

DEEP - SEA CORALS.

Family **TURBINOLIDÆ** M.-Edw. & H.

Caryophyllidæ DANA (pars).
Caryophyllidæ VERRILL.

With some exceptions the family of Turbinolidæ, as defined by Milne-Edwards and Hainne, seems to form a good natural group. The name is unfortunately chosen from one of the most aberrant genera composing it; but it is not a sufficient reason for changing it, as long as the genus Turbinolia and a few allied ones remain in the family.

The subdivision of the family into subfamilies (Caryophyllinæ and Turbinolinæ) characterized by the presence or absence of pali is not natural, genera nearly allied being thus separated from each other, and associated with very dissimilar ones. It would be better to make several groups of equal value, gathered around the genera Caryophyllia, Turbinolia, Desmophyllum respectively, and perhaps a part of the Paramilidæ.

CARYOPHYLLIA STOKES.

Caryophyllia CH. STOKES. Zoöl. Journ., t. III. p. 481, 1828.
Cyathina EHRLG., DANA, M.-EDW., & H.
Caryophyllia M.-EDW. & H. Hist. Nat. des Corall.

Caryophyllia formosa POURT.

Caryophyllia formosa POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate I., fig. 16.

More or less turbinate, on a rather slender curved or straight stem. Costæ equal, distinct only near the calicle; the latter circular or subovate, moderately deep. Columella formed of four to six twisted,

rather loose laminae. Septa in six complete systems and four cycles, thin, prominent, sharp, and rounded on the edge, sparsely granulated. Twelve pali, equal, large, flexuous, with few and comparatively large granules.

The young are elongated, and show much diversity in their development as regards the columella and pali; when the columella is developed early, the pali are much delayed in their appearance, and *vice versa*.

The differences between this species and *C. cyathus* are not very striking; our specimens are, however, always smaller, slenderer, and have the columella much less developed.

None of my specimens attain the size of a full-grown Mediterranean specimen.

Off Havana in 270 fathoms.

Off Tortugas in 60 to 68 fathoms.

Caryophyllia Berteriana ? DUCHASS.

Caryophyllia Berteriana DUCHASSAING. Anim. rad. des Antilles, 1850.

A single specimen obtained in 68 fathoms off Tortugas, with the preceding species, differs from it and from *C. formosa* by its very prominent primary and secondary septa, thus resembling the figure of Milne-Edwards and Haime. The systems of septa are, however, all complete and very regular, so that there are twelve pali, as in all other Caryophylliæ. The descriptions of Duchassaing and Milne-Edwards and Haime appear to have been made from the same specimen, perhaps an exceptional one.

Caryophyllia clavus SCACCHI.

Caryophyllia clavus SCACCHI. Notiz. int. alle conch. ed. a zoof. foss., etc., 1835.

Cyathina turbinata PHILIPPI. Enum. Moll. Sic. 1836.

Caryophyllia pseudoturbinolia MICH. Icon. Zooph. 1841.

Cyathina cyathus LEUCKART. De Zooph. corall., 1841.

Cyathina pseudoturbinolia M.-EDW. & HAIME. Ann. Sci. Nat., 3d Ser., t. XX., 1848.

I have selected, from the numerous authors who have mentioned this coral, those who have given figures representing the type approaching nearest my specimen. Not having the materials at hand to enable me to pronounce an opinion on Dr. Duncan's sweeping reduction of all the European species to a single one, and not wishing

to burden the nomenclature with a new name, I refer to *C. clavus* a number of specimens obtained near Tortugas, and also a few found with *C. formosa* on the coast of Cuba.

The passage from one form to the other is not plainly marked, though a good deal of variety certainly exists. On the Florida side not a single specimen of the *C. formosa* was found.

Caryophyllia cornuformis POURT.

Caryophyllia cornuformis POURT. Bull. Mus. Comp. Zool., No. 7.

Plate I., figs. 14 and 15.

Corallum simple, conical, always regularly curved, distinctly but faintly costate. Calicle circular, rather shallow. Septa very little exsert, thin, and somewhat wavy, in six systems and four cycles. Pali in front of secondary septa only, sometimes twisted. Columella of one or two twisted processes. Height about 6 mm., diameter of calicle 3 mm.

Off Sand Key in 237, 248, and 298 fathoms.

Off Cojima, Cuba, in 450 fathoms.

All the specimens have the base broken and apparently decayed even when living, and were never seen attached. A specimen still living was agglutinated to the shell of a *Xenophorus*.

I was at first tempted to refer this species to the genus *Ceratocyathus* of Seguenza (an inconvenient name, by the way, very apt to be confounded with *Ceratotrochus*), but I have seen good reasons lately to remove altogether Seguenza's genus from the *Caryophyllidæ* and place it next to *Parasmilia* (which see).

STENOCYATHUS POURT.

Corallum simple, free, very elongated, and of nearly equal diameter throughout; a single crown of pali; a columella of one or more twisted processes; no epitheca.

The single species known of this genus was placed by me in the genus *Cænocyathus*, having supposed the few specimens then in hand to be detached from clusters formed by budding. A larger supply has proved that they are always free.

Stenocyathus vermiformis Pourt.

Cænocyathus vermiformis, Pourt. Bull. Mus. Comp. Zoöl., No. 7.

Plate I., figs. 1 and 2; Plate III., figs. 11, 12, and 13.

Corallum very elongated, cylindrical. Costæ indicated only by lines of very flat tubercles. Calicle circular, shallow. Septa rather thick, flexuose, not exsert, in six systems of three cycles. Pali thick, curled, in front of the secondary septa. Frequently one of the systems remains incomplete, and there are then but five pali. Columella of a single twisted process. The older parts of the corallum are nearly filled up by the thickening of the septa, but the process is never carried out to a total obliteration of the interseptal chambers, which can be traced in the shape of slender canals to the very base.

The costal tubercles are hollow, and communicate through narrow canals with the interseptal chambers. These little cavities are no doubt homologous to the hollow roots of *Rhizotrochus*, *Thecocyathus*, and other genera of the family, but here their use is not apparent. (See Plate III., fig. 13, representing part of a horizontal section passing through these cavities.)

A singularity is the frequent occurrence of specimens having a living and growing polyp at either end (Plate III., fig. 11). These specimens are generally somewhat curved, having apparently been lying in the mud with both ends turned up and projecting. A longitudinal section shows no interruption in the continuity of the interseptal chambers from one end to the other, so that the digestive cavity is probably common to both polyps.

Height, 2.5 to 4 cm.; diameter, 2 to 3 mm.

Off Boca Grande, in 125 fathoms.

Off Key West, in 135 fathoms.

Off Key West, in 138 fathoms.

Off Sombrero, in 152 fathoms.

Off Sand Key, in 154 fathoms.

Off Tennessee Reef, in 174 fathoms.

Off Bahia Honda, in 176 fathoms.

Off Sombrero, in 183 fathoms.

PARACYATHUS M.-EDW. & H.

Paracyathus confertus POURT.*Paracyathus confertus* POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate VI., figs. 11, 12, and 13.

Corallum turbinate, pedicellate; costæ distinct to the base, not prominent, granular. Calicle oblong, concave. Septa crowded, thin, entire, slightly exsert, in five cycles, but with considerable irregularity in some of the systems. Pali numerous, difficult to distinguish from the papillæ of the columella.

Like Caryophyllia, this genus presents so many points of variation that it is very difficult to define a species. I have retained the above name provisionally, not having been able to make direct comparisons with European specimens, with which I have little doubt it will ultimately be identified. Specimens of a Paracyathus from the Azores do not differ from mine.

Off Tortugas, in 36, 37, 60, and 68 fathoms.

Off Carysfort Reef, in 52, 60, and 63 fathoms.

Off Conch Reef, in 60 and 77 fathoms.

Off Alligator Reef, in 79 fathoms.

Off The Samboes, in 93 fathoms.

Off Sand Key, in 125 fathoms.

Off Double-Headed Shot Key, in 315 fathoms (dead).

Paracyathus? folliculus POURT.*Paracyathus? folliculus* POURT.*Stephanophyllia folliculus* POURT. Bull. Mus. Comp. Zoöl., No. 7.

Corallum free, without mark of adherence, broader at the base than at the calicle. Costæ broad, granulated, flat, nearly meeting at the centre of the base; the primaries continuous, the tertiaries united to the secondaries. Intercostal furrows narrow. Calicle circular or subhexagonal, slightly concave. Septa in six complete systems and three cycles, covered with large tubercles, not exsert (in the only specimen obtained the edge of the septa, and the summit of the pali and of the columella, appear to have been injured or abraded during the life of the animal). The primaries and secondaries meet in the centre with an indistinct columella, the tertiaries connect with

the secondaries about the middle of the radius. There are indistinct traces of pali.

I have satisfied myself that the former determination of this coral was wrong; it is probably a free *Paracyathus*, not very unlike *P. caryophyllus* M.-Edw. and H.

Height 3 mm., diameter of calicle 2 mm.

Off the Samboes, in 237 fathoms.

LEPTOCYATHUS M.-EDW. & H.

Leptocyathus Stimpsonii POURT.

Plate III., figs. 1, 2, and 3.

Corallum free, more or less hemispherical, without mark of adherence. Costæ equal, continuous with the septa, without definite boundary, finely serrate and spinous, deeply separated by very narrow furrows, so that the wall proper is invisible. The primary costæ reach nearly to the centre, those of the fourth order embrace and unite with those of the third, and the resultant costæ of two half-systems unite below the secondaries. This arrangement is seldom regular except in the young, as the base of most of the old ones has the appearance of having been broken and mended, thus introducing much confusion in the arrangement. Calicle circular; fossa small and not deep. Septa subequal, finely denticulate, the teeth becoming larger towards the interior, crowded, in six systems and four cycles; the arrangement of the different orders as in the costæ. Pali in front of the secondary septa very distinct, those of the other orders scarcely distinguishable from the columellar processes, of which there are from six to twelve, crowded and irregularly prismatic.

The young are almost spherical, the calicle being quite small; they resemble a *Melocactus* deprived of its spines.

The polyp is of a delicate pink or sometimes greenish color, with simple conical tentacles.

Diameter 6 to 7 mm.; height about 3 mm.

Abundant in 60 fathoms off Conch Reef; one specimen in 160 fathoms off Tennessee Reef.

This coral is referred to the genus *Leptocyathus* with some doubt, as its denticulate septa would really remove it altogether from the family of *Turbinolidæ*.

THECOCYATHUS M-EDW. & H.

This genus, established by Milne-Edwards and Haime, contained heretofore only three species, fossils of the Upper Lias; there is but one other genus of Turbinolidæ as old as this one, the family having received its greatest development in the tertiary and present epochs. No representative of the genus Thecocyathus is known from any of the formations intermediate between the Lias and our epoch. Recent forms being found now present, therefore, a rare instance of the reappearance of a genus apparently extinct through a considerable succession of ages.

The two species described below agree in their shape, which is that of a short cylinder. To maintain this shape, notwithstanding the increase of the diameter of the calice, a peculiar arrangement is necessary. From every one of the interseptal chambers starts a hollow root, homologous to those of Rhizotrochus, but never detached, nor visible externally. These roots form a concentric circle round the original base of attachment. As the coral grows new roots are formed higher up, and a new circle concentric with the preceding is formed. In full-grown specimens five or six of these circles are produced. (See Plate V., figs. 3 and 4.) All the interseptal chambers emit these canals (which are filled up by extensions of the polyp body), thus differing from Rhizotrochus, in which only twelve chambers are thus provided; in our *R. fragilis* only once during the whole growth, in *R. typus* apparently twice.

A similar but less pronounced arrangement exists in Paracyathus, and probably in other corals.

In the Bulletin of the Museum of Comparative Zoölogy, No. 7, I had confounded two species under the name of *T. cylindræus*. I have since recognized the differences, after examining a pretty large number of specimens.

Thecocyathus cylindræus POURT.

Thecocyathus cylindræus POURT. Bull. Mus. Comp. Zool., No. 7.

Plate II., figs. 14 and 15.

Corallum attached by a broad base, short, cylindrical. Costæ generally visible through the epitheca, which reaches to, and sometimes over, the border of the circular calice. Fossa shallow. Septa *very*

finely dentate, slightly sinuous, granulated, not exsert, forming six systems of four cycles; one of the systems sometimes incomplete. Pali thick, with sinuous surfaces, fronting all the septa but those of the fourth cycle; those of the second largest. Columella thick, formed of a dense mass of papillose processes, arranged in rather indistinct rows coinciding with the pali.

Height 13 to 19 mm.; diameter 9 mm.

In 100 to 200 fathoms off the Florida Reef; less common than the following species. Full-grown specimens rather rare.

Thecocyathus lævigatus POUT.

Plate V., figs. 3 and 4.

General form, costæ, and epitheca not different from preceding species. Septa in four cycles and six incomplete systems, the fourth cycle remaining undeveloped in one of the systems and two half-systems. Septa smooth and as if enamelled, with very fine granules and *entire border*. Pali only before the septa of the third order, and seldom complete. Columella papillose, formed of four to ten pointed and smooth processes.

Height 9 to 13 mm., diameter 6 mm.

Rather abundant in 100 to 200 fathoms off the Florida Reef; also found living in 315 fathoms off Double-Headed Shot Keys.

TROCHOCYATHUS M-EDW. & H.

Trochocyathus ? coronatus POUT.

Platytrochus coronatus Pout. Bull. Mus. Comp. Zool., No. 6.

Plate VI., fig. 16.

Corallum free, cylindrical; horizontal base with a knob in the middle. Primary and secondary costæ having each a large tubercle at the junction of the vertical wall with the base. Calicle circular. Septa in six complete systems and four cycles, meeting in the centre. Tertiary septa frequently but not regularly coalescing with

the primary or secondary ones. Columella probably papillose (nearly destroyed in the specimen).

Diameter 16 mm.; height, including central knob, 10 mm.

One dead and badly preserved specimen was brought up by the lead some years ago, by one of the United States Coast Survey parties, from 460 fathoms, in lat. $30^{\circ} 41' N.$ and long. $77^{\circ} 3' W.$

This specimen was described as a *Platytrachus* by a mere inadvertence on my part. I place it now among the *Trochocyathi* with a doubt, since the specimen has lost its columella and pali, if it had any. Its general appearance would place it near *T. armatus* M.-Edw. & H., differing from it in having only knobs instead of spines, and equally on the primary and secondary septa.

DELTOCYATHUS M.-EDW. & H.

***Deltocyathus Agassizii* POURT.**

Deltocyathus Agassizii POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate II., figs. 1 to 5; and Plate V., figs. 9 and 10.

Corallum discoidal, free at all ages. Wall nearly horizontal, or flat conical, sometimes with a nipple-shaped projection in the centre. Costæ well marked, covered with spiny or smooth granules, generally subequal, but sometimes the primary costæ much larger and prolonged beyond the edge, forming a star. Septa in six complete systems and four cycles, covered with small spinous tubercles. Pali of the first, second, and third cycles projecting generally higher than the septa to which they are soldered at the base. The pali of the first cycle short, those of the third joined to those of the second, but the point of junction not being exsert, the V, or delta, is not as apparent as in the fossil species. Columella papillose and small, rising from the primary and secondary pali which meet in the centre. (The columella is represented a little too large in fig. 1, and particularly fig. 2, of Plate II.)

This coral has been pronounced by Dr. Duncan identical with the fossil species *D. italicus*. They are certainly very closely allied; but as far as I have been able to compare them, they are readily distinguished by the costæ, which in *D. italicus* are formed of large grains, and have thus a moniliform appearance, whilst all the Cuban and Floridan specimens, although in other respects very variable, have

the costæ covered with very fine sharp granulations. The columella of the recent species is also much less developed than in the fossil, and the pali more slender and delicate.

Among the varieties, those with large and prolonged primary costæ (Plate II., figs. 4 and 5) appeared to present therewith good specific characters, until a large specimen was found which had enlarged and projecting primary costæ until about half grown, and then suddenly changed to the form with equal costæ. One mutilated specimen has the primary costæ prolonged into horn-like appendages as long as one fourth the diameter of the calicle, and surmounted with a smaller prong, directed upwards. (Plate V., figs. 9 and 10.)

The polyp of a large living specimen dredged in 115 fathoms, off the Tortugas, was whitish, with brown stripes between the pali and on the secondary septa. The tentacles were club-shaped, short, placed in the depressions between the septa and the pali.

On the Florida side of the channel most of the specimens were immature. Until half grown the wall forms a regular cone of very large aperture (about 110°); at a later period it becomes flatter and saucer-shaped.

One single specimen was obtained living, and was also the largest; 13.5 millimeters in diameter.

Off Conch Reef, in 60 fathoms.

Off Alligator Reef, in 113 fathoms.

Off Tortugas, in 115 fathoms.

Off Chorrera (Cuba), in 270 fathoms.

Off Rebecca Channel, in 290 fathoms.

Off Marquesas, in 296 fathoms.

Off Boca Grande, in 327 fathoms.

DESMOPHYLLUM EHRBG.

Desmophyllum Cailleti DUCH. & MICH.

Desmophyllum Cailleti DUCH. & MICH. Suppl. Mém. Coral., 1864.

Six fine living specimens of this coral were obtained in 315 fathoms, off the Double-Headed Shot Keys. They agree with the definition of the above species, but are more elongated and more contracted at the base than the figure of those authors. Wall and septa are very thin and fragile, and the whole coral resembles *Rhizotrochus fragilis* very much. The largest specimen is 23 millimeters in height, and 13 in diameter at the calicle.

Desmophyllum solidum POURT.

Plate V., figs. 5 and 6.

Corallum conical, pedunculate, heavy. Septa very thick, finely granulated, in six complete systems and three cycles. The primaries and secondaries are nearly equal, somewhat exsert, the tertiaries are lower, but twice as thick; all the septa are so nearly in contact that the interseptal chambers are almost obliterated, except near the middle of the calicle. Costæ also very thick, continuous with the septa, not continued far from the border of the calicle.

Height 11 millimeters, diameter eight. One specimen (in a semi-fossil condition) found with the preceding species in 315 fathoms, off Double-Headed Shot Key. There are several species of this type with thick septa in the tertiary beds of Sicily, which have been described by Seguenza; none, however, appears to be identical with this.

RHIZOTROCHUS M-EDW. & H.

Rhizotrochus fragilis POURT.*Rhizotrochus fragilis* POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate IV., figs. 1 to 4.

Corallum simple, pedunculate, straight or slightly curved, regularly conical. Calicle subelliptical, deep. Six complete systems of septa, four cycles. Septa very thin, not exsert, finely granulated; those of the first and second order meeting in the centre, and united for about half their height. Costæ not prominent, no epitheca. Hollow roots attached to the costæ of the second order in pairs, at about one third or one half the height of the corallum, and continued down to the peduncle, where they slightly expand; they are never detached from the wall. The whole corallum very thin and fragile.

The young at first form a six-sided rounded cell, wider at the base of attachment than at the top. The six primary septa reach only half-way to the centre. At the next stage they unite in the centre, frequently leaving a small open space in their middle. Simultaneously or after the appearance of the secondary septa, a

circular wall arises from the floor and separates the interseptal chambers in two, the outer portion becoming the rootlike appendage. The cavity of the roots opens freely into the interseptal chambers (Plate XIV., fig. 3), and is occupied by a fibrous extension of the polyp. In old specimens the cavity becomes much reduced by the thickening of the walls.

The color of the polyp is greenish, or pale brick-red.

This coral was obtained in about forty different casts along the Florida reef, the least depth in which it was found being 49 fathoms, the greatest 324. The greatest abundance was between 100 and 200 fathoms.

Height 2 to 2.8 cm., diameter of calicle 1.5 to 2 cm.

TROCHOSMILIDÆ.

Trochosmilicæ M.-EDW. & H.

For reasons elsewhere stated, I prefer to elevate this group to the rank of a family, instead of leaving it among the *Astræidæ* as a mere section of the subfamily of *Eusmilinæ*, the place assigned to it by Milne-Edwards and Haime. Its affinities are partly with the *Astræidæ* and partly with the *Turbinolidæ*. We are not sufficiently acquainted with the value of the characters connecting it with either to say positively which of them ought to have the preponderance. As a family, it appears homogeneous, but the order or suborder to which it ought to be attached can be left undetermined for the present.

The principal character by which to separate the *Trochosmilidæ* from the *Turbinolidæ* is the presence in the former of dissepiments closing the interseptal chambers. In a large number of them they are of a very rudimentary character, and no more developed than they are occasionally in true *Caryophylliæ*, where I have observed similar structures secreted abnormally to exclude parasites.

The mode of propagation observed in three of the species here described, namely, a gemmation from the interior of the calicle, recalls the peculiar intracalicular gemmation of the *Rugosa*, and does not prevail among any of the families of corals of the present epoch.

CERATOCYATHUS SEGUENZA.

Having received, through the kindness of Mr. J. G. Jeffreys, some specimens of *Ceratocyathus ornatus* Seguenza, from the dredgings of the Porcupine Expedition off the West Coast of Ireland, I have satisfied myself that the genus does not belong to the family of Caryophyllidæ at all, but to Trochosmilidæ. If the European species from the deep-sea dredgings and the Sicilian tertiary beds does not show very distinct dissepiments (at least in the specimen of which Mr. Bicknell made a section for me), it is because the interspaces have been filled up, as a careful inspection shows plainly. The pali, which give to these corals so striking a resemblance to the typical Caryophylliæ, are found, when traced to their origin, to be formed by lobes of the septa, and not by independent growths rising from the bottom of the calicle.

Ceratocyathus prolifer POURT.

Plate III., figs. 8, 9, 10.

Corallum free when adult, conical, curved, showing no trace of attachment. Costæ finely granulated. No trace of epitheca. The wall rather thick and of compact texture. Calicle circular or slightly elongated in the direction of the curvature; fossa moderately deep. Septa finely granulated in six systems and five cycles, but the fifth cycle generally incomplete in some of the systems. The septa of the third order, and sometimes those of the fourth, have a paliform lobe, which in older specimens becomes merged in the columella. (This is the case in fig. 9.) Dissepiments rather massive, about eight or nine occurring in a chamber (Plate III., fig. 10). The base of the coral has a tendency to become filled up. Columella spongy with papillose convex surface; in the young it is little developed, and sometimes lamellar, so that an isolated specimen would be liable to be classed as a Placosmilia.

The propagation is by buds inside of the calicle of the parent, not unfrequently two or three growing out at the same time, but in such cases one of them outgrows and stunts the others. The parent is probably killed by the growth of the offspring, which fills the whole calicle before becoming free, but the wall being very strong

it is never broken as in *Parasmilia Lymani*. Out of twenty-four specimens obtained, nine show this mode of multiplying.

Height 15 to 20 mm., diameter 12 mm.

Found only in one locality, off French Reef; in 45 fathoms.

Parasmilia nutans Duch. & Mich. is perhaps nearly related to this species, but the description and figure are too vague for identification.

PARASMILIA M-EDW. & H.

Parasmilia Lymani POURT.

Plate VI., figs. 8, 9, 10.

Corallum more or less elongated, conical, nearly always attached to a fragment of the parent, otherwise free. Wall very thin. Costæ small, finely granulated, subequal or alternately larger and smaller, equally developed from base to top. Calicle circular or slightly elongated or irregular. Fossa moderately deep. Five cycles of septa, and six very irregular systems, having often the appearance of a greater number; the septa entire, moderately exsert, with few rather large and flat granules joined sometimes in oblique ridges. The internal edge of the septa is deeply divided into lobes forming false pali and sometimes a false columella (Plate VI., fig. 10). The paliform lobes are formed by the penultimate septa; whilst the twisted ones, simulating a columella, rise from the other cycles, except the last. Dissepiments rudimentary, membraniform, nearly horizontal, only two or three in number in an interseptal chamber. They are too faintly represented in fig. 10.

The propagation is by buds on the septa in the interior of the calicle, in the parent, the walls of which are burst by the growth of the young; the latter carrying a fragment attached to the base generally through life.

The largest specimen (incomplete at the base) is 4 cm. high, 18 mm. in the greatest and 13 in the smaller diameter.

Off Elbow Reef, in 70 fathoms.

Off Alligator Reef, in 79 fathoms (dead specimen).

Off the Samboes, in 96 fathoms.

Off Alligator Reef, in 110 fathoms.

Off Couch Reef, in 117 fathoms.

Off Alligator Reef, in 147 fathoms.

Parasmilia variegata POURT.

Plate I., fig. 13.

Corallum simple, free, conical, often deformed; the irregular shape resulting from the young being originally attached to fragments of the parent, which become gradually covered over and incorporated into the base. No epitheca, costæ distinct to the base, flat, finely granulated, those of the third order somewhat broader and more prominent than the others. Calicle oval, with moderately deep fossa. Septa in six complete systems of four cycles, considerably exsert and very unequal; those of the first and second order being closely connected at the wall with those of the fourth and fifth respectively, and rising high above those of the third order, which are the lowest of all. Septa entire on their upper edge, but deeply lacinated in the interior of the calicle, which thus becomes filled with a false columella of curled and twisted septal processes. The primary and secondary septa are colored of a dark purple, which color continues some distance down the corresponding costæ. Those of the fourth cycle are lighter colored, with a dark spot on the corresponding costæ, a short distance below the border. Those of the third order are white, with the same dark spot on the costa. Dissepiments not observed, none in the upper three fourths of the corallum.

The young bud out of the calicle of the parent, which is split in consequence.

Height 15 to 16 mm. ; diameters of calicle 10 and 13 mm.

Off Conch Reef, in 60 fathoms.

Off Carysfort Reef, in 63 fathoms.

Off Conch Reef, in 77 fathoms.

CŒLOSMILIA M.-EDW. & H.

Cœlosmilia fecunda POURT.

Plate I., fig. 12 ; Plate III., figs. 4 and 5 ; Plate VI., figs. 14 and 15.

Corallum elongated, conical, irregularly bent, showing sometimes a succession of slight swellings and contractions, attached by a slightly thickened base. Costæ finely granulated, rather obsolete near the base. Calicle circular or subelliptical, with deep fossa. Septa entire, granulated finely, not exsert, in six systems and four

cycles, the fourth developed in part of the systems only. The inner edge of the septa sends out trabicules uniting together to form the rudimentary columella, which is, however, frequently absent. Dissepiments thin but complete, moderately abundant. Gemmation external, at all heights, but generally near the calicle; abundant, one specimen having as many as eleven buds; some good-sized specimens, however, show none; as, for instance, the one figured on Plate III.

Height of largest specimen 4 cm., diameters of calicle 6 and 7 mm.

West of Tortugas, in 68 fathoms.

Off Havana, in 270 fathoms.

Off Double-Headed Shot Key, in 315 fathoms (dead specimen).

The generic affinities of this coral are a little doubtful. By its general aspect it reminds one of *Cladocora*, or rather *Goniocora*; but according to the classification generally adopted, it is widely separated from it on account of the entire border of the septa. In its general features it approaches the genus *Onchotrochus* Duncan; but this is described as destitute of endotheca, and therefore placed among the Turbinolians.

Family OCULINIDÆ Verrill.

Oculinaceæ M.-EDW. & H.

By constituting the section of *Stylasteraceæ* of Milne-Edwards and Haime into a separate family, the *Oculinidæ* become restricted to the *Oculinaceæ* of these authors, and form thus a much more homogeneous and natural group.

OCULINA M.-EDW. & H.

Oculina LAMK. (pars).

Oculina varicosa LESUEUR.

Oculina varicosa LESUEUR.

Oculina varicosa DANA.

Oculina Petiveri M.-EDW. & H.

Oculina disticha POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate VI., figs. 3 and 4.

I have become convinced that the specimens described by me as

Oculina disticha were fragments of the younger branches of *Oculina varicosa* Les. They were obtained

Off Conch Reef, in 40 fathoms.
Off American Shoal, in 43 fathoms.
Off French Reef, in 50 fathoms.

The description and figure of Lesueur are so imperfect, that they may apply to almost any species of the genus. Dana's description, however, really establishes the species, and is prior to Milne-Edwards and Haime's, who evidently referred to the same object. Why they should make Dana's species a synonyme of *O. diffusa* is not very clear.

***Oculina tenella* POURT.**

Plate V., figs. 11 and 12.

Corallum branching irregularly, slender. Cænenchyma finely granulated. Costæ distinct only on the border of the calicles, which are circular, irregularly alternate, very prominent, about one diameter apart, and as wide or slightly wider than the branches. Fossa moderately deep. Septa finely serrated, slightly exsert in six systems and three cycles. Pali before the primary and secondary septa. Columella papillose, more deeply sunk than the pali.

Smaller branches about 2 mm. in diameter. Calicles 2 to 2.5 mm.

Off Tortugas, in 36 fathoms.

***Oculina diffusa* LAMK.**

Was obtained living as deep as 15 fathoms.

DIPLOHELIA M-EDW. & H.

Attention has lately been drawn by Dr. Duncan to the difficulty of distinguishing from each other the genera *Diplohelina*, *Amphihelia*, and *Lophohelia* of Milne-Edwards and Haime. Like others of the genera established by these authors and based on very few species, they become very perplexing as our collections increase and the distinctive characters are found not to be so precise as they were at first enounced. My opportunities for the study of this group have

not been very extensive, still they are probably sufficient to illustrate and partly confirm Dr. Duncan's views.

The following are the species examined, keeping the usual generic names : —

1. *Lophohelia prolifera* M-Edw. & H., Florida and North European seas.
2. *Lophohelia exigua* Pourt., Florida.
3. *Amphihelia oculata* M-Edw. & H., North European seas.
4. *Amphihelia carolina* Pourt., Cuba.
5. *Amphihelia infundibulifera* Lamk. sp., East Indies?
6. *Amphihelia miocenica?* Seg. (*A. ramea* Sars), Norway.
7. *Diplohelia varistella* M-Ed. & H., fossil, France.
8. *Diplohelia profunda* Pourt., Florida.

The first and second have no columella, entire septa, thin cænenchyma (but quite distinct); the third has also entire septa, a small columella, thick cænenchyma; the fourth, entire septa, no columella, thick cænenchyma; the fifth, serrate septa, no columella, thin cænenchyma; the sixth, serrate septa (?), a columella, thin cænenchyma; the seventh and eighth, serrate septa, small columella, moderate cænenchyma.

It is evident from this arrangement, that, giving to the above characters the weight usually attached to them, these seven species would be assigned to at least five distinct genera. The distinction on account of presence or absence of cænenchyma falls to the ground, since it is only a question of more or less. The same might be said of the presence or absence of columella, since it is almost absent in some of the corallites of *Amphihelia oculata* for instance, and, on the other hand, rudiments can be found in some corallites of *Lophohelia prolifera*. There remains, then, only the serrate or entire edge of the septa, which in some families of corals constitutes a character for their division into subfamilies. It is in many cases a very unsatisfactory character, particularly to the paleontologist, and has given rise to serious mistakes, an example of which will be shown in another part of this paper (Astrocænia).

For the present, and considering the small number of species under comparison, it seems proper enough to combine the genera *Lophohelia* and *Amphihelia* into one, as there is really no permanent character to separate them. The genus *Diplohelia* might, however, be kept for those species in which the corallites never appear individualized, even when young, but form, as it were, part of the branch with the same diameter throughout. The character is not a very good one, perhaps, still there is something distinctive in it which strikes at first sight. If living specimens of *Diplohelia profunda* can be procured (mine are all more or less worn), some other characters may be detected.

This arrangement seems to me more natural than to combine Amphihelia and Diplohelia into one genus, and leaving out Lophohelia, as Dr. Duncan has done.

Diplohelia profunda POURT.

Diplohelia profunda POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate VI., figs. 6 and 7.

Corallum branching, cylindrical, finely granulated or striated, particularly on younger branches and near the calicles, where the granulations assume the shape of rudimentary costæ. Calicles slightly projecting, very deep, irregularly alternate, and very distant from each other. Septa in three cycles and six complete systems, subequal, not exsert, finely serrate and tuberculated, nearly meeting at the bottom of the fossa. Columella formed of six or seven club-shaped styles, not very distinct from the septa. Height, 3 or 4 cm.; diameter of branches, 4 mm.; of calicles, 2.5 mm.

This species resembles *D. varistella*, but has fewer, deeper, and larger calicles. It seems to differ also from *D. Doderleiniana* Seguenza by the same characters; in fact, the difference between Seguenza's species and *D. varistella* is not very apparent.

Off Havana, in 350 fathoms.

Off Bahia Honda, Florida, in 324 fathoms.

In lat. 28° 24' N., long. 79° 13' W., in 1050 fathoms.

In all cases, dead and more or less worn specimens only were obtained.

LOPHOHELIA.

Lophohelia + *Amphihelia* M.-EDW. & H.

Lophohelia prolifera M.-EDW. & H.

Lophohelia affinis POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate I., figs. 3, 4, 5.

My species is identical with *L. prolifera*, as numerous comparisons with specimens from European seas have shown.

Off Collin's Patch, Florida, in 195 fathoms.

Off Double-Headed Shot Keys, in 315 fathoms (dead fragments).

Lophohelia exigua POUT..

Plate I., figs. 6 and 7.

Corallum branching; the corallites alternate, forming angles of 70° – 75° with their predecessors, proportionally shorter and more open than in *L. prolifera*. Wall smooth or very finely granulated. Costæ sharp and prominent, but not extending far downward. Calicle circular, well opened, very deep. Septa thin, slightly exsert, in six systems and four cycles, the last almost rudimentary.

Height, 3 to 4 cm.; height of single corallites, 4 to 5 mm.; diameter of calicle, 4 to 6 mm.

Off Tortugas, in 36 and 79 fathoms.

Off Pacific Reef, in 287 fathoms (dead fragments).

The fragment from the last locality is doubtful, being much worn.

Lophohelia Carolina POUT..

Corallum branching, with smooth and very faintly striated canenuchyma, dense and heavy. Calicles regularly alternate, costæ distinct on the border of the calicles only. Calicles prominent, not very deep; septa with entire border, not exsert. Six complete systems, three unequal cycles, the first nearly meeting in the centre; no columella. The branch from which this description is taken is 18 cm. long, 8 mm. in diameter in the thickest part, calicles 4 mm.

This species is named according to the desire of Mr. R. Arango of Havana, who sent it to the Museum. The depth from which it was obtained is not stated, but it came probably from a fisherman's line or net, as many other interesting specimens in that gentleman's collection.

Family STYLOPHORIDÆ POUT.

Stylophorina M-EDW. & H., 1857.

Pseudoculina M-EDW. & H. Ann. Sc. Nat., 3d Ser., Vol. XIII., 1850.

This group was placed by Milne-Edwards and Haime at the end of the Oculinidæ, as a subfamily intermediate between the Oculinidæ and the Astræidæ, more nearly allied to the former than to

the latter. This relationship is based chiefly on the density of the cænenchyma, but this is a very variable character, and some genera left by the same authors among the Astræidæ proper, such as *Cyphastræa* for instance, have it just as compact as *Stylophora*, though less abundant. The reliance on this character alone has induced Milne-Edwards and Haime to establish the two genera *Axohelia* and *Madracis*, and to place the one among the Oculinidæ proper and the other among the Stylophorinæ, whilst in reality the two genera cannot be separated by any other characters.

The group, on the whole, does not appear to be allied closely enough either to the Oculinidæ or the Astræidæ to warrant their combination with the one or the other as a subfamily. It is better for the present to leave it as a small intermediate family.

MADRACIS POURT.

Madracis M-EDW. & H.

Axohelia M-EDW. & H.

A comparison of several representatives of the genus *Madracis* with an *Axohelia* from the West Indies, very closely allied to, if not identical with, *Axohelia myriaster*, M.-Edw. & H., has convinced me that the two genera cannot be separated, and much less placed in different subfamilies. The only difference is in the cænenchyma, more abundant and compact in the one than in the other; but this is a difference only in degree, for in both forms the cænenchyma becomes solid, but the interseptal chambers do not fill up completely as in the true Oculinidæ. The younger parts of *Madracis decactis* show the space between the calicles proper and the mural ridge occupied by large vesicular spaces, which afterwards become gradually filled up.

I propose to retain the name *Madracis* for the two genera combined.

Madracis asperula M-EDW. & H.

Plate VII., fig. 4.

The specimens which we refer to this species are in general a little slenderer than the one figured in the *Annales des Sciences*

Naturelles, but there are no sufficient grounds for separating them specifically.

The color is variable, sometimes light brown with black or dark brown calicles, or purplish pink of different shades, with or without darker calicles.

West of Tortugas, in 36 fathoms.

Saint Nicholas Channel, off Bahía de Cadiz, in 120 fathoms.

Madracis decactis Verrill (*Astrava decactis* Lyman, Proc. Bost. Soc. Nat. Hist., Vol. VI., 1857), Plate VII., figs. 1, 2, and 3, is found to a depth of 17 fathoms. It is generally thin and incrusting, but also rising in club-like masses. A specimen received from Mr. R. Arango, in Havana, forms thick branches bluntly expanded at the end, 6 cm. high, and 4 cm. in diameter.* *Stylophora incrustans* Duch. & Mich. I strongly suspect to be a young *Madracis decactis*, † and *Reussia lamellosa* Duch. & Mich., the full-grown form. ‡

Stylophora mirabilis Duch. & Mich. is a *Madracis* also, with massive cænenchyma.

The Museum of Comparative Zoölogy has also received from Mr. Arango, in Havana, specimens of a coral, which agrees with the description of *Arohelia myriaster*, M.-Edw. & H. It differs from *Madracis mirabilis* chiefly by its striated cænenchyma and larger calicles, which, instead of being prominent, are rather sunk below the surface.

* The polyp is purplish brown, tentacles tipped with white; disk emerald green, mouth yellow. The mural lines separating the polyps are tipped with white. The tentacles are in one circle, five of them large, prominent, and almost spherical when fully expanded, the white tip swelling up in that shape. The other tentacles are in groups of three between the larger ones, the total number being thus twenty, or double the number of the septa. There are thus five primary, five secondary, and ten tertiary tentacles. The disk, when fully expanded, projects in the shape of a cone, with the mouth at the apex. The water is kept in a whirling motion over the mouth by ciliary action. The animal bears handling and taking out of the water very well, expanding again after a few minutes of rest.

† Duchassaing et Michelotti, Supplément au Mémoire sur les Coralliaires, Plate IX., fig. 3, is evidently a magnified portion of *Stylaster elegans*, represented on fig. 4. Fig. 2 may be intended to represent *Stylophora incrustans*, the numbers having been misplaced.

‡ There is again here (Duchassaing et Michelotti, Mémoire sur les Coralliaires des Antilles) a confusion in the numbering of the figures, and in the figures themselves. One of the generic characters of *Reussia* (differing in no way from those of *Madracis*) consists in having always ten septa. Fig. 9 of Plate IX., purporting to be a magnified portion of *Reussia lamellosa*, shows from fourteen to twenty-seven! Fig. 8 agrees well with the large specimens of *Madracis decactis* from Havana.

Family ASTRÆIDÆ M.-Edw. & H. (pars).

As the typical Astræidæ are not represented in the deep-sea fauna, it would lead too far to attempt a revision of the family or even suggestions towards it in this place.

But one group of genera I have felt justified in separating from the Astræidæ, as I have remarked before, under the head of the Trochosmilidæ. It may remain for the present an open question if they ought to form a family by themselves, and if so, what place that family ought to occupy and what other corals might be added to it.

Most of the Astræidæ described here will be found to be adventitious, having been drifted from shallow water.

STYLINACEÆ M.-Edw. & H.

Galaxea eburnea POUPT.

Plate III., figs. 6 and 7.

Corallites cylindro-conical. Wall smooth, shining, concave between the very flat costæ of the two first cycles; no costæ for the third cycle. Calicle regularly dodecagonal; fossa small and deep. Septa smooth, very little exsert, rather thick, very regular, in six systems and three cycles. Dissepiments few and deeply seated. Height 2 cm., diameter 6 mm.

This description applies to the only specimen obtained off Havana in 270 fathoms. Although fresh, it had no trace of the peritheca except discoloration for about half the height. Since then I have seen specimens from the collection of Mr. R. Arango in Havana, having four cycles of septa in some of the systems, costæ for all the cycles, and cellular peritheca reaching to about one third the height. They were also detached corallites. There is probably but one species, notwithstanding the differences indicated.

CLADOCORACEÆ M.-Edw. & H.**CLADOCORA M.-EDW. & H.***Cladocora (pars)* EHRLG. & HEMP.**Cladocora debilis** M.-EDW. & H.

Specimens of a *Cladocora* somewhat different from *C. arbuscula*, common in shoal water, are referred to this species. They are slenderer, less branching, have a more shallow fossa, well-developed pali and columella, and more exsert septa.

Off Sand Key, in 26 fathoms.
 Off French Reef, in 45 fathoms.
 Off Elbow Reef, in 49 fathoms.
 Off Carysfort Reef, in 63 fathoms.

Cladocora arbuscula, as far as my observations go, is found from low-water mark to 13 fathoms. It is possible that *Cladocora debilis* may be merely a deeper water variety of this species.

ASTRANGIACEÆ M.-Edw. & H.**PHYLLANGIA M.-EDW. & H.***Synlepas* LYMAN. Proc. Bost. Soc. Nat. Hist., VI. p. 274, 1857.**Phyllangia americana** M.-EDW. & H.

Synlepas Gouldii LYMAN l. c.
Stellangia reptans? DUCH. & MICH.

Off Double-Headed Shot Key (Elbow Key), in 315 fathoms.

Dead specimens, rather worn, were dredged up with quite a number of other dead corals at this place, shoal-water and deep-water species being mixed together. The locality is very near the edge of the Salt Key Bank, at the foot of a very steep submarine slope, and washed by the edge of the Gulf Stream.

ASTRANGIA M-EDW. & H.

Astrangia solitaria VERRILL.

Astrangia solitaria VERRILL. Bull. Mus. Comp. Zoöl., No. 3.

Caryophyllia solitaria LESUEUR. Jour. Phil. Acad. Nat. Sc., I., p. 180, Pl. VIII., fig. 11, 1817; and
Mém. du Mus., T. VI., p. 273, Plate XV., fig. 1.

Astrangia phyllangioides? DUCH. & MICH.

Dead specimens off Double-Headed Shot Key, in 315 fathoms.

The same remarks apply to this species as to *Phyllangia americana*. Both are rather common shoal-water species.

COLANGIA POURT.

Corallum immersed in an expanded epithecal membrane, forming several successive stories, following the growth of the coral. Primary and secondary septa entire; those of the lower cycles denticulate. Well-developed pali in front of the tertiaries. Columella lamellar or papillose, not much developed. The genus is chiefly distinguished by the highly developed epitheca from *Phyllangia*, which has none, or only a false one formed by a coralline growth.

Colangia immersa POURT.

Corallum incrusting, in loose clusters, the corallites tending to develop in rows, immersed in an epithecal membrane, stretching out horizontally from the margin of the calicles, and forming anew when the corallites increase in height. No costæ visible. Calicles round or somewhat elongated; fossa shallow. Septa thin, smooth, with very few granules, in six systems, generally complete. Four cycles. Primaries exsert, with straight perpendicular inner edge. Secondaries not exsert, having, like the primaries, an entire edge. Tertiaries with rounded denticulations. Pali prominent, thin, rounded, in front of tertiary septa. Columella in shape of an irregular lamella with a few lateral papillæ, or sometimes simply papillary.

Diameter of calicles, 7 mm.

Like the other *Astrangiaceæ*, this is a shallow-water form, found on

the reefs, though rather rare. Dead specimens were found off Double-Headed Shot Key (Elbow Key) in 315 fathoms, with the preceding species. The association of three allied shoal-water forms transported to this deep-water locality is rather singular.

Family STYLASTERIDÆ Gray.

Stylasteraceæ M-EDW. & H. (pars).

This family was first established by Gray (Ann. & Mag. Nat. Hist., Vol. XIX., 1847), for the genus *Stylaster* alone. M-Edwards and Haime made of it a group or subfamily (*agèle*), and placed it among the Oculinidæ under the name of Stylasteraceæ. They have, however, left out the genus *Errina* Gray altogether, placed *Distichopora* among the genera of doubtful position, but included *Arohelia*, which is a *Madracis*. Otherwise the limits of the group are the same which we shall use.

Professor Verrill first recognized the close affinity of *Distichopora*, *Errina*, and *Stylaster* (Bull. Mus. Comp. Zool., No. 3, 1864). In his "Notes on Radiata" (Trans. Conn. Acad., Vol. I., 1870) he adopted a suggestion of mine to make a distinct family of the Stylasteridæ, which he places in his suborder of Oculinacea, both of us overlooking the fact that Gray had long before already established it.

The association of the Stylasteridæ with the Oculinidæ does not appear natural, and a closer examination of the structure seems to warrant their removal from that vicinity. The cænenchyma is found, on close examination, to be abundantly perforated; this can be seen more distinctly in *Allopora miniata* (and best in dead and bleached specimens) than any other form that I have examined, but after proper preparation there is no difficulty in recognizing that structure in all the genera. The best way is to prepare a section and brush it over with ink or some other colored liquid, which will fill the fine canals and show them to pervade the whole cænenchyma, anastomosing among themselves and communicating with the surface and with the interior of the calicles.

According to this character we should be warranted in placing the Stylasteridæ among the Perforata, were we to follow M-Edwards and Haime's system implicitly; but this section contains so heterogeneous an assemblage of families, that it will most certainly have to be dismembered. In another place in this paper reasons will be given for separating the Eupsammidæ from the Madreporidæ, with which they have been closely connected. It would be perhaps imprudent, without further research, to associate the Stylasteridæ with the

Eupsammidæ; but besides the porous cænenchyma, there is another character connecting the two families, though in a somewhat remote degree: it is the tendency of the septa to unite by their inner edges and enclose, in the interseptal chamber thus formed, the septa of a higher order. This character, more or less developed in the Eupsammidæ, is carried to excess in the Stylasteridæ, where sometimes the interseptal chambers are so far removed from the central part of the calicle as to lose all apparent connection with it.

The subfamily of Turbinarinæ M.-Edw. & H. has also considerable affinities with the Stylasteridæ, having like them all the septa alike.

In Stylasteridæ the calicle is invaded by the cænenchyma, and in a great measure obliterated as in the Oculinidæ proper. This character was relied upon, together with the fancied solid cænenchyma, for associating these forms; in reality the filling up of the Stylasteridæ is of a different kind; the interseptal chambers, always narrow, are continued down and merge in the fine canals of the cænenchyma, whilst the central fossa is obliterated by the growth of the columella. True dissepiments do not appear to exist.

I have, unfortunately, never succeeded in obtaining a satisfactory view of the living polyp of any of the corals of this family, nor am I aware that it has been observed by others. When it is, our views of the classification may be much modified. The so-called ampullæ, peculiar to this family, were found in the fresh polyp to be filled with a yellow mass resembling the yolk of an egg.

The genera forming this family are the following: *Allopora*, *Stylaster*, *Distichopora*, *Cryptohelia* (= *Endohelia*?) *Lepidopora*, n. g., and *Errina*. Professor Verrill has also included *Axohelia*, which I consider identical with *Madracis*, and which belongs to an entirely different family.

Of these genera, *Allopora* and *Stylaster* are very closely allied, differing only by their mode of growth. *Stenohelia* Kent, a new genus established to receive *Allopora madeirensis* Johnston, and *Stylaster complanatus* Pourt., I believe very difficult to maintain, as the passage from the Stylasters with circular calicle to those with an oval one is very gradual, as is also the other character derived from the obliteration of one of the lips of the calicle by the intrusion of the cænenchyma. *Cyclopora* Verrill has all the fundamental characters of a true *Stylaster* (the columella is well developed); it leads the way towards *Distichopora* by its interseptal chambers becoming more separated from the fossa, and the latter assuming a more elongated form; still, the differences from *Stylaster* proper are scarcely sufficient to warrant a new generic name. *Lepidopora*, a new genus, forms the passage from *Stylaster* through *Cryptohelia* to *Errina*, which is the

most aberrant genus of the family. The genus *Endohelia* is the only one of which I have not seen a representative. From the description it seems to be scarcely different from *Cryptohelia*, except in the extent of the lip-like appendage.

To recapitulate, the characters of the family can be expressed as follows:—

Corallum generally branching, frequently colored, multiplying by gemmation. Calicles small and deep, septa all equal, united by their inner edges, and sometimes containing, in the closed interseptal chamber, rudimentary septa of a higher order; in some genera the septa are merged in the cænenchyma and the interseptal chambers are at some distance from the calicle. Columella styliform or globular, spongy, and hirsute. Cænenchyma abundant, finely porous, and permeated by fine canals.

Stylasteridæ	{	with distinct septa	{	gemmation alternate	{	calicles regular . . .	<i>Stylaster.</i>
		gemmation irregular		calicles labiate . . .		<i>Cryptohelia.</i>	
		{	septa obliterated, interseptal chambers distant from fossa.		{	calicles confluent on edge of corallum . .	<i>Distichopora.</i>
				calicles labiate . . .		<i>Lepidopora.</i>	
				calicles without lip .		<i>Errina.</i>	

STYLASTER GRAY.

***Stylaster erubescens* POURT.**

Stylaster erubescens Pourt. Bull. Mus. Comp. Zoöl., No. 7.

Plate IV., figs. 10 and 11.

Branching densely, flabellate, not coalescing, rising from a broad encrusting expansion; younger branchlets slender, with rather close-set alternate calicles; older branches much thickened, with calicles in irregular rows on one surface, interspersed with ampullæ. Cænenchyma smooth. Calicles slightly prominent, 1.2 to 1.5 mm. in diameter, deep. Septa nine to twelve, most frequently eleven, equal, shaped like folds of the wall, joined with each other at a little distance below the edge of the calicle, thus forming pit-like interseptal chambers. Tertiary (?) rudimentary septa in the shape of a hairy fringe, enclosed in these interseptal chambers. Columella deeply sunk, rounded, and hirsute. Color white, with a delicate pink blush when fresh.

Dimensions: height and breadth of flabellum 10 cm., diameter of largest stems 1.5 cm. Rather common between 120 and 324 fathoms off the Florida Reef, on rocky bottom.

Stylaster filigranus POURT.

Plate V., figs. 13 and 14.

Corallum a dense and elegant flabellum, the branches setting off at an angle of 35° to 40° . Sometimes a few aberrant branchlets out of the plane, very rarely coalescing; the branchlets generally bending slightly out of each other's way. Main branches considerably thickened. Calicles comparatively large, regularly alternate on the terminal branchlets, about one diameter apart; this position is preserved on the larger branches, but on the main stem the calicles become obsolete. Calicles transversely elongated, with prominent outer lip; the inner one almost merged in the cænenchyma. Septa generally twelve, prolonged rather deeply in the fossa; tertiary rudimentary septa scarcely visible. Columella styliform, hirsute, too deeply seated to be seen from outside. Color light pink, fading into white in the younger branchlets. The color diffused through the entire thickness.

Spread and height of corallum, 10 to 15 cm.; thickest branches, 5 to 10 mm. in diameter; calicles. 0.8 to 1 mm.

West of Tortugas; ? fathoms (label lost).

Stylaster Duchassaingii POURT.*Stylaster elegans* DUCH. & MICH.

Plate VI., figs. 1 and 2.

As stated by me in Bull. Mus. Comp. Zoöl., No. 6, the name *St. elegans* was preoccupied by Verrill (January, 1864) when Duchassaing and Michelotti published their *Supplément au Mémoire*, &c. (May, 1864). A *Stylaster* found near Tortugas in 43 fathoms agrees pretty well with those authors' description and figure, though the latter is not detailed enough for safe identification.

The calicle in this species is quite small and is invaded in its upper half by the cænenchyma, thus forming a transition to the forms for which Mr. Kent has established his genus *Stenohelia*.

The color of my specimens was white or pale pink, with bright pink ampullæ.

Stylaster punctatus POURT.

Corallum subflabellate, slender; cænenchyma smooth, finely punctate with little pores, looking under the lens like eggshell. These pores are present in all the family, as stated before, but they are more conspicuous in this species than in the others of the genus. Calicles alternate, subpedicellate, but very little larger than the pedicel, always confined to two sides of the branches, upper lip not obliterated, except in the axillæ of the branchlets, where the outer lip also becomes appressed and scalelike. Fossa deep and narrow, columella deeply seated. Septa twelve, as usual in the genus. Color light purple. It differs from *St. roseus*, which it resembles most, by its slenderer branches, smaller and less prominent calicles, more distant from each other, and strictly lateral; deeper fossa, smaller and more concealed columella.

One specimen in 9 fathoms off Orange Key, and another in 315 fathoms off Double-Headed Shot Key, a very unusual range. I suppose the shoaler locality to be the true habitat, as the cast in 315 fathoms produced a great mixture of shoal and deep-water species. The locality is at the foot of a steep slope washed by a strong current. I have also seen it in Mr. R. Arango's collection, in Havana, from an unknown depth.

Stylaster complanatus POURT.

Stylaster complanatus POURT. Bull. Mus. Comp. Zoöl., No. 6.

Stenohelia complanata KENT. Ann. & Mag. Nat. Hist., February, 1870.

Plate II., figs. 16 and 17.

Corallum branching, flabellate, not coalescing, slender. Calicles pedicellate, gemmating from the edge of the preceding calicle, generally on alternate sides, so as to give a zigzag form to the branches, but sometimes two or even three corallites rise from the border of the preceding. They are directed towards one of the faces of the flabellum. Calicles compressed in the same plane, their diameters being 1 mm. and .7 mm.; on the larger branches the calicle becomes hidden by the plicated lip raised against the stem. Fossa moderately deep, columella styliform, and surrounded by rudimentary pali. Spiny anpullæ, chiefly confined to the rear side.

Septa twelve, rather exsert, and forming a plicated or scalloped edge to the calicle. Tertiary rudimentary septa in the interseptal chambers.

Color white; specimens in Mr. R. Arango's collection, in Havana, delicate pink.

In 270 fathoms off Havana; not found on Florida coast.

(For other species of this genus, see Appendix.)

CRYPTOHELIA M.-EDW. & H.

Cryptohelia Peircei POURT.*Cryptohelia Peircii* POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate II., figs. 18 and 19.

Corallum arborescent and subflabellate, irregularly dichotomous, slender, finely striated, with minute pores in the striae. Calicles subpedicellate, of a larger diameter than the stem, all facing to one side. Septa twelve to sixteen, not extending far into the calicle. Columella not visible. The lower border of the disklike expansion of the calicle prolonged into a lip folded over so as to hide the fossa. Some of the calicles inflated and globular, perhaps from the presence of parasites.

Dimensions: height 2 cm. (broken); diameter of stem 2.5 mm., of branchlets 1 mm., of calicles 2 mm.

Off Havana, in 270 fathoms.

Off Sombrero Lighthouse, in 262 fathoms (one specimen, dead.)

Off Bahia Honda, in 324 fathoms (living).

In 600 fathoms, lat. 31° 32' N., long. 78° 20' W., fragments brought up by the lead.

ALLOPORA EHRLG.

Allopora miniata POURT.*Allopora miniata* POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate III., figs. 14, 15, and 16.

Corallum branching, flabellate, the main trunk rather massive and flattened. Surface finely and sharply granular, porous. Branchlets thick and obtuse. Calicles irregularly but densely distributed on one surface of the branches, obsolete on the main trunk. Small ampullae abundant between the calicles on the younger branches. Calicles slightly prominent, fossa deep, columella large, spherical, hirsute, deeply immersed. Septa from seven to ten, generally eight. Interseptal chambers comparatively large, with very distinct hirsute tertiary septa enclosed, giving to the whole when magnified the appearance of a

calicle surrounded by a number of smaller ones, all provided with columellæ. The edge of the calicle and of the septa is crowded with small sharp points and abundantly perforated. Color brick-red.

The corallum seems to have grown in a horizontal trailing manner, as the lower surface often shows signs of contact with foreign bodies.

Dimensions: length 10 to 15 cm., thickness 1 to 1.5 cm., diameter of calicles 1.2 to 1.5 mm.

Off Tennessee Reef, in 124 fathoms.

Off Collin's Patches, in 195 fathoms.

This species is the most massive of our deep-sea corals, the next to it in that respect being perhaps *Stylaster erubescens*.

DISTICHOPORA LAMK.

Distichopora sulcata POURT.

Distichopora sulcata POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate IV., fig. 14 ; and Plate VII., fig. 7.

Corallum dendroid, much compressed, somewhat rugose. Calicles sometimes isolated, but generally confluent and forming a deep furrow. Interseptal pores round, from eight to ten, surrounding the isolated calicles. Columella deep seated, hirsute, styliiform. Color whitish.

Off Havana, in 270 fathoms.

In Mr. Arango's cabinet, in Havana, from the coast of Cuba, depth unknown.

Fragments brought up by the lead from 600 fathoms, lat. 31° 32' N., long 78° 20' W.

Distichopora foliacea POURT.

Distichopora foliacea POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate IV., figs. 12 and 13.

Corallum branching, flabellate, much compressed, finely striated and granulated. The calicles in a somewhat irregular row, a little on one side of the edge, which is sharp and finely serrated. One of the rows of lateral pores on the summits of the denticulations, the other not well defined, represented by scattered tuberculated pores. The plane towards which the calicles are situated is thickly studded with am-

pullæ, each of which has a small lateral opening. They are less numerous on the other surface. Columella deep seated, long, hirsute, in the shape of a pointed club. Color orange-pink. Height 4 to 5 cm., thickness 2 to 3 mm.

This species differs from the preceding by its smaller calices, not placed in a furrow, irregular lateral pores, and serrated edge.*

Off Key West, in 100, 135, and 154 fathoms.
 Off the Samboes, in 116, 135, and 147 fathoms.
 Off Tennessee Reef, in 124 fathoms.
 Off Sombrero Light, in 152, 183, and 262 fathoms.
 Off Bahia Honda, in 176 fathoms.
 Off Collin's Patches, in 195 fathoms.

ERRINA GRAY.

Errina carinata.

Heliopora carinata POURT. Bull. Mus. Comp. Zool., No. 6.
Pliobothrus carinatus POURT. Bull. Mus. Comp. Zool., No. 7.

Plate VI., fig. 5.

Corallum branching, very slender. Calices confined to one side of branches, round, without lip or trace of septa. Perforated tubercles prominent, continued downward in sharp ridges. Columella slender, elongated, hirsute, too deeply seated to be seen without a section.

Having but a very small specimen of this coral, the determination of it remained uncertain until a part was sacrificed for a section, when a view of the columella settled the question.

The branchlets are only a millimeter and less in diameter.

Off Havana, in 270 fathoms.

* There is in the Museum of Comparative Zoölogy a specimen of a third species of *Distichopora* of West Indian origin. It was received from St. Thomas, through Mr. Duchassaing, and appears to be undescribed. It has nearly cylindrical branches, flattened more or less near the ends. Calices in a very flat furrow, rather crowded. Lateral pores more developed in one of the series than in the other, transversely elongated, on top, or down the side of small tubercles, thus forming an approach to the structure of *Errina*. Smaller branches studded with ampullæ, scattered ones on the main stem. Color white. I would propose for it the name of *Distichopora cervina*.

LEPIDOPORA POURT.

Corallum finely branching; interseptal chambers separate from calicles, in the shape of slit tubercles; lip of calicle projecting as a scale over the calicle.

This genus combines the characters of *Errina* and *Cryptohelia*, having the raised lip of the latter and the separate interseptal chambers of the former.

Lepidopora glabra POURT.

Errina glabra POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate VII., figs. 8 and 9.

Corallum flabellate, not coalescing; the older parts of the stem much thickened, faintly striated and granulated; a row of very small perforated tubercles on each side of the branches. Calicles very small, circular; when terminal, surrounded by a few interseptal pores, which become separated from the calicles in the subsequent growth and form the lateral perforated tubercles. The calicles on one face of the branchlets hid by a scale-like projection; calicles obsolete on larger branches. Columella styliform, hirsute, in a deep fossa. Ampullæ scarce and small, smooth. Color white. Height 5 to 7 cm., diameter of branchlets .7 to 1 mm., of main branches about 3 mm.

Off Havana, in 270 fathoms.

Lepidopora cochleata POURT.

Errina cochleata POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate III., figs. 17, 18, and 19.

Corallum branching, flabellate, very slender, finely granulated and striated, studded with echinulate ampullæ. Calicles formed as in preceding species, but distinctly bilabiate when terminal, and covered by a large spoon-shaped lip when lateral. Perforated tubercles more distinct than in *L. glabra*.*

Height 2 cm., diameter of branchlets .3 to .4 mm.

Off Havana, in 270 fathoms; rarer than preceding.

* The Museum of Comparative Zoölogy possesses remarkably fine specimens of a third species of *Lepidopora*, sent from Fayal by Miss Dabney. From want of specimens of comparison, and relying on the very brief definition of *Errina aspera* Gray, they were labelled with that name, and cata-

Family EUPSAMMIDÆ M.-Edw. & H.

Eupsamminae M.-EDW. & H. Hist. Nat. des Coral.

This group, a subfamily of the Madreporidæ, according to Milne-Edwards and Haime, ought to be entirely separated from that association and constituted as a family by itself, as the same authors had done in their earlier publications in the "Annales des Sciences Naturelles" and in the "British Fossil Corals." It is one of the most natural families of the corals, and its affinities are much closer to the Turbinolidæ (the polyps being very similar) than to the Madreporidæ, with which it is only allied by its perforated walls.

BALANOPHYLLIA SEARLES WOOD.

Balanophyllia floridana POURT.

Balanophyllia floridana POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate IV., figs. 5 and 6.

Corallum elongated, conical, straight, attached in younger stages and often through life; but frequently also becoming free, by covering up the small object (shell or fragment of shell), after the manner of *Heteropsammia*, or by becoming accidentally detached from it. No epitheca, wall porous, costate to the foot. Calicle rather deep, elliptical. Septa entire, slightly exsert, finely granulated, in six unequal systems of four cycles, with rudiments of the fifth in some of the systems. Columella flat and papillose. Polyp generally brick-red. Height 2 to 3 cm. Diameters of calicle 10 and 15 mm.

- Off Sand Key, in 26 fathoms.
- Off the Quicksands, in 34 fathoms.
- Off Conch Reef, in 39 fathoms.
- Off French Reef, in 45 fathoms.
- Off Carysfort Reef, in 48 fathoms.
- Off Pacific Reef, in 49 fathoms.
- Off Carysfort Reef, in 63 fathoms.

logged in the same way in Bull. Mus. Comp. Zoöl., No. 3. Having since seen the original specimens of *Errina aspera* in the British Museum, I have been enabled to recognize the mistake. The Fayal specimens form large flabelliform expansions, of great elegance, resembling *Stylaster flabelliformis*. The species is very nearly allied to *Lepidohelia glabra*, from which it differs by its more crowded branchlets, larger and more numerous tubercles, not confined to the sides of the branches, and rough cænenchyma. I would propose the name *Lepidopora Dabneyi* for this species, which I cannot find to be described. (See Plate VII., figs. 10 and 11.) The specimens are associated with *Caryophyllia cyathus*, growing from the thicker branches. The spread of the corallum is nearly a foot.

The youngest individuals observed have the shape of a truncated cone attached by the base. The wall is quite smooth, *imperforate*, and the septa, twelve in number, equal and not quite extending to the centre, where the rudiments of the columella are already visible. At this stage none of the family characters are displayed. The dimensions are then about 2 mm. in diameter at the base, 1.3 at the calicle, and .8 in height. The next step of development is the formation of costæ on the upward prolongation of the wall. They first appear in the shape of sharp points grouped about the origin of the septa. About the same time an opening appears on the border and rather outside of the calicle, opposite each of the secondary septa, which gradually widens inwards, dividing apparently the septum in two. The two borders of that opening become the tertiary septa, the secondary septum is gradually pushed inwards, and is replaced by a new one growing out on the same radius from the wall, and but loosely connected with the joined tertiaries and original secondary. In a vertical section of an adult specimen a row of perforations is seen to extend both on the old and the new part of the secondary septum at the lines of junction with the tertiaries. The interior part of the tertiary septum is now to all intents and purposes a palus, and the whole arrangement quite similar to that of *Deltocyathus*, for instance. At this stage the septa are rather exsert and jagged on the edge, and seen in profile the resemblance with *Stephanophyllia* is quite striking, not taking the attached condition into consideration.

As the growth proceeds, the point of junction of tertiaries and secondaries moves farther into the calicle, until it reaches the columella. At this period the older or internal part of the secondary septum has nearly or entirely disappeared, and the same process of growth goes on with the septa of the fourth cycle, which become joined to those of the third.

One or two specimens show a coalescence of two individuals growing in a crowded position.

Although this species is generally destitute of epitheca, I hesitate in separating from it a form of which a number of specimens were obtained in 68 fathoms off the Tortugas. These were almost cylindrical, covered nearly to the calicle by a thin wrinkled epitheca, through which the costæ can be distinguished; the calicle contracted. All except a few young ones were dead, and have all the appearance of having been killed by being gradually covered with mud, as the calicle has mostly grown smaller and become stunted until definitively smothered. Having seen none of this form of a healthy growth, I am inclined to believe that they belong to *Balanophyllia floridana*, modified by external circumstances.

THECOPSAMMIA POURT.

Corallum simple, attached, without costæ, or only rudimentary ones on the peduncle, covered with a complete epitheca. This genus is intermediate between Balanophyllia and Heteropsammia; like the latter, it is destitute of distinct costæ, but has an epitheca like some of the Balanophylliæ, more developed indeed than in any other representative of the family.

Thecopsammia tintinnabulum POURT.

Thecopsammia tintinnabulum POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate I., figs. 9 and 10.

Corallum subcylindrical, or almost hemispherical, with turbinate base and small, abruptly constricted peduncle. Wall thick, very porous and vermiculated. Epitheca well developed, seldom rising quite to the border of the calicle, its tissue penetrating the mural pores and solidifying the wall. Calicle slightly elliptical, moderately deep. Septa in six unequal systems and four cycles, entire, thin, not exsert, with fine granulations; those of the fourth and fifth order scarcely bent towards those of the third, and not connected with the latter and with each other. The septa of the first and second order connected with the columella. The two opposite systems on the longer side of the calicle always incomplete in one of their halves, and one or two of the other systems also incomplete in the same manner. The columella papillose and porous, sometimes sublamellose, and forming three distinct masses in the adult, the middle one being largest.

Height 1.5 to 2 cm. Diameters 1.2 and 1.4 cm.; the average size is rather less.

The living polyp is of a handsome pinkish-orange color; the mouth oblong, and surrounded by rather numerous conical tentacles.

- Off Key West, in 120 fathoms.
- Off Key West, in 125 fathoms.
- Off Key West, in 135 fathoms.
- Off Key West, in 138 fathoms.
- Off Marquesas, in 140 fathoms.
- Off Key West, in 154 fathoms.

Thecopsammia socialis POURT.*Thecopsammia socialis* POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate II., figs. 9 and 10.

Corallum turbinate, rather long conical, with a thick, not much constricted peduncle. Wall and epitheca as in preceding species, but obscure traces of costæ can sometimes be seen through the epitheca near the peduncle. Calicle elliptical, moderately deep. Septa entire, smooth, crowded, not exsert, thick near the wall. Six unequal systems and five cycles. The convergence of the septa of the fourth cycle to meet in front of the tertiaries generally plainly visible from outside. The septa of the fifth cycle are developed in old specimens only, and then in few of the systems; but they soon become very large and encircle the two preceding cycles. The tertiaries remain smallest of all. The columella is papillose and porous, but more compact than in the preceding species, and nearly always forms three distinct masses, of which the middle one is largest.

This species often forms clusters, several individuals being united by their bases.

Height about 2 cm., diameter of calicle about 13 mm.

Off Coffin's Patches, in 195 fathoms.
Off Sombrero Lighthouse, in 262 fathoms.

This species, according to Dr. Duncan, has also been found by the "Porcupine" Expedition, in 345 and 363 fathoms, in the seas north of Scotland. The specimens were more developed than those from Florida, and rather variable, since Dr. Duncan distinguished three varieties. There is a considerable range of variation also in the Florida specimens. I have found in some cases, since the first description was written, the traces of costæ which had been noticed in some of the European specimens. The epitheca is particularly subject to variation, sometimes extending to the edge of the calicle, sometimes confined to the lowest parts of the peduncle. A specimen of the latter category shows distinct granular costæ in the bare part of the peduncle.

DENDROPHYLLIA BLAINV.

Dendrophyllia cornucopia POURT.

Plate V., figs. 7 and 8.

Corallum elongated, conical, generally curved, budding irregularly at various heights and on all sides. The younger corallites, remaining much smaller than the parent stock, implanted at right angles, afterwards curved upwards, but irregularly. Costæ distinct, but not prominent, finely porous. Sometimes a very rudimentary epitheca. Calicle elliptical, fossa rather deep. Septa thin, finely granulated, serrated inside of calicle, entire above, in six systems and four cycles in all the systems, the fifth in some of the quarter-systems adjoining the primaries. Columella large, densely spongy, elongated, and slightly convex.

Height of largest specimen 10 cm. Greater diameter of calicle 18 mm., lesser 16 mm. The younger ones budding out are not more than 6 mm. in diameter in any of the specimens.

A specimen has thirty-two buds, the largest has eighteen, smaller ones have none.

The polyp is of a deep maroon color, darkest on the disk, lighter on the wall.

Off Key West, in 120 and 125 fathoms.

A specimen of *Dendrophyllia*, rather incomplete, in the collection of Mr. R. Arango, in Havana, appears to be *D. cornigera* of which the Museum of Comparative Zoölogy possesses numerous specimens from Fayal. It differs from our species by the large size of the buds, which rapidly equal the parent stock. They are also usually confined to two sides of the main stock.

Dendrophyllia cyathoides POURT.

Plate I., figs. 8 and 9.

Corallum broadly attached, elongated, branching irregularly and apparently only a few times, generally widened at the calicle. Costæ distinct to the base, in part veiled by a rudimentary epitheca, but prominent and serrate near the calicle, and continuous with the septa, which are thin, granulate, rounded, finely serrate, more exsert than in any other species of the genus, in six systems and four cycles, mostly

quite regular. Columella elongated, convex, composed of transverse or irregular twisted lamellæ.

Height 2 to 3 cm. Diameter of calicle about 1 cm.

Off Havana, in 270 fathoms.

Family FUNGIDÆ Dana.

This family has few representatives in the Atlantic basin, and most of them belong to the subfamily of Lophoserinæ M.-Edw. & H. In the littoral and reef zone all the species are compound; from deep water the dredge has brought up three small, simple species, the first simple Fungidæ found in these seas.

Fungia symmetrica POURT.

Plate VII., figs. 5 and 6.

Corallum circular, plano-convex. Wall perfectly plane, with very small convex umbilicus in the middle, very little perforated. Costæ distinct to the centre; corresponding to the septa, finely spinous and granulated, particularly towards the border, subequal, primaries and secondaries slightly larger. Septa subequal, spinous, larger ones somewhat lobed, in six regular systems and four complete cycles. The septa of the fourth cycle connected by their inner edge with those of the third, and the latter with those of the second; the points of connection sometimes expanded into a kind of membrane. The primary septa reach the centre without lateral connection. Columella rudimentary, sometimes covered with a membranous expansion, through which some of the spines project. The synapticules are large, rather deeply seated, and correspond to each other in the contiguous chambers, so as to form from four to six more or less regular concentric circles.

Diameter of larger specimen 1 cm., of smaller 7 mm.

Off Cojima, Cuba, in 450 fathoms.

Off Carysfort Reef, in 350 fathoms.

This coral resembles *Cycloseris hexagonalis* very much, but the perforations of the wall and the echinulated costæ separate it apparently from that genus. I am, however, inclined to doubt the generic value of those characters, as the younger of the two specimens shows them in so small a degree that they would generally escape notice. If found in a sea where larger Fungidæ were common, these specimens would naturally be considered as the young of one of them.

Diaseris pusilla POURT.*Diaseris pusilla* POURT. Bull. Mus. Comp. Zoöl., No. 7.

Plate II., figs. 6, 7, and 8.

Corallum subelliptical, very fragile. Wall flat or slightly concave, imperforate, very thin, finely costate. Costæ thin, alternately large and small, finely dentate. The base shows the traces of lobes joined together, often very imperfectly. Septa strongly dentate, laciniate, and perforate, marked with strong ridges and furrows, connected with each other by synapticula near the base (see Plate II., fig. 7). Five cycles of septa and six unequal systems, one or two being generally incomplete. The primary septa more lobed and much higher than the others; those of the lower cycles tending to unite with those of the cycles preceding them. Fossa oblong, well marked. Columella rudimentary in the shape of a narrow ridge.

Color of the polyp dark brown, tentacles simple, conical, rather long.

Diameter of largest specimen 16 mm.

- Off Sand Key, in 119 fathoms.
- Off Sand Key, in 120 fathoms.
- Off Sand Key, in 135 fathoms.
- Off Alligator Reef, in 147 fathoms.
- Off Tennessee Reef, in 174 fathoms.
- Off Alligator Reef, in 156 fathoms.
- Off Alligator Reef, in 189 fathoms.

Diaseris crispa POURT.

Plate V., figs. 1 and 2.

Corallum irregularly circular, formed of loosely joined lobes. Wall very thin, horizontal, indistinctly costate, but deeply furrowed in the junction of the lobes. A few minut scattered spines and granules, particularly at the edge of the lobes. Septa subequal, not laciniate, serrate; the teeth equal and flattened transversely to the septa, thus giving to the surface a densely crispate appearance. Systems unequal on account of the irregular mode of growth, four cycles and seldom rudiments of a fifth. Primary and secondary septa equal, those of the two next cycles slightly smaller. All the septa but those of the fourth cycle reach the centre, the latter connect with the tertiaries about half-way. Fossa moderately concave, no columella, the wall in the centre sometimes eroded.

Dimensions slightly smaller than those of *Diaseris pusilla*. Both species are generally found together in some abundance, but perfect specimens are rare, on account of their great brittleness. Many specimens have evidently been broken and mended as the one figured in Plate V., fig. 2. Such deformities in other groups of corals have been described as genera, as, for instance, *Ecmesus* by Philippi, and *Hemicyathus* by Seguenza.

MYCEDIUM OKEN.

Mycedium fragile DANA.

This species was obtained in considerable quantities in the two localities named below. The greater number of the specimens were dead, but an interesting series of young ones of all ages were obtained (see Bulletin Mus. Comp. Zoöl., No. 13, by Professor Agassiz). It is not uncommon in less depth, though not often found on the reef.

In looking over the materials in the Museum, for the determination of this coral, it has become very apparent that a revision of the group is very urgent, and that probably a large number of species, and even some genera, are based on very insufficient characters and ought to be united. In fact, several of the specimens obtained by me in the same dredgeful, if seen separately from different localities, would unhesitatingly be pronounced different species; whilst being put on guard by the association, a closer examination shows that the characters vary considerably, even in different parts of the same corallum. Such are the costal striæ, which may be subequal, or alternately large and small; the calicles, which may be flat or raised, isolated or in rows, columella present or absent, etc.

In this connection it may be remarked that *Mycedium fragile*, which Milne-Edwards and Haime think may be closely allied to *Agaricia undata*, has really no resemblance to that species at all. The latter is found on the coast of Cuba (cabinet of Mr. R. Arango, in Havana), but not in Florida, as far as I am aware.

Off Tortugas, in 36 and 43 fathoms.

ORDER RUGOSA M.-EDW. & H.

The section of Rugosa was established by Milne-Edwards and Haime for a large number of fossil corals, all of an older age than the carboniferous formation, and particularly abundant in the palæozoic ages. Their chief characteristic, according to those authors, is the development of the septa proceeding from four primary ones, whilst in all of the living corals the primary number is six. In addition, the chambers are closed inferiorly by an abundant endotheca, often assuming the shape of floors; but this character is not found in all the families of the section, though certainly in the greater number. Mr. R. Ludwig has shown (H. v. Meyer's *Palæontographica*, Vols. X. and XIV.) that the tetrameral arrangement claimed for the Rugosa is only apparent, there being originally six primary septa; but that the further development in each system is asymmetrical, and that two of the systems remain generally undeveloped.

I had, before having knowledge of Ludwig's researches, come substantially to the same conclusions by the examination of *Lophophyllum proliferum* Edw. & H., from the carboniferous formation, a form very suitable for that study. As I find my mode of explaining the development slightly different from Ludwig's, it may not be too much out of place to mention it here in a few words.

When the youngest stage of the coral is examined by cutting through the tip of the conical *Lophophyllum proliferum*, six primary septa and six interseptal chambers are found, placed symmetrically on two sides of a vertical plane, and unequally developed. This plane would pass through two of the primary septa, of which one may be called anterior and the other posterior, for convenience merely. The two lateral systems (which would be divided by a plane at right angles to the antero-posterior plane) are at the earliest stages larger than the others. In progress of growth the anterior primary system is checked in its development, and the two adjacent chambers partly coalesce to form the so-called *septal fossa*. The posterior primary septum is fully developed, and joins the columella (when there is one). The systems between this and the two adjacent primaries do not become subdivided again, so that these three septa remain close together; according to Ludwig, they subdivide to a small extent in some genera. Thus, of the six primary interseptal chambers, the two posterior ones remain undivided. The four other ones are each divided by a secondary septum joining the primary; of the two half-systems thus formed in each, the anterior one is again divided by a tertiary septum joining the secondary; next the anterior quarter-systems are divided, and so on. The four lateral

For the sake of symmetry, the number of septa has been made equal in all the systems in these diagrams, which is seldom the case.

Sometimes a small rudimentary septum is seen in each half of the septal fossa on the sides of **S**.

Numerous illustrative figures will be found in the plates accompanying Ludwig's paper.*

Mr. A. Kuntz (*Zeitschr. der Deutsch. Geol. Ges.*, XXI., Heft 3) has also examined the law of growth of the Rugosa, chiefly by the consideration of the successive development of the costæ. He still adheres to the tetrameral primary division, from want of having examined individuals of very young age, and hence great simplicity. The papers of Römer and of Lindström I have had no opportunity to examine.

In the Bulletin of the Museum of Comparative Zoölogy, No. 7, I referred to the Rugosa, a new genus and species, though with some doubt. I hoped to be able to procure more numerous specimens, particularly as the single one on which the determination rested was not quite normally developed. In this I have been disappointed, so that the position of the genus in the system must still remain provisional. The chief ground for placing it among the Rugosa is its general appearance, its smooth ungranulated septa, not resolvable into the regular hexameral arrangement, but on the other hand difficult also to refer to the modified hexameral system just exposed.

HAPLOPHYLLIA POURT.

Haplophyllia POURT. Bull. Mus. Comp. Zoöl., No. 7.

Corallum simple, fixed by a broad base, covered with a thick epitheca; columella styliform, strong, very thick at the base. Interseptal chambers deep, uninterrupted by tabulæ or dissepiments, but filling up solid at the bottom.

The nearest known form to Haplophyllia which I have been able to find is *Calophyllum profundum* Germ. (Geinitz) (*Astrocyathus Geinitzii* Ludw.),† which, however, lacks a columella. It is fossil in the Dyas.

* There are several points of resemblance in the mode of division of the calicle in the Pocilloporæ and in the Rugosa, which would warrant a closer examination; such are the bilateral symmetry combined with a more or less marked antero-posterior asymmetry, the shallow calicles, the tabulæ, etc. The order of succession of the septa in the Pocilloporæ is not known.

† Ludwig has formed new generic names for nearly all the fossil corals, to adapt them to his classification; such a proceeding can only introduce confusion, particularly as his arrangement is quite artificial. A table of double entry is no doubt very convenient, but unfortunately the organized beings were not created on such a plan.

Haplophyllia paradoxa POURT.

Plate II., figs. 11, 12, and 13.

Corallum subcylindrical, short, fixed by a broad base; epitheca thick, wrinkled, reaching above the border of the calicle, and forming around the latter several concentric circles, as if formed of several layers. Calicle circular, fossa deep. Septa smooth, without granulations or perforations, not reaching the border of the calicle, with smooth enamelled surface, like the other internal parts of the calicle. Columella formed of two smooth conical processes, very thick at the base and tending to fill up the chambers. Eight septa larger and connecting with the columella, alternating with smaller ones, which touch the columella at a much lower level. A further cycle is indicated by mere rudiments in some of the chambers. In the specimen there are irregularities in two of the systems or half-systems, one of which is closed by a horizontal plate, probably to exclude a parasitic intruder.

Polyp scarlet, greenish in alcohol, with about sixteen rather long tentacles, bluntly tuberculated at the tip.

Height 1.5 cm., diameter 1.2 cm.

Off Bahia Honda, Florida, in 324 fathoms.

SUBORDER ANTIPATHARIA M.-EDW. & HAIME.

This suborder, with one single family, the Antipathidæ, constitutes a very natural and homogenous group, if we remove from it the genus *Gerardia* of Lacaze-Duthiers, which has no other relationship with the other genera than the property of secreting a horny polypidom. The polyps of a *Gerardia* differ in no particular from those of most of the Zoanthidæ in the arrangement, number, or shape of the tentacles; they even agree with that group in the habit of incrusting the derm with small foreign bodies. Hence it would be quite proper to place *Gerardia Lamarcki*, Lacaze-Duthiers, the only species known, among the Zoanthidæ, as type of a subfamily.

The subdivision of the Antipathidæ into genera by Blainville, Gray, and Milne-Edwards is based entirely on the solid parts. The few species of which I have had the opportunity of examining the polyps, all belong to the genus *Antipathes* proper, according to the characteristics heretofore adopted. It has seemed to me, however, that two distinct types of polyps could be distinguished, the one well circum-

scribed, flower-shaped, symmetrically radiate, with long tentacles; the other so elongated longitudinally that the radiate shape is quite indistinct, the six tentacles being disposed in pairs at some distance from each other. Unfortunately the number of species examined is too small to allow of basing any attempt at classification on those characters, which furthermore seem to bear no connection with the general shape of the corallum.

ANTIPATHES PALLAS.

Antipathes tetrasticha POURT.

Antipathes tetrasticha POURT. Bull. Mus. Comp. Zoöl., No. 7.

Corallum with simple stem, pinnate; branchlets alternate and generally double, two branchlets starting from the same point at an acute angle, thus forming four rows, two on each side of the main stem. In some specimens few of the branchlets are double, in others nearly all. The branchlets are moderately beset with short, somewhat blunt, triangular spines. No swellings, as in *A. humilis* and *A. filix*.

Polyps small, very much elongated, with the tentacles short and blunt, placed in pairs, so that in a branchlet or pinnule the lower side appears fringed with tentacles placed in pairs, and it requires some attention to distinguish the single polyps by the position of the mouth. They are all of one size on the pinnules, but there is generally a somewhat larger polyp on the main stem between the successive pinnules.

Total height 7 cm., length of pinnules 3 to 4 cm.

Off Sand Key, in 120 and 125 fathoms.

Duchassaing and Michelotti have described very briefly, under the name of *A. americana*, a pinnate species with simple stem, but the pinnules are described as dichotomizing rather frequently, which is never the case in ours.

Antipathes dissecta DUCH. & MICH.

The very scanty description given of this species in *Supplement au Mémoire sur les Coralliaires*, etc., leaves some doubt as to the correct identification of my specimens, of which it is therefore not superfluous to give a fuller description.

Corallum large, irregularly branching into long, crooked arms, of more or less elliptical section. Ultimate branchlets or pinnules few in number, alternate and very loosely pinnate, without swellings. (Du-

chassaing and Michellotti had evidently specimens with dried polyps before them, which give to the branchlets the appearance described by them.) Spines confined only to the smaller branches and branchlets, few, small, and rounded, thus having under the microscope a nipple-shape appearance in profile, though flattened longitudinally.

Polyp large, resembling in their proportions those of *A. arborea*, as represented by Dana. They are all on one side of the branchlets (not the upper or lower), and generally the row is composed of alternately large and small polyps. The mouth surmounts a tubercle and is elongated transversely to the branch, as has been observed by Lacaze-Duthiers in other species of the genus. The tentacles are elongated, conical, and do not appear susceptible of much contraction, but can be curled up over the mouth. They are never found contracted into small knobs, as in some species hereafter described. The largest specimen obtained is one meter high, the main stem being 2 cm. in diameter. Pinnules 3 or 4 cm. long.

Off Alligator Reef, in 110 fathoms.

Off Sand Key, in 125 fathoms.

Off Coffin's Patches, in 195 fathoms.

Off Bahia Honda, in 324 fathoms.

***Antipathes filix* POURT.**

Antipathes filix POURT. Bull. Mus. Comp. Zool., No. 6.

Main stem simple, pinnate; the pinnules setting off nearly at right angles, rather short, alternate, covered with spines or short, stiff hairs, and showing a succession of slight swellings and contractions. Soft parts not observed.

Height about 7 cm.

Every specimen obtained served as support to the tube of an Annelid.*

Off Havana, in 270 fathoms.

***Antipathes humilis* POURT.**

Antipathes humilis POURT. Bull. Mus. Comp. Zool., No. 6.

Corallum flabellate, irregularly dichotomous, spreading more laterally than vertically, hirsute, the spines being slender and longer than the diameter of the branchlets, which are alternately swollen and con-

* The specimens having been sent to Professor Ehlers with the collection of Annelids, I have been prevented from comparing the polyps with those of the other species since obtained.

tracted. Polyps all on the same side of the flabellum, on the swellings of the branchlets, about one diameter apart. Tentacles very short, when contracted forming small knobs shorter than the spines, and placed in two rows, the mouth appearing between the middle pair.

The spines surrounding the polyp are larger than those in other parts of the branches; the largest appear inside the polyp, in the spaces between the tentacles. Mouth surmounting a tubercle surrounded by about twelve papillæ in a close circle; a second circle of papillæ on the peristome just inside of the tentacles; similar ones are scattered on the whole surface of the sarcosome.

Height 10 to 12 cm., spread 12 to 14 cm.

Off Havana, in 270 fathoms.

Fragments of another subflabellate *Antipathes* were brought up from 68 fathoms, west of Tortugas, different from *A. humilis*. There is not enough of it, however, to give a full description.

Antipathes lenta POURT.

Mode of branching unknown. Pinnules very long and slender, like thin horse-hair, not in a regular pinnate arrangement; spines in number intermediate between *A. larix* and *A. subpinnata*, as figured by Lacaze-Duthiers, but somewhat longer, and straighter than in either.

Polyps of the same type than those of *A. dissecta*, but very much smaller, and appear more distant from each other; the longitudinal and transverse diameters are more disproportionate than in the preceding species, and the tentacles show more the tendency of arranging themselves in two parallel rows. The alternance of large and small polyps, though not very regular, is quite noticeable, and the disproportion of size of the two kinds very great. Only a few branchlets of this species were obtained, some of them 10 to 12 centimeters long, without much diminution of diameter.

Off Carysfort Reef, in 35 fathoms.

Off Tortugas, in 37 fathoms.

Family ACTINIDÆ M.-Edw. & Haime.

This family is represented by five species in our deep waters, namely, two Actiniæ, two Palythoæ, and one Ilyanthus. The almost insuperable difficulty of determining satisfactorily animals of this family from much contracted alcoholic specimens will prevent anything more than a simple notice, without attempt at naming them.

The larger Actinia, milk-white, with orange disc and tentacles, is found sparingly between 120 and 195 fathoms. The smaller appears to live unattached in sand, in about 90 fathoms: it is of brownish color, and disk-shaped when contracted.

A Palythoa not very different from *P. ocellata* Lamx. from the Florida coast is quite common, ranging from 35 to 287 fathoms, attached in considerable numbers to foreign bodies.

A large black Palythoa appears to live solitary in 42 fathoms.

One specimen of an Ilyanthus was found in 124 fathoms, off Tortugas.

A disk-shaped Actinian covered with sand was obtained in 85 fathoms off Tennessee Reef, and in 91 and 93 fathoms off Bahia Honda and off the Samboes. It probably belongs to the new genus *Ammodiscus* Carpenter, dredged off the coast of Portugal. It is not destitute of tentacles in my specimens.

ORDER ACALEPHILÆ.

SUBORDER HYDROIDILÆ JOHNSTON.

MILLEPORIDILÆ AGASS.

Milleporidilæ M-Edw. & H.

Since Professor Agassiz's first announcement of the affinities of the Millepores with the hydroid polyps, it does not appear that new observations have been made on the subject, although twenty years have elapsed since. The polyps of *Millepora* are very difficult to observe, not only on account of their very small size, but also because they require peculiar care in collecting, being killed by the shortest contact with air. If they have finally expanded, after much patient waiting on the part of the observer, the least shock to the vessel, or attempt to bring the specimen in a convenient position, is sufficient to make the polyps contract instantaneously and often finally. I have succeeded but once in having a good view of one of the larger polyps of *Millepora alcicornis*, in company with Professor Agassiz. It differed from the figure in the "Contributions to the Natural History of the United States," Vol. III., Plate XV., fig. 6, in being comparatively shorter, and having larger tentacles or rather tentacular masses studded with lasso cells, five in number instead of four. The mouth was not seen very

distinctly, but appeared to be a transverse slit in the middle of the disk. It remained expanded but a short time.

It is almost unnecessary to add, after these remarks, that the deep-sea Milleporidæ afforded no opportunity to observe their polyps.

PLIOBOTHRUS POURT.

Corallum branching; tissue more compact than in Millepora; larger pores scarcer, smooth, without any rudiments of septa; smaller pores tubulated, cænenchyma finely porous, the pores linear and arranged in rows.

Pliobothrus symmetricus POURT.

Pliobothrus symmetricus POURT. Bull. Mus. Comp. Zool., No. 7.

Plate IV., figs. 7 and 8.

Corallum ramose, rising from an incrusting base and a short trunk, branching into a more or less regular flabellum. Branches cylindrical, flattened, and slightly expanded at the tip. The tendency in branching is towards considerable symmetry between the two halves of the flabellum. Three kinds of pores; very small, linear, over the whole cænenchyma; larger tubulated, with very minute aperture when unbroken, and larger round or oval ones scattered irregularly. Internal structure coarsely porous; the larger pores expanding at the bottom into a flat cavity communicating laterally with other canals. Tabulæ very thick and not numerous; the interposed chambers soon filling up. Occasional round cavities are found in the centre of the branch, filled with a yolk-like substance contained in a membrane.

Color gray. Height 5 to 7 cm. Diameter of branches about 5 mm. Diameter of larger pores .4 to .5 mm.

Off American Shoal, in 98 fathoms.

Off Alligator Reef, in 118 fathoms.

Off Sand Key, in 123 fathoms.

Off the Samboes, in 125 fathoms.

Off Sand Key, in 135 fathoms.

Off Sand Key, in 143 fathoms.

Off Sand Key, in 154 fathoms.

It has also been found, according to Dr. Duncan, in from 500 to 600 fathoms, in the cold area to the northward of the British Islands by the "Poreupine" Expedition.

Pliobothrus tubulatus POURT.

Heliopora tubulata POURT. Bull. Mus. Comp. Zoöl., No. 6.

Plate IV., fig. 9.

Branches not much divided, cylindrical; the tubulated pores very prominent and slender, giving to the coral a hirsute appearance. The internal structure appears to be of the same pattern as in the preceding species.

Height, incomplete, 2.5 cm. Diameter of branches about 3 mm.

Off Havana, in 270 fathoms.

GEOGRAPHICAL DISTRIBUTION.

WE are as yet too little acquainted with the deep-sea fauna of other parts of the world to be able to trace the distribution of our corals. The only parts of the sea bottom well explored up to the present time, besides the Florida Straits, are along the coasts of Europe from Norway to the Straits of Gibraltar and the Mediterranean. The comparison of the Echinoderms of the two regions has revealed quite a number of species common to both (see Bull. Mus. Com. Zoöl., Nos. 9 to 12). But this is not the case with the corals; Dr. P. M. Duncan, in his paper on the Madreporaria dredged up in the expedition of H. M. S. "Porcupine," enumerates four species common to the northern seas of Europe and the Florida Straits, namely, *Diplohelia profunda*, *Lophohelia prolifera*, *Thecopsammia socialis* and *Pliobothrus symmetricus*. *Lophohelia prolifera* is found also in the Mediterranean. To these can be added *Caryophyllia clavus*, which has about the same range as the last. *Madracis asperula* and *Cladocora debilis* are found in Florida and Madeira; but they cannot properly be called deep-sea corals.

The observations on the coast of Cuba are so few, that no definitive conclusions can be drawn as to the differences between the faunæ of the two sides of the straits, but I have found no reason yet for doubting the statement made in a former paper, that certain species are found only on the Cuban side; for instance, *Stylaster complanatus*, *Distichopora sulcata*, *Errina carinata*, *Lepidopora glabra*, *Dendrophyllia cyathoides*, and *Pliobothrus tubulatus*. Examples from other classes can also be found, which appear never to have crossed the Gulf Stream and the straits; such is the *Pentacrinus*.

TABLE OF DISTRIBUTION ACCORDING TO DEPTH IN FATHOMS.

	Lit.	10	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	etc.	
<i>Caryophyllia clavus</i>					68										270								
<i>Caryophyllia formosa</i>					68										270								
<i>Caryophyllia cornuformis</i>															234								450
<i>Stenocyathus vermiformis</i>								125			174												460
<i>Trochocyathus coronatus</i>							100																
<i>Theocyathus levigatus</i>							100																(315)
<i>Leptocyathus Stimpsonii</i>					60					160													(315)
<i>Paracyathus confertus</i>				36				125							237								
<i>Paracyathus folliculus</i>					60																		327
<i>Deltocyathus Agassizii</i>																							
<i>Parasmilia prolifera</i>				45																			
<i>Parasmilia Lymanii</i>				70					147														
<i>Parasmilia variegata</i>				60			77																
<i>Celosmilia fecunda</i>				68																			(315)
<i>Oculina varicosa</i>				43	50																		
<i>Oculina tenella</i>				36																			
<i>Diplohelia profunda</i>																							
<i>Lophohelia prolifera</i>													195										(315)
<i>Lophohelia exigua</i>				36													287						
<i>Madracis asperula</i>				36					120														
<i>Cladocora debilis</i>		26			63																		
(<i>Phyllaugia americana</i>)																							(315)
(<i>Colangia immersa</i>)																							(315)
(<i>Astrangia solitaria</i>)																							(315)
<i>Stylaster erubescens</i>								120															324
<i>Stylaster filigranus</i>																							
<i>Stylaster Duchassaingii</i>				43																			(315)
<i>Stylaster punctatus</i>		9																					
<i>Stylaster complanatus</i>																							
<i>Allopora miniata</i>								124			195							270 C					
<i>Cryptohelia Peircei</i>																		270					600
<i>Distichopora sulcata</i>																		270 C					600
<i>Distichopora foliacea</i>							100											262					
<i>Errina cariuata</i>																		270 C					
<i>Lepidopora glabra</i>																		270 C					
<i>Balanophyllia floridana</i>		26			63																		
<i>Thecopsammia tintinnabulum</i>								120		154													
<i>Thecopsammia socialis</i>											195							262					
<i>Dendrophyllia cornuocopia</i>								120	125														
<i>Dendrophyllia cyathoides</i>																		270 C					
<i>Fungia symmetrica</i>																							
<i>Diaseris pusilla</i>								119			189												350 . . . 450
<i>Diaseris crispa</i>								119			189												
<i>Mycedium fragile</i>				43																			
<i>Haplophyllia paradoxa</i>																							324
<i>Pliobothrus symmetricus</i>							98			154													
<i>Pliobothrus tubulatus</i>																		270 C					

N. B. — The letter C added to the figures indicating the depth means that the species was found exclusively on the coast of Cuba. A parenthesis indicates that the specimens were probably carried to the locality by currents. Names in parentheses are littoral species.

BATHYMETRICAL DISTRIBUTION.

THE bathymetrical distribution is exhibited on the accompanying table. From it we can readily separate the species found in depths less than 100 fathoms, which inhabit the region of *débris* between the reef and the rocky plateau beginning at the above depth. They are the following:—

- Parasmilia prolifera.
- Parasmilia variegata.
- Oculina varicosa (dead fragments only).
- Oculina tenella.
- Cladocora debilis.
- Stylaster Duchassaingii.
- Balanophyllia floridana.
- Mycedium fragile (found also on the reef).

A few others extend from the same region into the next or rocky one; but as the limit is not a sharp one, it is difficult to say if they really belong to the one or the other, or were gathered by the dredge from patches of rock in the muddy bottom, or muddy patches in the rocky bottom.

They are:—

- Caryophyllia clavus.
- Caryophyllia formosa (decidedly on rock on Cuban coast).
- Leptocyathus Stimpsonii.
- Deltocyathus Agassizii.
- Parasmilia Lymanii.
- Cælosmilia fecunda.
- Lophohelia exigua.
- Madracis asperula.
- Stylaster punctatus (see remarks in description).
- Pliobothrus symmetricus.

The characteristic species of the rocky bottom, at greater depths than 100 fathoms, are:—

- Stenocyathus vermiformis.
- Thecocyathus cylindraceus.

Thecocyathus lævigatus.
Lophohelia prolifera.
Stylaster erubescens.
Allopora miniata.
Distichopora foliacea.
Thecopsammia tintinnabulum.
Thecopsammia socialis.
Dendrophyllia cornucopia.
Dendrophyllia cyathoides.
Diaseris pusilla.
Diaseris crispa.
Pliobothrus symmetricus.
Pliobothrus tubulatus.

In the *Globigerina* mud we find only the following species:—

Caryophyllia cornuformis (living).
Paracyathus folliculus (dead).
Diplohelia profunda (dead).
Fungia symmetrica (dead).
Haplophyllia paradoxa (living).

On the whole the differences between these different regions are not very great, at least as far as family and generic characters go. But the differences from the nearest reef fauna are, as might be expected, very striking. No *Astræidæ*, no *Madreporidæ* (excluding the *Eupsammidæ*), the most abundant families in species and in individuals on the West Indian reefs, extend to any considerable depth. The families having apparently the greatest range in depth are the *Oculinidæ*, the *Stylasteridæ*, and the *Milleporidæ*.

Simple corals which form such a large proportion of the deep-sea fauna are not represented at all in the Floridian reef fauna; some species are described from the West Indies, but without indications of depth.

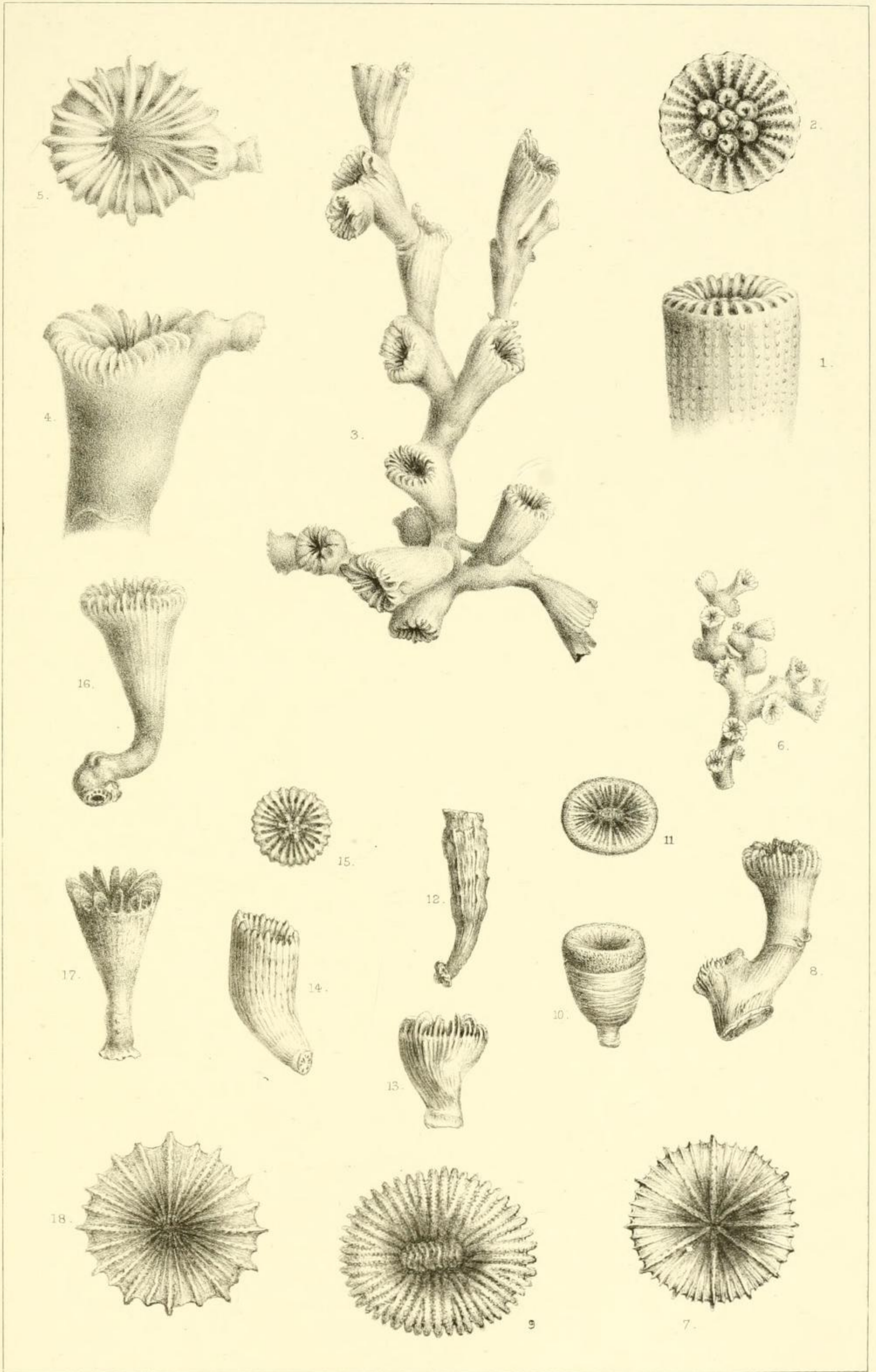
The specimens of soundings brought up by the lead from the Gulf Stream farther north contain frequently small fragments of corals, of which the following have been determined:—

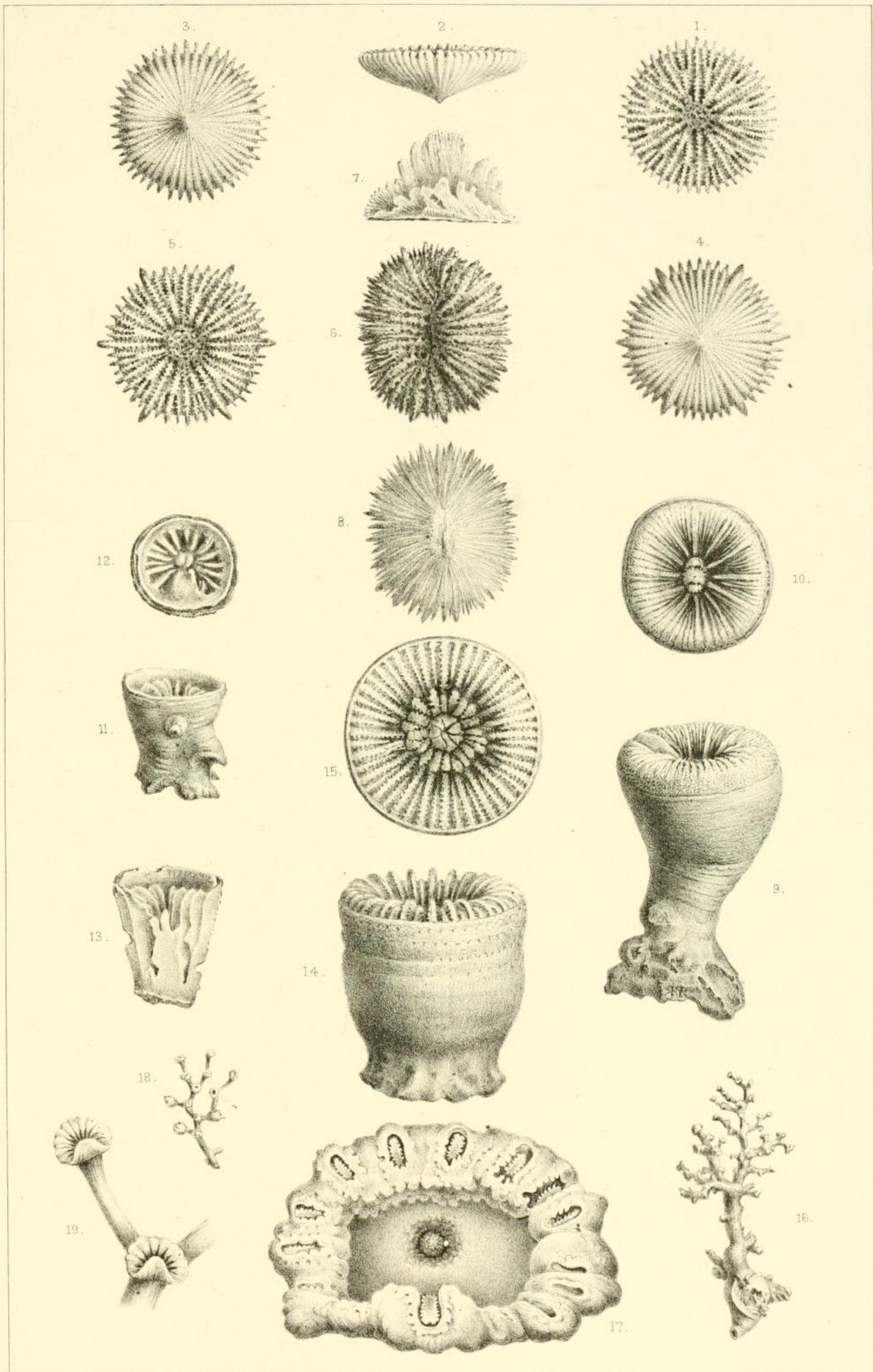
Cryptohelia Peircei, lat. $31^{\circ} 32'$ N., long. $78^{\circ} 20'$ W., 600 fathoms.
Distichopora foliacea, lat. $31^{\circ} 32'$ N., long. $78^{\circ} 20'$ W., 600 fathoms.
Stylaster erubescens, lat. $31^{\circ} 32'$ N., long. $78^{\circ} 20'$ W., 600 fathoms.
Lepidopora glabra, lat. $31^{\circ} 32'$ N., long. $78^{\circ} 20'$ W., 600 fathoms.
Diplohelia profunda, lat. $30^{\circ} 1\frac{1}{2}'$ N., long. $79^{\circ} 35\frac{1}{2}'$ W., 530 fathoms.
Caryophyllia formosa, lat. $30^{\circ} 1\frac{1}{2}'$ N., long. $79^{\circ} 35\frac{1}{2}'$ W., 530 fathoms.
Stylaster erubescens, lat. $29^{\circ} 48'$ N., long. $79^{\circ} 17'$ W., 450 fathoms.
Lepidopora glabra, lat. $29^{\circ} 48'$ N., long. $79^{\circ} 17'$ W., 450 fathoms.
Diplohelia profunda, lat. $28^{\circ} 53\frac{1}{2}'$ N., long. $79^{\circ} 33\frac{3}{4}'$ W., 410 fathoms.

These localities are all in or near the axis of the Gulf Stream, be-

tween the latitudes of Cape Canaveral and Savannah. The specimens are all broken and worn and associated with Foraminifera remarkably clean and free from mud. The indications are that a current sweeps over the bottom in a direction from south to north: in other words, the Gulf Stream extends to the bottom at least as far north as the highest latitude mentioned, and is not underlaid by a cold arctic current running in opposite direction, as has sometimes been assumed to account for the low temperature at the bottom. We know that the corals enumerated above (with the exception of *Diplolohelia profunda*, which I have never found alive) live on the coast of Cuba and Florida in depths not less than 100 fathoms, and are thus out of reach of transportation by superficial agencies.

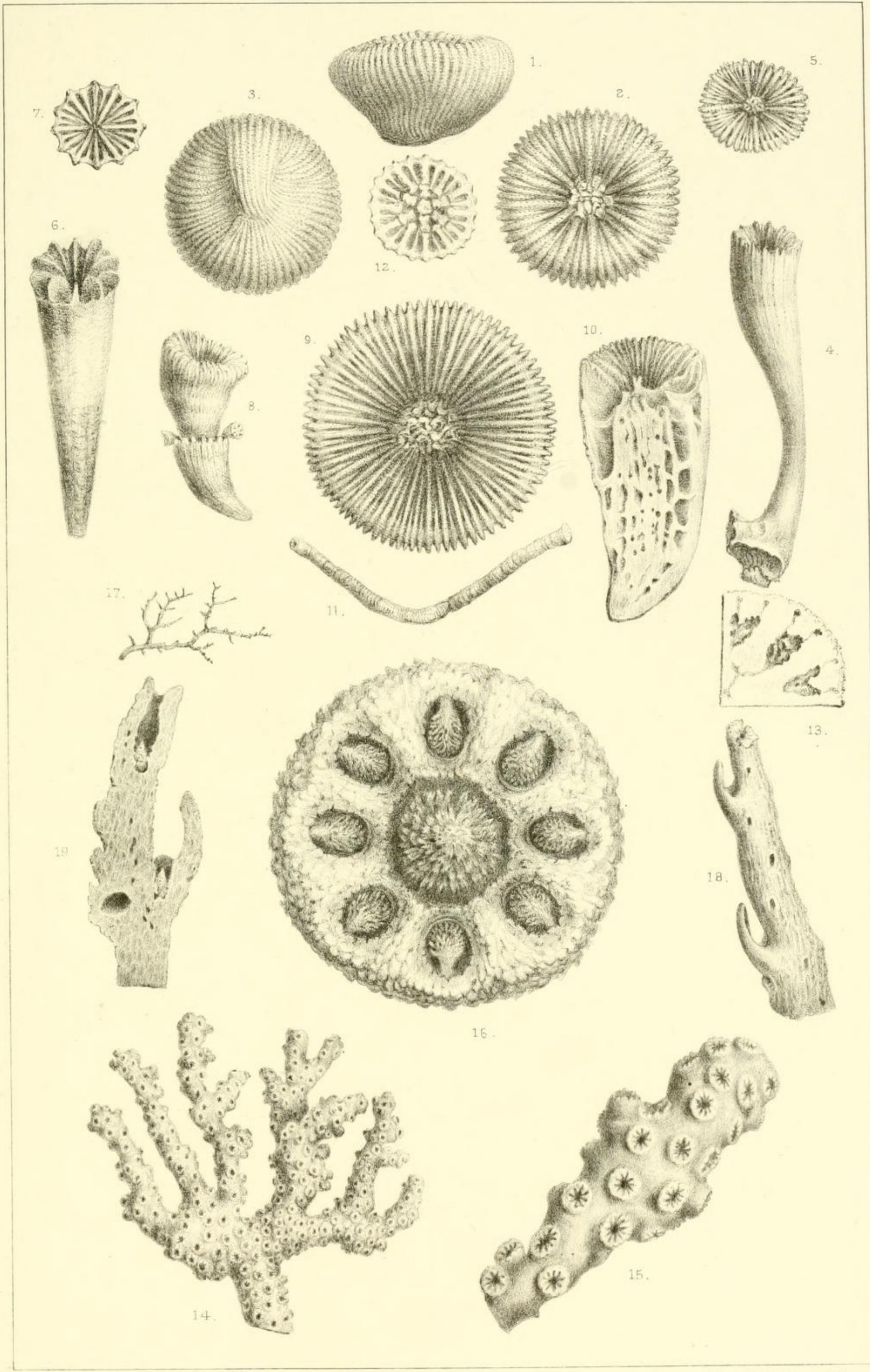
A possible nearer habitat would be the northern extremity of the Bahama Banks, between latitudes 27° and 28° , and perhaps somewhat farther north on the extension of the banks which is known to exist on the eastern border of the Gulf Stream; yet even in this case the transportation would be in the same direction. We have positive evidence of the depth to which the current extends in the straits, in the experiment of Assistant H. Mitchell, United States Coast Survey, whose conclusion is, "*that the Gulf Stream has a nearly uniform velocity and constant course for a depth of six hundred fathoms, although its temperature varies in this depth 40° Fahrenheit.*" (See Report of the Superintendent United States Coast Survey for 1867, pp. 176 - 179.)





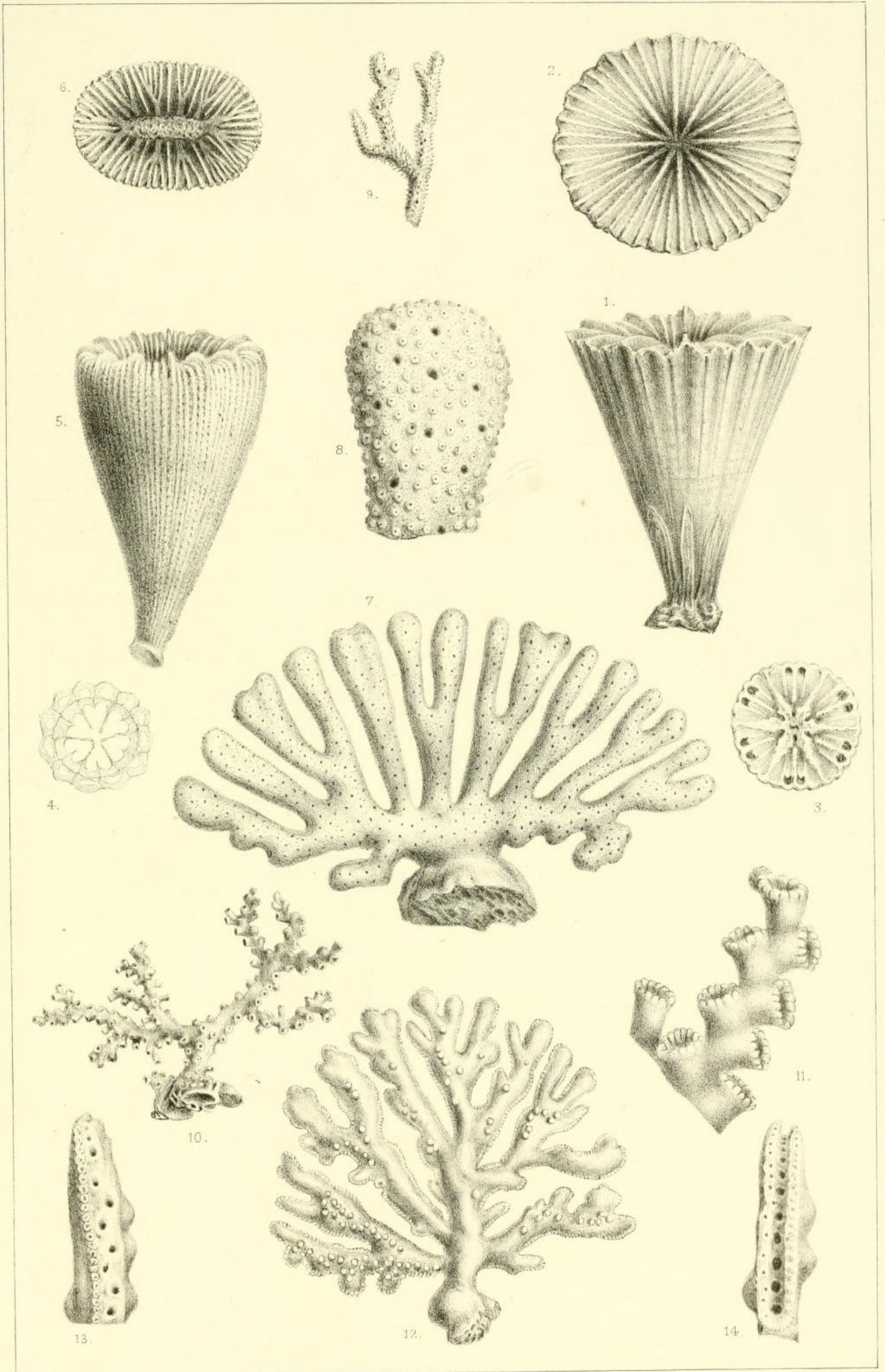
P. Roetter on stone from nat.

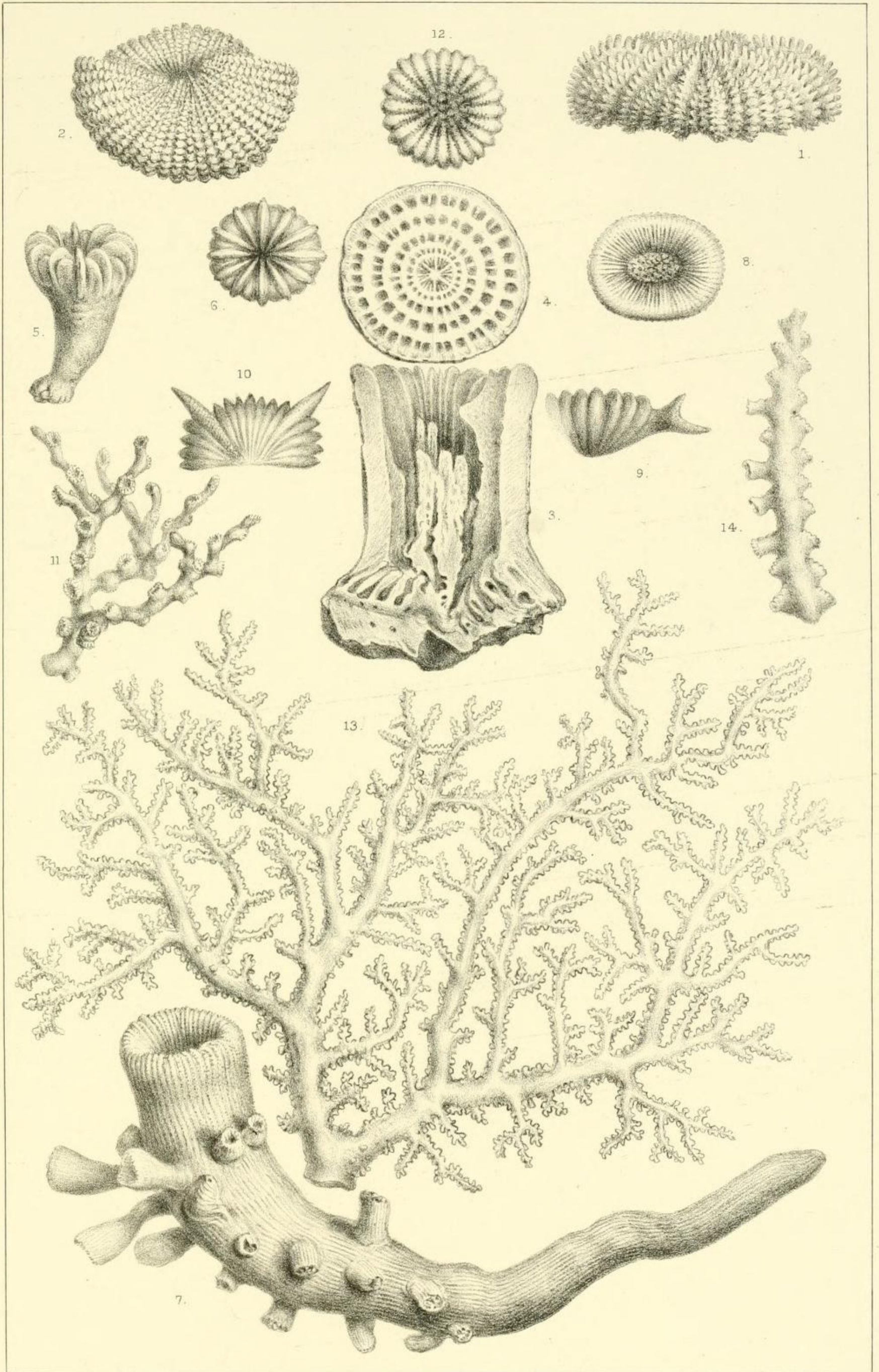
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P. Reuter on stone from nat.

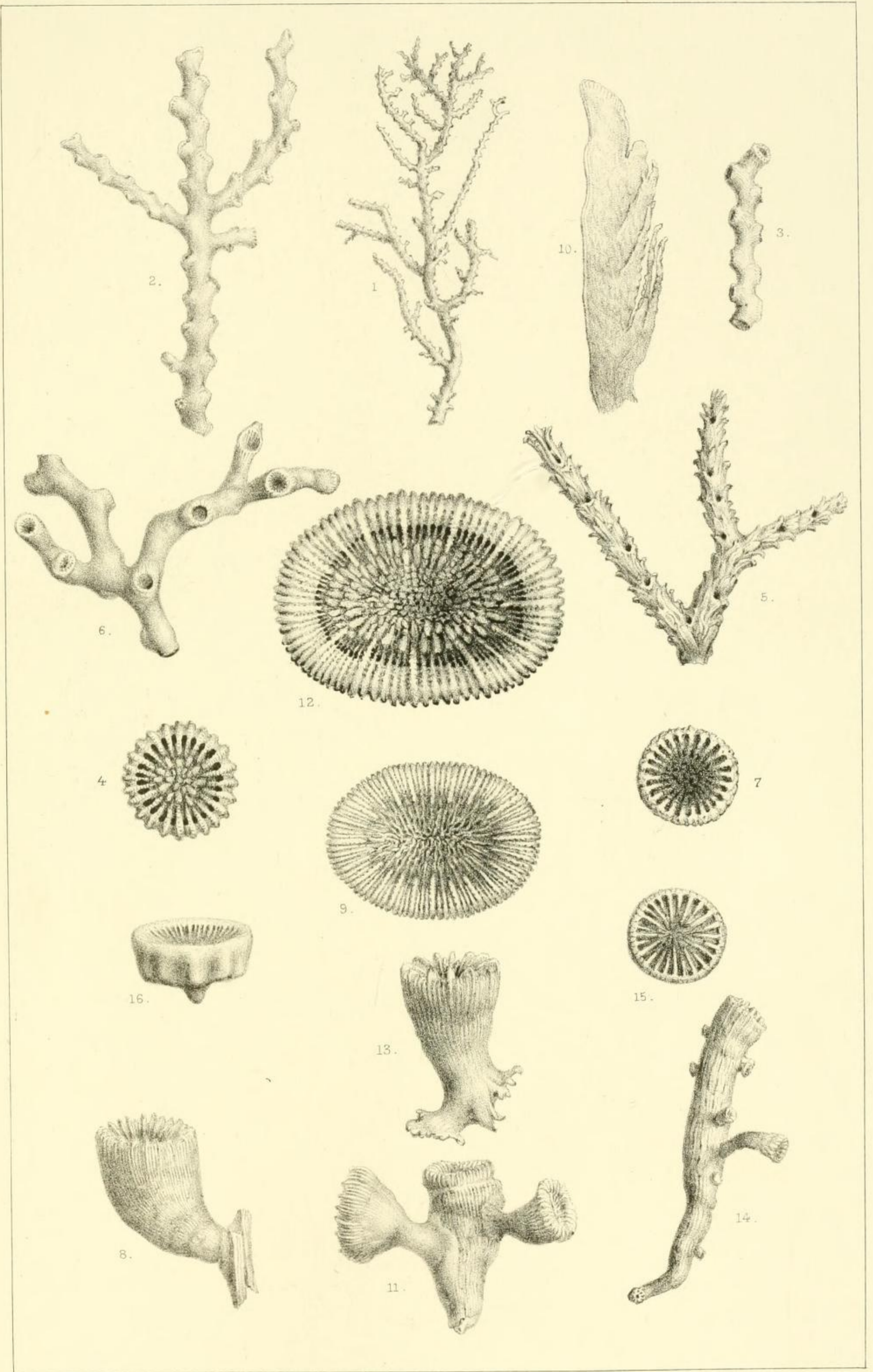
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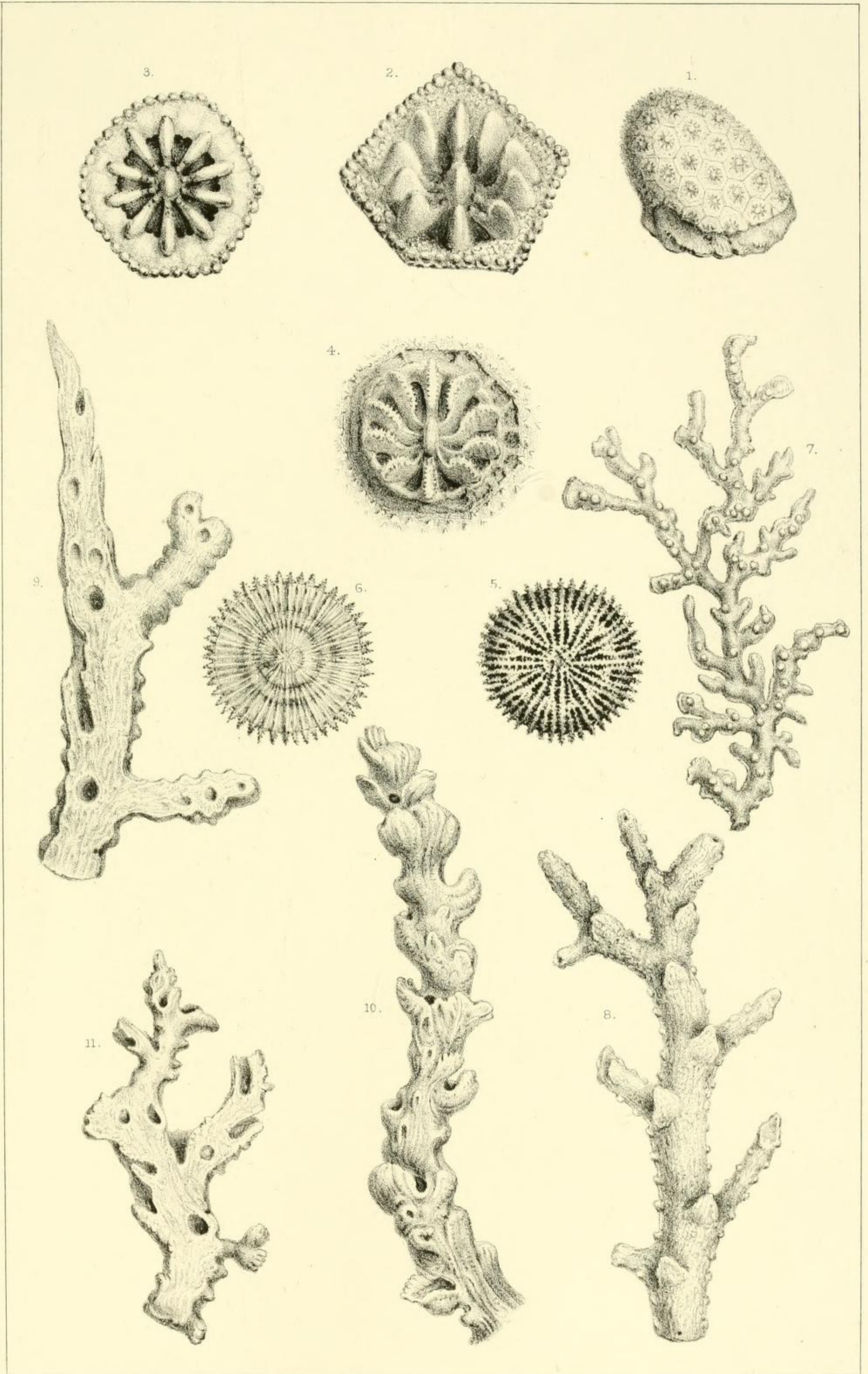
P Roetter on stone from nat.

Print. by H.W. Longfellow.



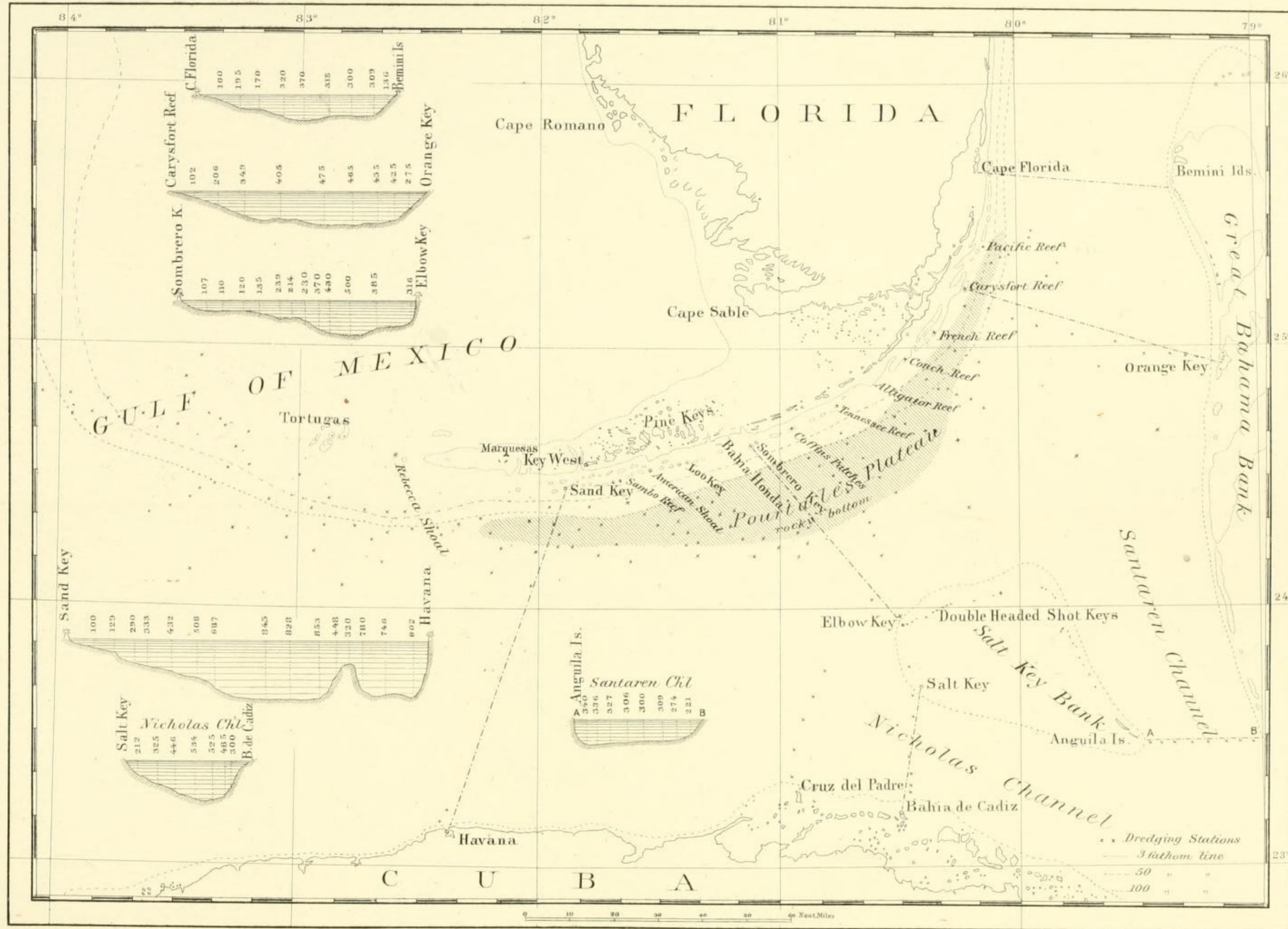
P. Reuter on stone from nat.

Print. by H.W. Longfellow



P. Roetter on stone from nat.

Print by H.W. Longfellow.



THE SEA BOTTOM BETWEEN FLORIDA AND CUBA.

HW Langfellow Lith.

80 Westliche Länge von Greenwich 75

Westliche Länge 73 von Greenwich

DER SEEBODEN
 an der atlantischen Küste der
 Vereinigten Staaten von Nordamerika.
 Nach den Untersuchungen der
NORDAMERIKANISCHEN COAST SURVEY

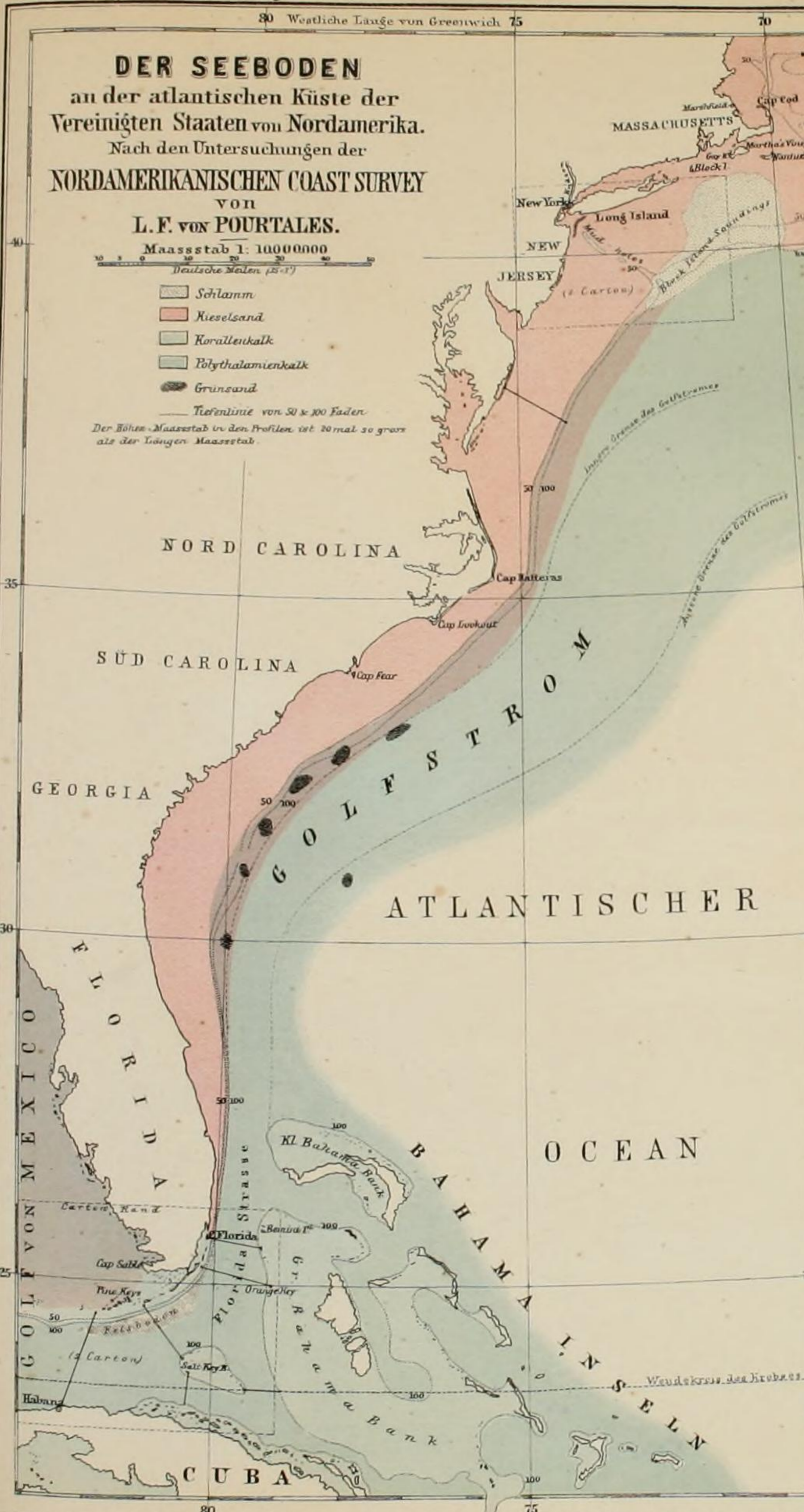
VON **L. F. VON POURTALES.**

Maassstab 1: 10000000

Deutsche Meilen (15-17)

- Schlamm
- Kieselsand
- Korallenkalk
- Polythalamienkalk
- Grünsand

Tiefenlinie von 50 & 100 Faden
 Der Höhen-Maassstab in den Profilen ist 20 mal so gross
 als der Längen-Maassstab.



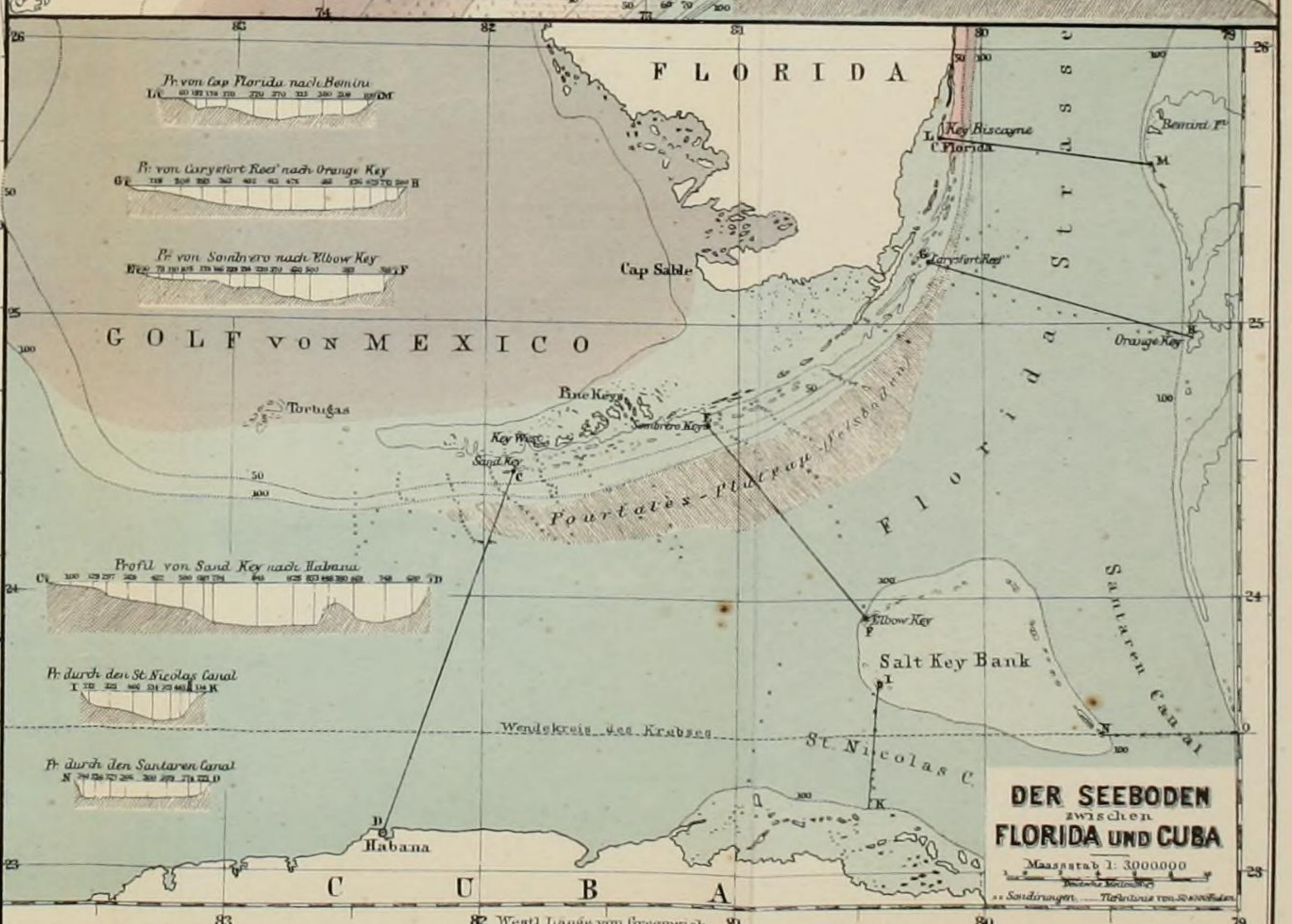
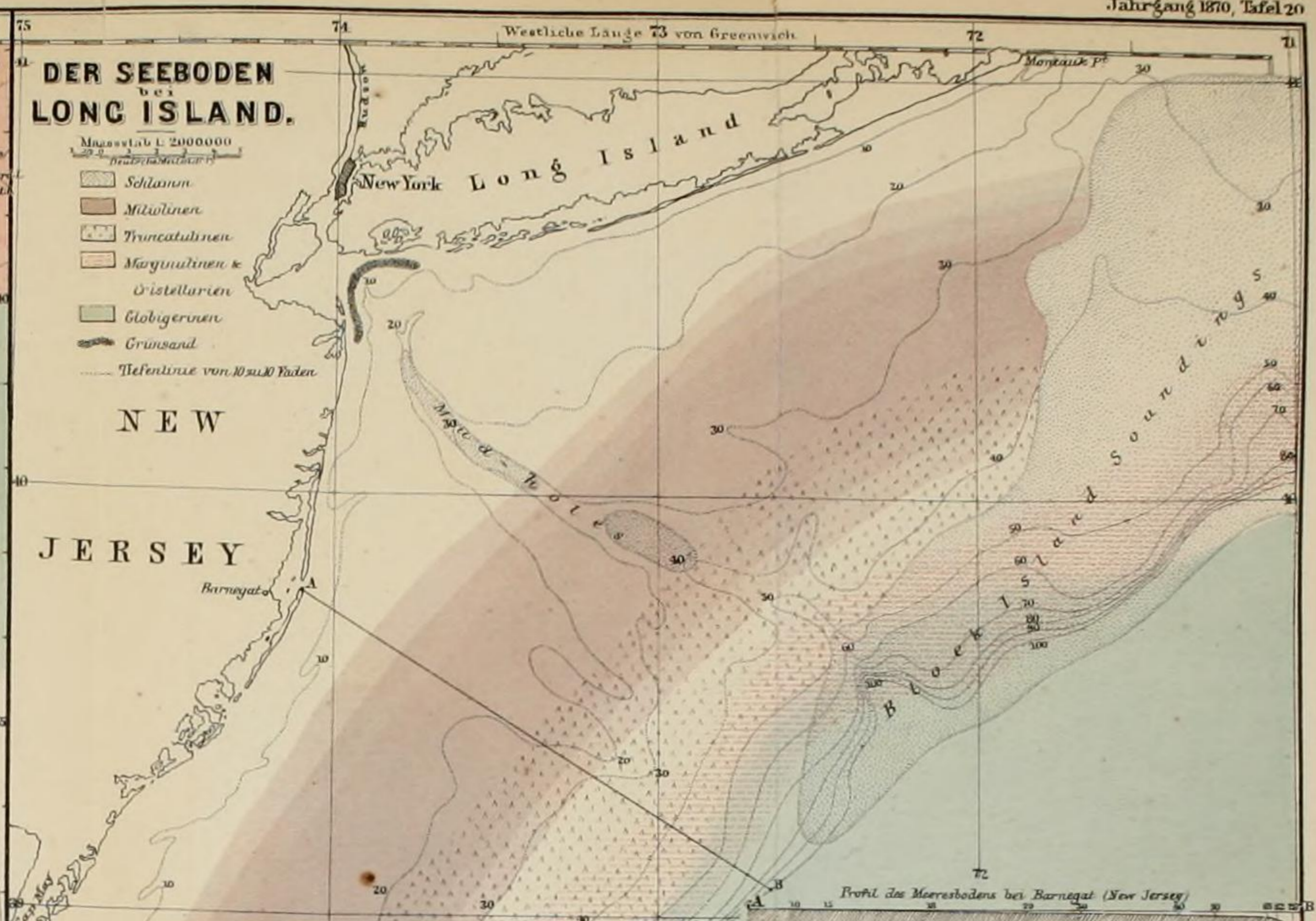
DER SEEBODEN
 von **LONG ISLAND.**

Maassstab 1: 2000000

Deutsche Meilen (15-17)

- Schlamm
- Mittelnien
- Truncatulinien
- Margaritinen & Orstellarien
- Globigerinen
- Grünsand
- Tiefenlinie von 1000 Faden

NEW
JERSEY



DER SEEBODEN
 zwischen
FLORIDA UND CUBA

Maassstab 1: 3000000

Deutsche Meilen (15-17)