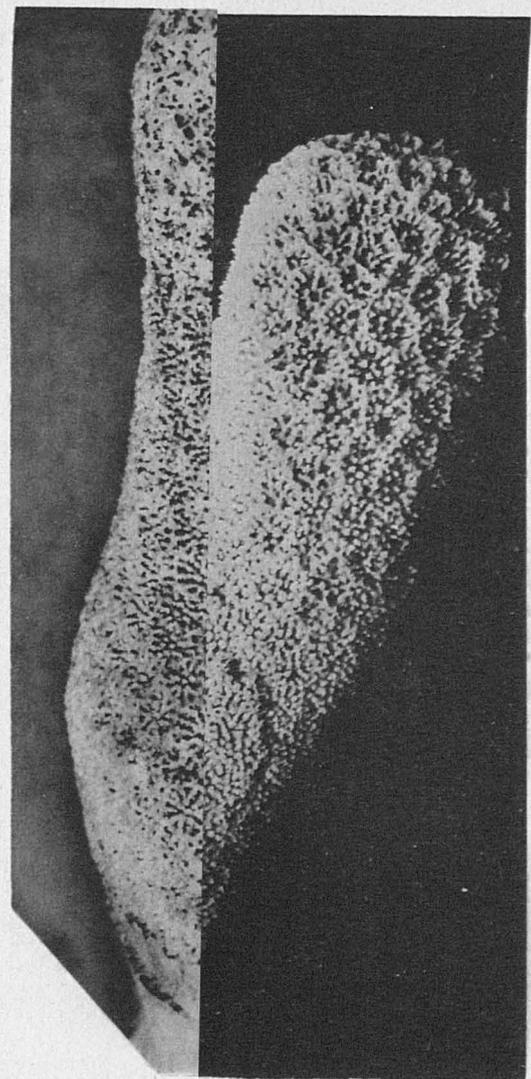


FIG. 2. PORITES PORLAM. CALICES ENLARGED.

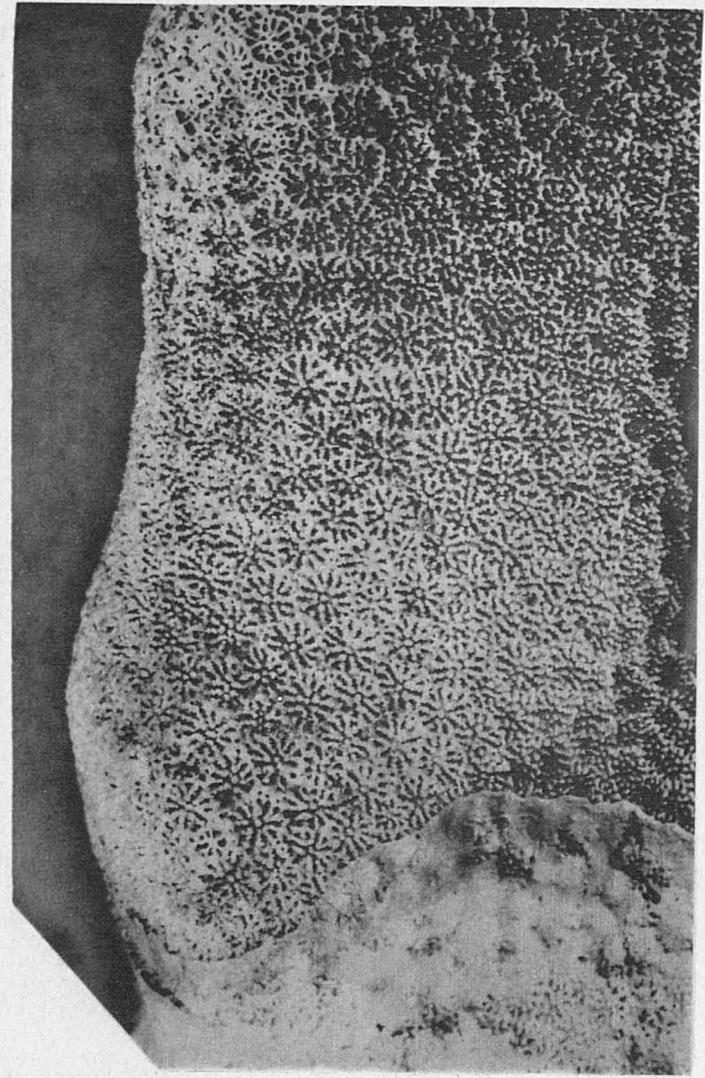
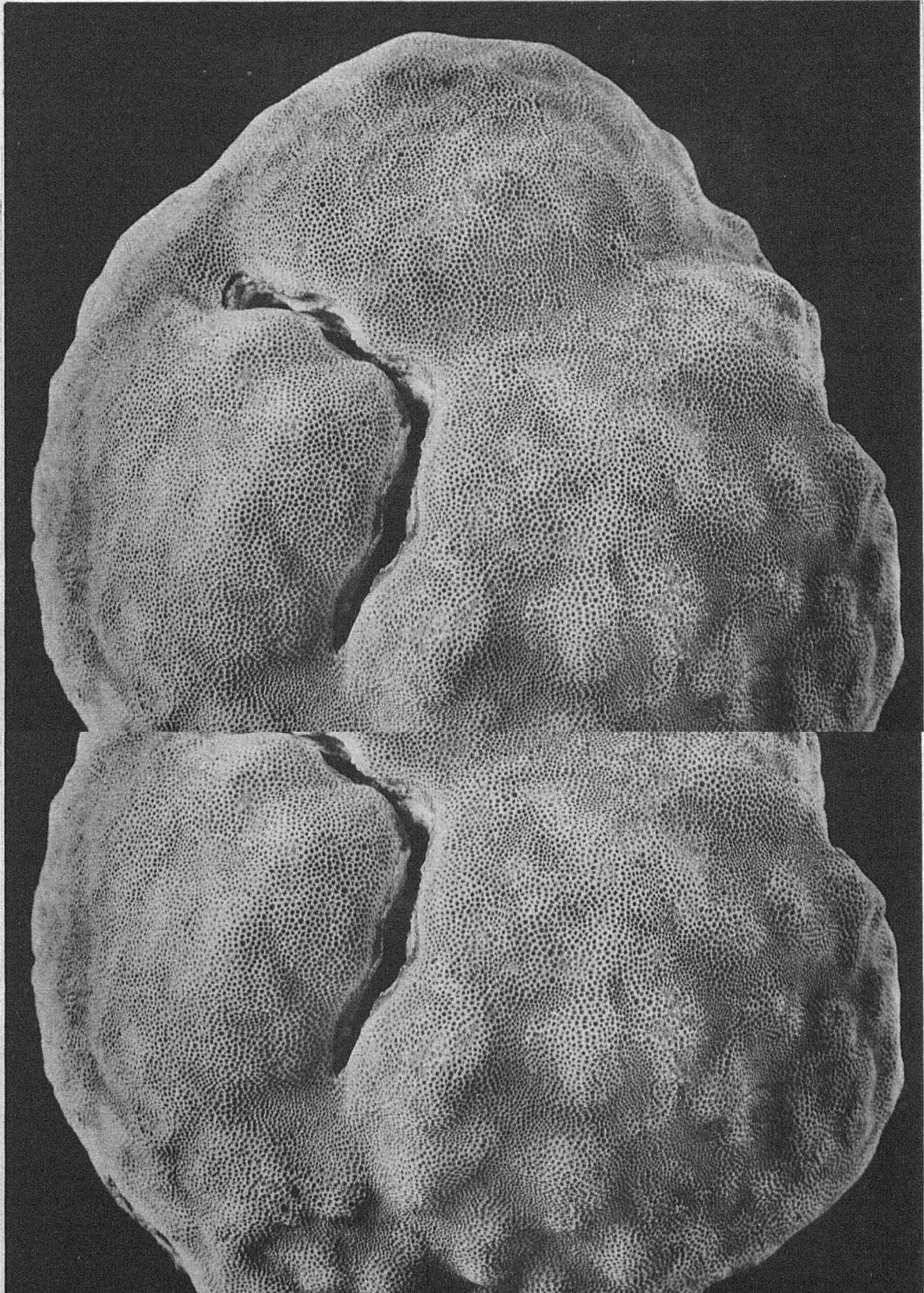


FIG. 2. PORITES PORITES FORMA CLAVARIA LAM. CALICES ENLARGED.





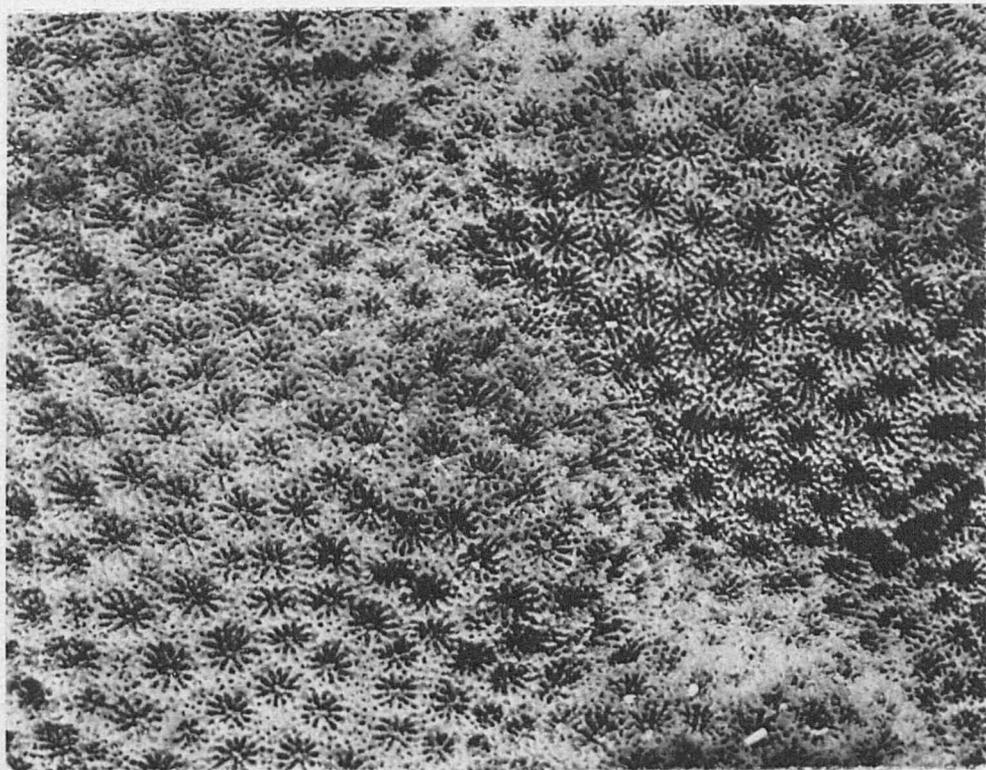


FIG. 1. PORITES ASTREOIDES LAM. FORMA  $\alpha$ . CALICES ENLARGED.

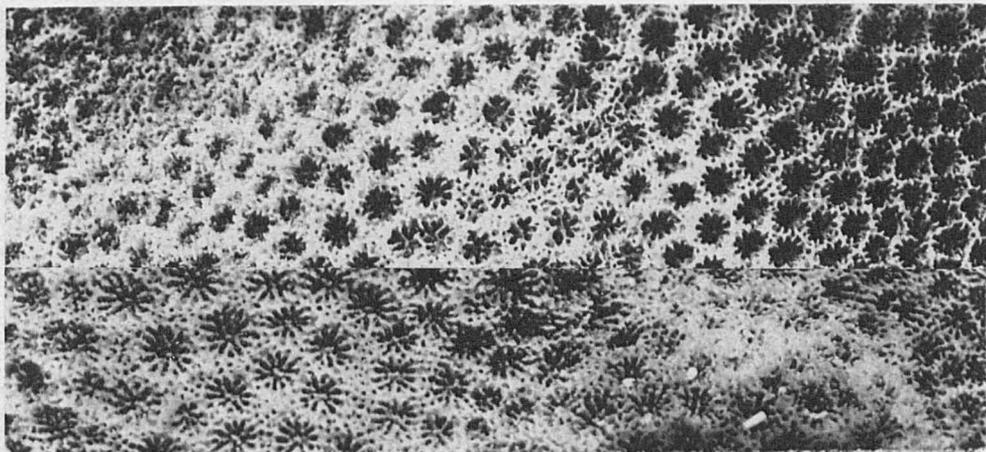
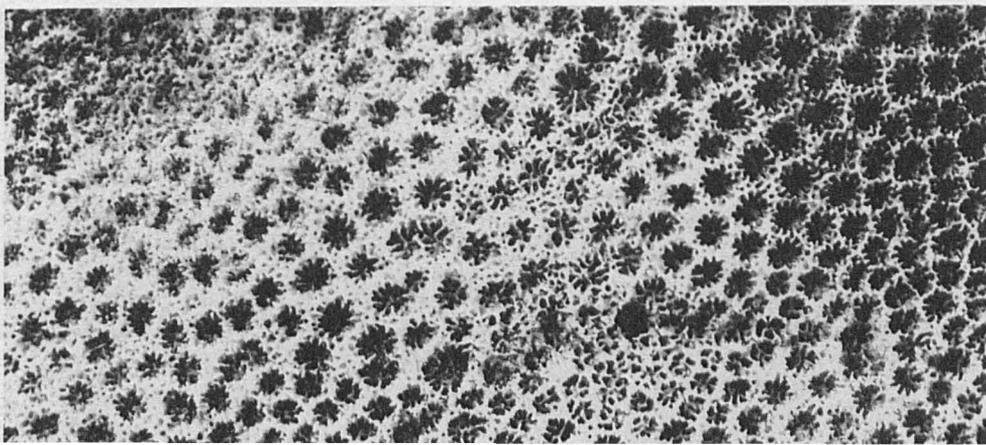
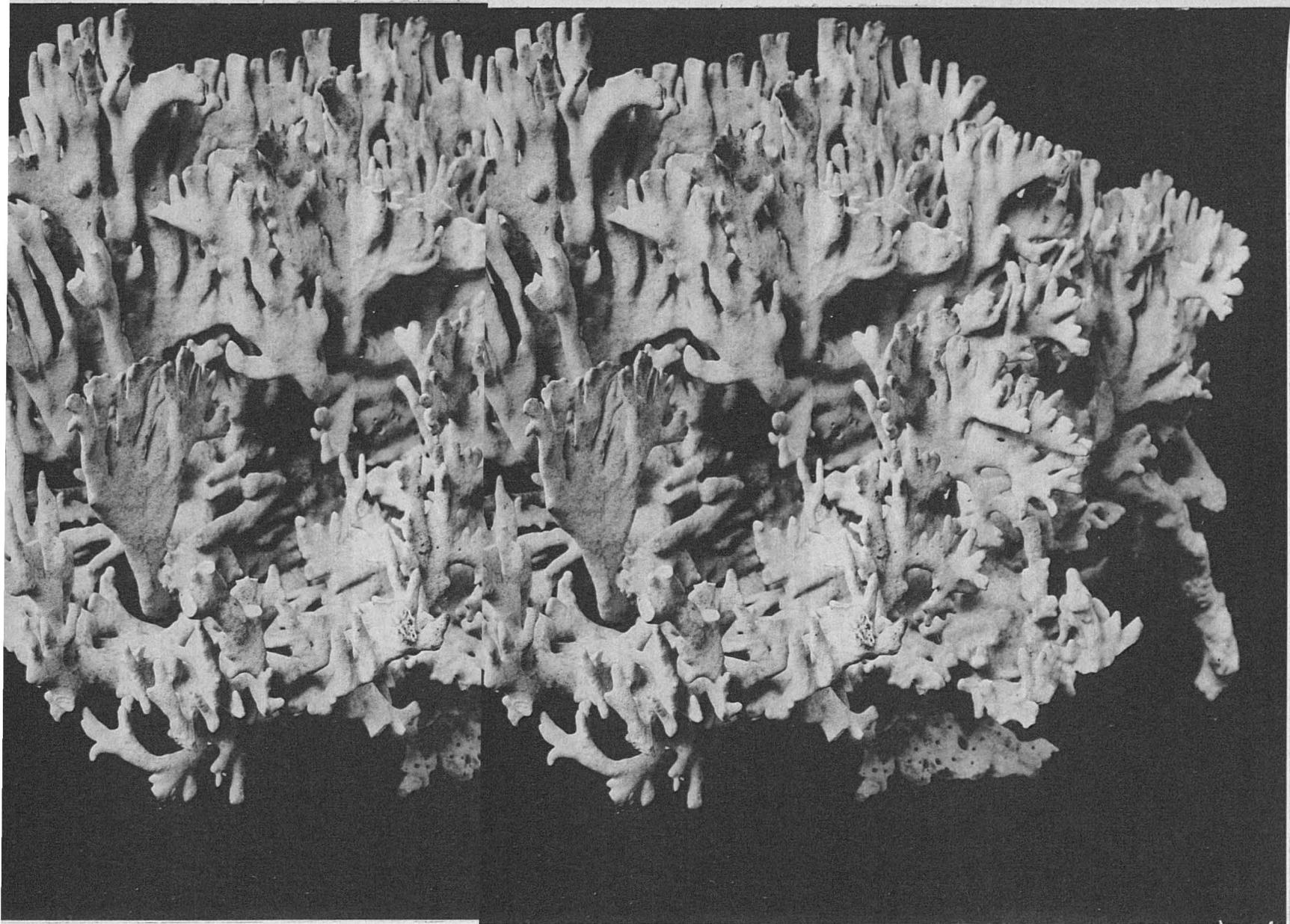


FIG. 1. PORITES ASTREOIDES LAM. FORMA  $\alpha$ . CALICES ENLARGED.





CICORNIS LINN. DIGITIFORM VARIETY. GREATEST BREADTH CORNIS LINN. DIGITIFORM VARIETY. GREATEST BREADTH, 35.5 CM.

