
THE SPONGES COLLECTED IN PORTO RICO IN 1899 BY THE
U. S. FISH COMMISSION STEAMER FISH HAWK.

BY

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The following report has been put, at the request of the Commission, in such shape that it may be used for the identification of forms by those unprovided with the special literature bearing on the different species. Some description of each species, whether known or new, is therefore given. The descriptions in all cases apply particularly to the collection specimens. It has seemed unnecessary to give complete lists of the synonymy. Under each species reference is made to the memoir containing the original description. The additional references are to works in which important redescriptions have been given, and which for the most part are readily accessible.

It is needless to dilate on the limitations imposed on one who undertakes to describe a collection of sponges. The histological condition of the material is, of necessity, very poor. Many specimens are broken; and frequently a species is represented by but a single specimen. Species founded on such data are, of course, provisional. Subsequent study of the animals in their habitat, particularly observations on the individual differences due to mere locality, age, or regularly recurring physiological condition (for example, alteration in the surface associated with the closing and opening of pores and oscula), will naturally lead to a more precise conception of the systematic position of those forms, of which the collection specimens are examples.

The question whether a specimen or two, differing in certain respects from a described species (itself frequently based on a study of a very small number of preserved specimens), is to be recorded as a new species or as a variety is one as familiar as vexing. Where in the sponges the difference is one of shape only (as in the cases of *Pilochrota fibrosa* var. *globulariformis*, p. 385, or *Aplysina flagelliformis* var. *anomala*, p. 407), even though this difference be a very considerable one, there can be no doubt that it is right to group the differing forms as varieties, round a type form having the same skeletal elements and arrangement, canal system, and histological structure; or indeed to merge them in the type. Where, as for instance in the case of *Hircinia fatida* var. *cuspidata* (p. 406), the differences are slight but definite, and concern various parts of the anatomy, the question becomes more complex and is obviously one that must be decided in each particular case from the standpoint of expediency. In cases of this sort, where we do not know whether the individual peculiarities are inheritable, and thus racially distinctive, or whether the offspring of the "varying" forms start afresh on the same footing with those of the type, the term *variety* clearly can have no precise meaning. This fact does not,

however, do away with its practical value as an index of slight differences—differences so slight as to make it probable that the forms exhibiting them intergrade and interbreed, or would interbreed, with the type.

Microscopic sections sufficiently good to show the plan of the canal system (in particular the size, shape, and connection with exhalent cavities, of the flagellated chambers) are *necessary* for the diagnosis of most horny and calcareous sponges; less necessary for the silicious forms.

For the study of the skeleton: (1) It is sometimes necessary to bisect the whole sponge in order to learn the relative arrangement of internal and peripheral portions. (2) The arrangement of spicules, spiculo-fiber, or horny fiber, may best be learned from thick sections. These may conveniently be cut free-hand after a very short imbedding in paraffin. Warm turpentine dissolves the paraffin very quickly, and the sections may be mounted in balsam. (3) For the demonstration of horny matter where scanty (as in certain chalinine sponges) and for the study of *Hircinia* filaments, glycerin preparations are far superior to balsam ones. (4) In the case of the horny sponges it is advisable to prepare macerated skeletons as well as sections. Warm carefully a piece of sponge or a thick slice in caustic potash, not allowing fluid to boil. Leave in the fluid until the skeleton can be cleaned by gently squirting upon it with pipette. (5) In the case of silicious sponges the arrangement of the skeleton may often be learned in a somewhat similar way. Warm a thick slice in potash, not allowing the slice to disintegrate; compress between slide and cover, admitting fresh water into the space until the skeleton has been cleared of the macerated débris. (6) Surface preparations of the ectosome are usually necessary; surface layer may be stripped or sliced off. (7) For a study of the individual megascleres it is only necessary to boil a bit of sponge in potash, wash, and examine the sediment. Microscleres are often overlooked in this way. For the microscleres a small piece may be boiled on the slide, though I prefer to make a section, or dehydrate and soak in clove oil a fragment, teasing it then on the slide and mounting in balsam.

Unless special mention is made, measurements of spicules given are the average maximum measurements, the diameter given being the greatest diameter of spicule. Colors mentioned are those of alcoholic specimens.

Stations at which sponges were obtained.

Station No.	Locality and exact position. (All compass bearings magnetic.)	Depth (fms.)	Bottom.	Dredging instruments used.
6056	Off Aguadilla, Punta de Borinquen light-house NE. $\frac{1}{2}$ E. $3\frac{1}{4}$ miles	48	Sand, mud, shells.	Dredge.
6063	Mayaguez Harbor, Punta del Algarrobo E. $2\frac{1}{4}$ miles	75 to 76	Rocky, sand, and coral.	11-foot beam trawl.
6067	Mayaguez Harbor, Punta del Algarrobo E. by N. $\frac{1}{2}$ N. $5\frac{1}{4}$ miles	97 to 120	Coral	Dredge.
6070	Mayaguez Harbor E. $\frac{3}{8}$ S. 9 miles	220 to 225	Rocky	9-foot beam trawl.
6072	Off Punta de Melones, Cabo Rojo light-house SSE. $5\frac{1}{4}$ miles	7 $\frac{1}{2}$	Coral, sand, shelly.	Tangle.
6075	Boca Prieta, Punta Guaniquilla SSE. $3\frac{1}{4}$ miles	8 $\frac{1}{2}$	Coral, sand	Do.
6076	Off Gallardo Bank, tangent of Morillos de Cabo Rojo ESE. $\frac{1}{4}$ E. $9\frac{1}{2}$ miles.	10	do	Do.
6079	Off St. Thomas, Sail Rock W. by N. $\frac{1}{2}$ N. 6 miles	20 to 23	Coral	Do.
6080	Off St. Thomas, Sail Rock NW. $\frac{1}{2}$ W. 4 miles	20	do	Dredge.
6088	Off Vieques, Sail Rock NE. $\frac{1}{2}$ N. $10\frac{1}{4}$ miles	23	do	Tangle.
6090	Off Culebra, Culebritas light-house NNE. $5\frac{1}{4}$ miles	16	do	Do.
6097	Off Humacao, village of Hueares N. $\frac{3}{4}$ W. $5\frac{1}{4}$ miles	10	do	Do.

In some cases the specimen label did not bear a station number, reference being made to a named locality. A query (?) has been put after *Station* in cases where there was no label or the station number had been effaced.

DEFINITIONS OF SYSTEMATIC TERMS USED IN THIS REPORT.

Actine. The ray of a *uniaxial* (*diactinal* or *monactinal*) spicule or of an *aster*.

Anatriene. A triene in which the cladi are directed backward. Fig. 1.

Aster. A microsclere in which several rays (actines) proceed from a center or from a longer or shorter axis.

Chela. A microsclere consisting of a more or less curved axial part, the shaft bearing at each end several recurved processes, the teeth. The chela is said to be palmate when the teeth (three at each end) are broad and palm-like, the lateral teeth united with the shaft throughout their length, the median tooth separated from the shaft. Figs. 3, 4.

Chiaster. A minute aster with very slender cylindrical rays, knobbed or not, sometimes truncate, at the ends. Fig. 2.

Choanosomal. Said of microscleres restricted to the choanosome.

Choanosome. Vide *ectosome*.

Chord. Vide *triene*.

Cladome. Vide *triene*.

Cladostongyle. A rod-like megasclere rounded off at one end and divided into branches at other.

Cladus. Vide *triene*.

Collenchyma. A tissue consisting of more or less stellate branching cells, irregularly distributed through a transparent, jelly-like ground substance.

Connective. Vide *secondary fiber*.

Conulus. A more or less conical projection on the surface.

Cortex. An especially differentiated, dense, and more or less fibrous ectosome.

Dermal membrane. A thin membranous ectosome, or the membranous outer layer of the ectosome.

Desma. An irregular, gnarled spicule. Fig. 5.

Deuterocladus. Vide *dichotriene*.

Diactinal. Term applied to a *uniaxial* spicule in which growth proceeds in opposite directions from the point of origin. Thus, two equivalent and usually similar rays (halves) are produced, the point of origin remaining at or near the middle of the spicule.

Dichotriene. A triene in which the cladi are dichotomously divided. The undivided part of the cladus is the *protocladus*. The distal divisions are the *deuterocladi*. Fig. 6.

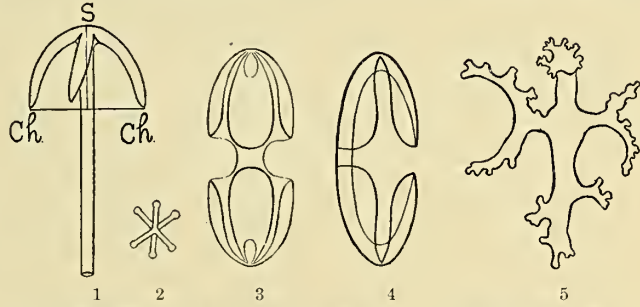
Ecactine. The centrifugal part of a radially arranged *rhabdus*.

Ectosome. The outer layer of the sponge, not containing flagellated chambers. The rest of the sponge body, containing flagellated chambers, is known as the *choanosome* or *parenchyma*.

Esactine. The centripetal part of a radially arranged *rhabdus*.

Euaster. Comprehensive term applied to asters in which the rays proceed from a center and not from an axis.

Filament. Term applied to the elongated thread-like bodies, of problematical nature, found in species of *Hircinia*. These bodies are 4 to 8 mm. long, very slender, and dilated at the ends.



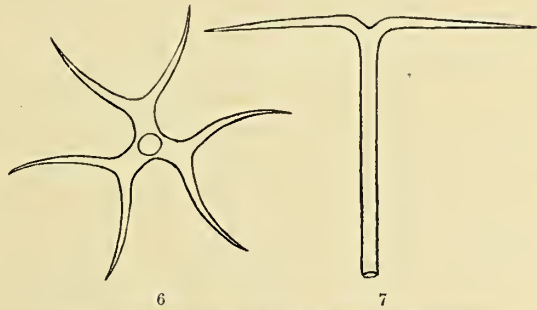
1. Anatriene. For lettering, see triene.

2. Chiaster.

3. Chela, face view.

4. Chela, side view.

5. Desma.



6. Dichotriene, view of the cladome, from above.

7. Orthotriene.

Isoactinate. When both *actines* of a diactinal spicule are alike in shape and size, the spicule is said to be *isoactinate*.

Isochela. A *chela* in which the two ends are alike and equal. Figs. 3, 4.

Main or primary fiber. A principal fiber of the skeleton, directed radially to the surface or extending longitudinally through the body.

Megasclere. One of the larger spicules which compose the supporting skeleton.

Microsclere. One of the small spicules scattered irregularly through the body in many sponges.

Microxea. A minute *oxea*.

Monactinal. Term applied to a uniaxial spicule in which growth proceeds in only one direction from the point of origin. Thus only one ray is formed, the point of origin remaining at the end of the spicule, which may or may not be swollen.

Orthodiæne. A reduced orthotriæne in which the cladome includes but two rays. Fig. 7.

Orthotriæne. A triæne in which the cladi make about a right angle with the rhabdome. Fig. 8.

Oxea. A uniaxial spicule gradually pointed at each end. Fig. 9.

Oxyaster. Euaster with small centrum or none, and in which the rays taper to points. Fig. 14.

Oxyhexaster. Hexact, principal rays of which divide into straight or bent terminals, which run out to a point. Fig. 11.

Palmate. Vide *chela*.

Parenchyma. Vide *ectosome*.

Pentact. Spicule with five rays; a reduced hexact. Fig. 12.

Plagiotriæne. Triæne in which the cladi are directed forward, making an angle of about 45° with the rhabdome produced.

Polyserial. Arranged in several rows.

Primary fiber. Vide *main fiber*.

Protocladus. Vide *dichotriæne*.

Protriæne. Triæne in which the cladi are directed forward, making an angle of less than 45° with the rhabdome produced. Fig. 13.

Rhabdome. Shaft of a triæne.

Rhabdus. A rod-like, uniaxial spicule; with like or unlike ends.

Rhaphide. A long hair-like spicule. Fig. 10.

Sagitta. Vide *triæne*.

Sanidaster. Microsclere consisting of a rod-like axis, bearing spines along its whole length. Fig. 15.

Sclere. Skeletal element or spicule.

Secondary fiber. A fiber extending directly or indirectly (as part of a reticulum) between two main fibers.

Sigma. Microsclere shaped like the letter "e." Fig. 16.

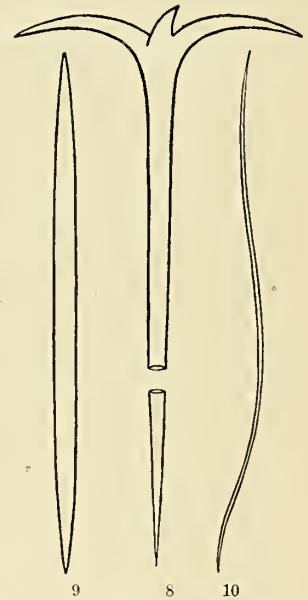
Sigma-spire. A rod-like microsclere spirally twisted. Fig. 17.

Somal. Said of microscleres which are found both in ectosome and choanosome. Such spicules often give the impression of belonging peculiarly to the ectosome.

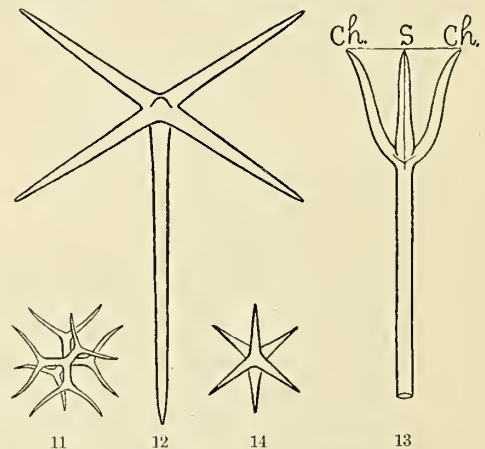
Sphærohexaster. Hexact, principal rays of which divide into terminals provided with spherical knobs at the ends. Fig. 18.

Spheraster. Euaster in which centrum is large as compared with length of the rays. Figs. 19, 20.

Spherule. A minute microsclere, more or less spherical in form. Fig. 21.



8. Orthotriæne.
9. Oxea.
10. Rhaphide.



11. Oxyhexaster.
12. Pentact.
13. Protriæne.
14. Oxyaster.

Spiculo-fiber. Tract of uniaxial spicules united by spongin to form a fiber, becoming, when spicules are reduced in number, a horny fiber containing spicules.

Spiraster. Microsclere consisting of a spirally bent axis, bearing spines on its outer surface. Fig. 25.

Spongin. The horny material uniting spicules together, or (as in the *Keratosa*) constituting the skeleton.

Sterraster. Euaster with numerous rays, which become soldered together. Fig. 23.

Streptaster. A comprehensive term applied to asters in which the rays proceed from an axis, and not from a center.

Strongyle. A uniaxial spicule in which both ends are rounded, but not swollen. Fig. 27.

Strongyloxea. A uniaxial spicule with one end simply rounded off, the other pointed. Not, in general, distinguishable in shape from the *style* (fig. 28). According to the terminology of Sollas (1888) the term is restricted to diactinal spicules, *style* being used for monactinal spicules of approximately similar shape. But in many cases the "point of origin" of the spicule can not be made out. Where I employ the term it is to facilitate reference to previous important descriptions.

Style or stylus. A uniaxial spicule with one end simply rounded off, the other pointed. Fig. 28.

Subdermal cavity. A comparatively extensive chamber just beneath surface, opening to exterior either directly through the pores or by means of short canals. A peripheral enlargement of the inhalant canal system.

Subtylostylus. A *tylostylus* in which the enlargement at one end (head) is very slight.

Tetraxon. Spicule in which the rays develop along four axes.

Tornote. A uniaxial spicule in which both ends are abruptly pointed. Fig. 26.

Toxa. A bow-shaped microsclere. Fig. 22.

Triane. A *tetraxon* in which a ray, distinguished as the *shaft* or *rhadome*, bears at one end three other rays, the *cladi*. The *cladi* together constitute the *cladome*. Forms of the *triane* are shown in figs. 1, 8, 13. Distance between the ends of two *cladi* is the *chord*, *ch.*—*ch.* in figs. 1 and 13. Perpendicular distance from the origin of the *cladome* (point where *cladi* spring from *rhadome*) to the *chord* is the *sagitta* (line *s* in figs. 1 and 13).

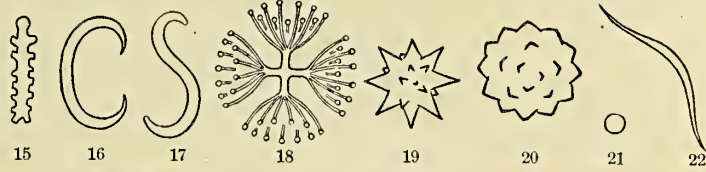
Trichodragmata. Hair-like spicules in bundles. Fig. 24.

Tylostylus. A uniaxial spicule pointed at one end, swollen at the other. Fig. 29.

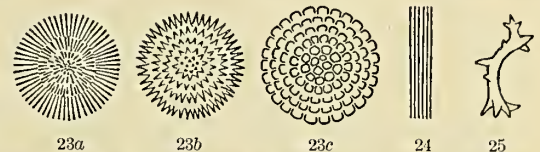
Tylote. A uniaxial spicule swollen at both ends. Fig. 30. *Used as an adjective* with respect to any spicule ray, it implies that the ray is swollen or knobbed at the end.

Uniaxial. Term applied to a spicule in which growth proceeds along only one axis. Spicule (*monaxon*) is thus rod-like, though it may be straight, or somewhat curved, or even bent. Figs. 9, 10, 26, 27, 28, 29, 30.

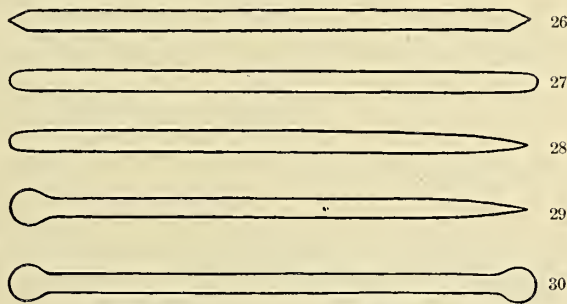
Uniserial. Arranged in one row.



15. Sanidaster.
16. Sigma.
17. Sigmaspire.
18. Sphærohexaster.
19, 20. Two forms of sphaeraster.
21. Spherule.
22. Toxa.



23. Stages in development of Sterraster: a, youngest stage; b, next condition; c, perfect spicule.
24. Trichodragmata.
25. Spiraster.



26. Tornote.
27. Strongyle.
28. Style.
29. Tylostylus.
30. Tylote.

Class I. CALCAREA Bowerbank.

Order HETEROCELA Poléjaeff.

With flagellated chambers, remaining parts of inner surface covered with pavement epithelium.

Family LEUCONIDÆ (LEUCONES) Hæckel.

The usually round flagellated chambers communicate with the central cavity by means of exhalent canals. Spicules irregularly scattered.

Genus PERICHARAX Poléjaeff (1883).

With distinct subdermal cavities.

Pericharax carteri var. *homoraphis*, Poléjaeff.

Pericharax carteri var. *homoraphis*, Poléjaeff, 1883, p. 6, pl. II, fig. 5; pl. VII, fig. 8.

Station 6090, seven specimens; station ?, two specimens.

Sizes range from a greatest length of 25 mm. to one of 10 mm. Variety of shape exhibited is interesting. A tubular or vase-like shape, expanded above, tapering below into peduncle-like portion, and with a single terminal osculum, is represented. The vase may be very low and wide; may be especially expanded above, and furnished with two oscula at the upper end; or the body may be of a massive, somewhat flattened character, with an osculum on upper surface and another at the margin. In a specimen of the massive shape one surface is convex, the other concave, with the appearance of having been attached; one osculum at the margin.

Color.—Specimens from station 6090, a fairly dark brown; those from station ?, very light brown.

Skeleton.—(1) Regular gastric quadriradiate spicules; facial rays straight, smooth, sharp-pointed, about 150 μ long; apical ray, sharp-pointed, straight or curved, often irregularly bent, sometimes rudimentary, usually 200 to 250 μ long. (2) Triradiate spicules of parenchyma differing from quadriradiates only in absence of fourth ray. Among them are scattered very large (similar) triradiates with rays sometimes exceeding 1 mm. in length; connected with smaller triradiates by intermediate stages. (3) Dermal and subdermal triradiate spicules, similar to the smaller triradiates of parenchyma (in var. *heteroraphis* becoming sagittal and irregular).

Class II. NON-CALCAREA Vosmaer.

Subclass I. TRIAXONIA F. E. Schulze.

Order HEXACTINELLIDA O. Schmidt.

With silicious spicules belonging to the triaxial type, or readily derivable from it.

Family MEANDROSPONGIDÆ Zittel.

Dictyonine hexactinellida (i. e., having the large parenchymal hexacts united in a firmly connected framework). Body consists of a connected system of labyrinthine anastomosing tubes, between which there is a connected interstitial system of intercanals.

Genus MARGARITELLA O. Schmidt (1880).

With the single species.

Margaritella celoptychioides O. Schmidt.

Margaritella celoptychioides, Schmidt, 1880, p. 54, pl. VII, fig. 7.

Margaritella celoptychioides, Schulze, 1887, p. 351, pl. CI, figs. 3-8.

Station 6056, nine fragments, all flattened pieces about 10 mm. thick, the largest 60 mm. wide.

Only fragments have been seen. From these O. Schmidt inferred that the body has a shallow cup-like form. The intercanals are commonly of a cylindrical shape, but externally are more or less united so as to give rise to the meandriiform furrows seen on outer surface of the sponge. The furrows or separate intercanals are covered in by a delicate dermal membrane perforated by pores and

supported by a reticulum composed of the tangential rays of dermal pentacts. The projecting rounded ridges also seen on outer surface, between the furrows, are perforated by numerous small apertures. On the inner (gastral) surface of the sponge are the mostly separate, rounded or elongate, sometimes confluent, apertures of the efferent canals, which extend out into the above-mentioned ridges.

Skeleton.—Meshes of dictyonal framework mostly triangular; beams covered with fine tubercles; nodes not thickened; slender tubercle-like bosses projecting freely on the bounding surface. Dermal membrane contains roughened pentacts; tangential rays usually somewhat dilated at the end, forming a supporting meshwork; proximal radial ray tapering, often no longer, or even shorter, than tangential rays, in other cases longer (as in Schulze's diagnosis). Very similar but smaller pentacts are arranged round the canals, the tangential rays lying in the canal wall, radial ray extending away from the canal longer than the others.

In the parenchyma are found: (1) Oxyhexasters, delicate, variable spicules; terminals, of which there may be two, three, or four, somewhat undulating; some of the principal rays occasionally undivided. (2) Sphaerohexasters of variable size and with a variable number of terminal rays.

Subclass II. DEMOSPONGIÆ Sollas.

Order I. TETRACTINELLIDA Marshall.

Some or all of the scleres are tetraxons, trienes, or desmas.

Suborder CHORISTIDA Sollas.

Without desmas. Megascleres not articulated to form a coherent skeleton.

Family TETILIDÆ Sollas.

Characteristic megasclere is a protriene. Microscleres when present are sigmaspires, but the sigmaspires are not infrequently absent.

Genus *CHROTELLA* Sollas (1886, 1888).

Ectosome is a cortex, excavated by subdermal cavities, and furnished with tangentially disposed spicules.

Chrotella minuta, n. sp.

Station 6070, one specimen.

Sponge body ovoidal, colorless, 6 mm. long by 5 mm. wide, with thickness of 4 mm., somewhat flattened on what is probably the under surface. Surface covered with small conuli, from which radiating bundles of long and diverging spicules project to a distance of 800 to 1,600 μ . Cortex, about 500 μ thick and very translucent, is occupied by a single layer of rounded subdermal spaces, about 300 μ deep, lying between the radiating spicular bundles. Cortex collenchymatous, deepest layer having fibrous appearance, owing to fusiform cells running tangentially. No oscula. Pores, few in number, open into subdermal cavities.

Skeleton.—Megascleres. (1) Oxea fusiform, smooth, 2 to 2.5 mm. by 40 μ ; eactine stouter than esactine. Spicule confined to and fairly abundant in the radial bundles. (2) Protriene; rhabdome, 2.2 mm. by 24 μ above, tapering to a very slender hair-like termination below; cladi 200 μ by 25 μ at the base, tapering to a point, noticeably incurved at apex; sagitta 160 μ with chord 240 μ ; confined to and most abundant spicule in the radial bundles. (3) Anatriene; rhabdome, 2 mm. by 20 μ just below cladome, then narrowing to diameter of 8 μ , which is preserved close to the fine point; cladi 60 μ in length with chord 110 μ and sagitta 48 μ , to 120 μ in length with chord 220 μ and sagitta 70 μ ; cladome with apical prominence; confined to and much the least abundant spicule in the radial bundles. (4) Scattered irregularly and in great abundance throughout choanosome, between the radial bundles, are small smooth isoactinate oxeas about 425 μ by 8 μ . Some of these spicules extend out into the deepest layer of the cortex, where they occupy a tangential or oblique position.

Microscleres. (5) Sigmaspire 12 μ long; abundant in dermal membrane and throughout cortex, especially in wall of subdermal cavities; common, but not abundant throughout choanosome.

The specimen is possibly merely a young form. It is much like *C. simplex* Sollas (Sollas 1888, p. 17, pl. n, figs. 1-4), differing chiefly in the presence of the abundant small oxeas and in the possession of conuli. Less important differences concern the size of the radial spicules and the degree to which they protrude.

Family STELLETIDÆ Sollas.

Megascleres are oxeas and orthotriænes, or plagiotriænes, or dichotriænes, frequently with anatriænes in addition. Microscleres include euasters, but never spirasters nor sterrasters.

Genus *PILOCHROTA* Sollas (1886, 1888).

"Oscules usually distinct. Pores in sieves leading into radial incurrent canals, which are not constricted on passing through the fibrous layer of the cortex. Ectosome differentiated to form a cortex, which usually consists of a middle collenchymatous layer, an outer thin fibrous layer, and an inner thicker fibrous layer." There is but one form of aster, and this is a chiaster.

Pilochrota variabilis, n. sp.

Station 6079, two specimens; station 6090, three specimens; station ?, ten specimens.

The sponges here described resemble several of Sollas's species (*P. hacketti*, *P. pachydermata*, *P. purpurea*, *P. lendenfeldi*), but the limitations laid down in Sollas's descriptions (1888) make it impossible to refer my specimens to any of these species.

Body spheroidal, often flattened. One specimen attached by its under surface obliquely to coral; the others free, many with foreign particles adhering to surface. Younger forms occasionally found with short (2 mm. or less in length) slender rhizoids on under surface; such rhizoids being prolongations of soft tissue almost without megascleres. Color in alcohol whitish or purplish-brown. The larger specimens measure mostly 20 to 25 mm. in diameter; the smallest, apparently young forms, 5 to 7 mm. in diameter.

In several of the larger specimens a single large osculum, 2 to 3 mm. diameter, is present, leading into a deep cloaca, on the inner wall of which the apertures of excurrent canals may be seen. Such an osculum may be situated in center of upper surface or nearer one side, then opening obliquely. In the attached specimen one such osculum is present on the side, low down, below the margin, while two other very small oscula, appearing as apertures in smooth membranous areas, are similarly situated. In one of the large specimens there are no oscula, but several smooth membranous areas on the surface. In another of the larger specimens a single small osculum is present in the center of a similar smooth membranous area. Most of the young (small) forms are without oscula, but in two cases a very small osculum is situated in center of upper surface. All oscula are surrounded by a smooth membranous border, narrow in the case of the larger ones. Appearances indicate that oscula may be opened and closed.

Pores of variable size, but easily distinguishable with lens, lying in meshes of the network formed by cladi of the cortical orthotriænes. Surface as seen with lens may be practically smooth and obviously porous, or punctate with minute elevations. Such elevations may be enlarged, appearing as areas of rounded polygonal shape, with pores in channels between—this appearance more obvious to eye than when sponge is examined with lens or objective, since the elevated areas themselves are porous.

Cortex in the larger specimens about 700 μ , in the younger forms only 500 μ thick; fibrous with abundant densely granular cells, often in groups, in the outer half. Numerous subdermal cavities in the deeper portion of cortex form a conspicuous layer. These are connected with short, wide (sometimes rounded) canals, which pass outward, branching near surface (often bifurcating), each branch terminating in a pore.

Skeleton.—Megascleres. (1) Orthotriæne; rhabdome, tapering to a fine often whiplash-like end, 1,350 to 1,700 μ by 12 to 24 μ ; cladi 100 to 250 μ (increasing with length of rhabdome), slightly curved outward, then straightening or recurved near tip; center of cladome depressed. (2) Very slender orthotriænes of variable size, probably young stages of the preceding, the cladi directed slightly forward so as to give to the spicule the plagiotriæne character; rhabdome tapering to fine long point. A common size has a rhabdome about 500 by 4 μ , cladi 20 to 24 μ . (3) Anatriæne with depressed apex, rhabdome tapering to point, 1,530 to 2,210 μ by 20 to 24 μ ; cladi stout, tapering to sharp point, with length 44 to 84 μ , and sagitta 20 to 80 μ , the sagitta increasing with the length of cladus, as does length of cladus with that of rhabdome. Cladome is thus comparatively shallow or quite deep. (4) Oxea smooth, tapering to sharp points, 1,020 to 1,600 μ by 12 to 16 μ , with much smaller forms of same spicule. (5) Ectosomal oxeas slightly curved, 168 to 200 μ by 6 to 8 μ . Such spicules occur scattered very sparsely through outer part of cortex; arranged vertically to surface and slightly project-

ing. The variations (many no doubt due to difference in the stage of development) in the size and shape of the megascleres, above indicated, may all be encountered in the same individual.

In the center of the sponge, oxeas (4) are the only megascleres. Spicules (1), (2), (3), (4), all radiate outward from central portion as far as the cortex. Just within cortex the cladi of the orthotrienes may be arranged in conspicuous concentric layers, the larger spicules on the outside. In other specimens this concentric arrangement of the cladi is not conspicuous, the orthotrienes of this region not being abundant, and nearly all comparatively small. From the interior separate spicules or bundles, containing each a few diverging spicules, radiate out through cortex to surface. Such spicules are large orthotrienes (1), accompanied by anatrienes (3), with occasional oxeas (4). Cladomes of the orthotrienes lie just beneath the surface. Anatrienes are frequently found projecting from surface.

Microscleres. (6) Chiasters with a very small centrum or none, the rays very slender, minutely roughened, and somewhat tylote. Choanosomal chiasters have diameter 12 to 16 μ and about 8 rays; somal, diameter 10 to 12 μ and about 12 rays. In some specimens the chiasters are rare throughout the sponge; in other specimens they may be abundant in the cortex and comparatively rare in the interior.

***Pilochrota fibrosa* (O. Schmidt) Sollas var. *globulariformis*, n. var.**

Ancorina fibrosa, Schmidt, 1870, p. 67.

Pilochrota fibrosa, Sollas, 1888, p. 180.

Station 6079, one specimen.

Schmidt (l. c.) gave the name of *Ancorina fibrosa* to a sponge of irregular, incrusting habitus, with a clearly differentiated cortex. Schmidt says the megascleres are similar to those of *A. simplicissima* Schm. In this latter sponge (Schmidt, 1868, p. 18; Taf. III, fig. 9; Taf. IV, fig. 9) are found oxeas, anatrienes (Anker "mit abwärts gekehrten Spitzen"), and plagiotrienes. Sollas (l. c.) examined one of Schmidt's preparations of this sponge and discovered chiasters, also determining size of oxea. He does not, however, in his diagnosis, mention the anatrienes.

The Porto Rico form, although differing in habitus from Schmidt's specimen, agrees with it in the character of its spicules, and must therefore be identified as belonging to the same species. The specimen is spheroidal, 35 mm. in diameter, with one osculum, 4 mm. in diameter, leading into a cloaca-like cavity, into which efferent canals open. Surface uneven and almost completely covered with broken pieces of shell. Color, reddish-brown.

Skeleton.—Megascleres. (1) Oxea 1.43 mm. by 0.027 mm., smooth, tapering to points. (2) Plagiotrienes very abundant; rhabdome about 1 mm. long, 24 μ thick above, becoming very slender below, tapering to fine point; cladi 80 μ long, nearly straight, tapering gradually to a point. Anatriene not abundant; rhabdome about 1.45 mm. long, 16 μ thick above, becoming very slender below, tapering to fine point; cladi 52 μ long, sagitta 44 μ .

Microscleres. (4) Chiasters are abundant and alike in ectosome and choanosome; total diameter 12 μ ; no differentiated centrum; rays tylote, 6 to 12.

Genus *TRIBRACHIUM* Weltner (1882).

Sponge produced into a special cloacal tube, the megascleres of which are orthotrienes. The characteristic microscelere is a sanidaster.

***Tibrachium schmidtii* Weltner.**

Tibrachium schmidtii, Weltner, 1882.

Tibrachium schmidtii, Sollas, 1888, p. 154, pl. XVII; pl. XXI, fig. 5.

Station 6067, four specimens.

Sponge body is spheroidal, 5 to 8 mm. diameter; cloacal tube 3 to 5 mm. long. The Porto Rico specimens differ from the type as described by Sollas in the character of the somal trienes. These in Sollas's description are orthotrienes, but he mentions that "sometimes one or more cladi are bifurcate" (l. c., p. 154); and in the explanation of fig. 17, pl. XVII, he mentions that dichotrienes occur near the base of the cloacal tube, but not elsewhere. In the Porto Rico specimens the somal trienes are all dichotrienes, but in view of the agreement in other respects with Sollas's description, it does not seem advisable to make a new species on this evidently variable characteristic.

Skeleton.—Megascleres: (1) Oxeas about 2.8 mm. by 34 μ . (2) Somal dichotriænes: Rhabdome about 2.5 mm. by 68 μ above. Cladi stout; protocladus about 150 μ by 68 μ ; deuterocladus about 170 μ by 50 μ at base, tapering to point; deuterocladi of same spicule not always of same length. Here and there are found dichotriænes with rhabdome much slenderer than in the type; and with cladi longer and also much slenderer than in the type. (3) Cloacal orthotriænes, with rhabdome 2 mm. by 25 μ above; cladi 475 μ long. No anatriænes observed, although such spicules were present in Sollas's specimens.

Microscleres: (4) Sanidasters 12 to 14 μ long, are abundant in parenchyma and very abundant in dermal membrane. (5) Sollas says "oxyasters would appear to be characteristically absent." He, however, observed a single spicule. In the Porto Rico specimens, a few minute and somewhat irregular asters having a total diameter 6 to 8 μ , with a small and variable number of slender rays (chiaster type), are present. In a small percentage of the sanidasters, the actines become fewer in number and longer, while the axis decreases in length. The asters just mentioned are, I think, to be regarded as excessively shortened sanidasters.

Family GEODIIDÆ Gray.

Megascleres include triænes. Characteristic microsclere is a sterraster.

Genus CAMINUS O. Schmidt (1862)

Megascleres are orthotriænes and rhabdi; anatriænes and prototriænes absent. Sterraster is spherical, and the somal microsclere a spherule. Osculum leads into a cloaca.

Caminus sphæroconia Sollas.

Caminus sphæroconia, Sollas, 1888, p. 214, pl. xxvii.

Station?, one specimen.

Specimen is massive, obconical, 80 mm. high; two oscula on upper surface.

Skeleton.—Spicules in general somewhat smaller than in Sollas's specimen (from Bahia). Megascleres: (1) Strongyle about 450 to 500 μ by 12 μ . (2) Orthotriæne; rhabdome 240 μ by 8 μ ; cladus about 148 μ . Microscleres: (3) Sterraster about 44 μ diameter. (4) Spherule, 4 μ diameter.

Order 2. CARNOSA Topsent.

Sponges without megascleres. Microscleres present or absent; when present, they are asters or 4-rayed spicules.

Suborder OLIGOSILICINA Vosmaer.

Sponges either entirely without skeleton, or with only stellate microscleres.

Family CHONDROSIDÆ F. E. Schulze.

With a fibrous cortex. Flagellated chambers opening by special canaliculi into exhalent cavities. Surface slippery.

Genus CHONDRILLA O. Schmidt (1862).

Bulbous or incrusting sponges with stellate spicules (spherasters associated in some species with oxyasters).

Chondrilla nucula O. Schmidt.

Chondrilla nucula O. Schmidt, 1862, p. 39, pl. III, figs. 22, 22a.

Chondrilla nucula F. E. Schulze, 1877, p. 24, Taf. IX.

Chondrilla nucula Lendenfeld, 1896, p. 34, Taf. I, VI, VIII, IX.

Station 6079, two specimens incrusting *Pachychalina amaranthus*.

Skeleton.—Spicules are spherasters, especially abundant in the cortex and accompanying the canals. In the Porto Rico forms (in one and the same individual) there is a considerable variation in the details of shape, as well as in the size, of the spicules. Schmidt, for Mediterranean forms, puts the total diameter at 27 μ , with smaller sizes. Schulze and Lendenfeld, for Mediterranean forms, put the diameter respectively at 10 to 20 μ and 13 to 28 μ . In the Porto Rico specimens the cortical

spicules vary but little. Total diameter from ray apex to ray apex is 28μ or close to it, with a ray length of 6μ . The spicule resembles that figured by Schmidt, rather than the other extreme present in Schulze's specimens; differing from the latter in having a longer, sharper ray, outline of which is not convex, but is either straight or slightly concave. About nine rays are seen round the edge when the equator of the spicule is brought into focus.

In the interior of the sponge the spicules vary more. Spherasters similar to those of the cortex are abundant, with a ray length 6 to 8μ . Smaller sizes of same spicule, down to 10μ diameter, are present. Forms with relatively larger body and shorter rays are also fairly common. In these, total diameter of which is 12 to 20μ , the rays are mere projections, 2μ and less in length, on the surface; outline of ray straight or frequently convex. Such spicules resemble those described by Schulze. Intermediate forms between the two extremes are fairly common; total diameter, 28 to 32μ ; ray length, 3 to 4μ ; rays with straight or slightly concave outline.

Order 3. MONAXONIDA Ridley & Dendy.

Silicious sponges in which the megascleres are uniaxial.

Suborder I. HADROMERINA Topsent.

Compact sponges, with skeleton radiately arranged, or without order, rarely forming spiculo-fibers, not reticulated, and usually without spongin. Megascleres, monactinal or diactinal, as a rule of a single kind. Microscleres, when present, some form of aster or microxea, never chelæ or sigmata.

Family COPPATIDÆ Topsent.

Megascleres diactinal. Body massive, rarely cyathiform. Microscleres absent, or when present euasters with which streptasters may be associated.

Genus COPPATIAS Sollas (1888).

Megascleres arranged partly in radiating fibers, partly scattered loosely in the choanosome; in the ectosome they lie tangentially. Microscleres are euasters.

Coppatias solidissima, n. sp.

Station 6079, two specimens, both fragments.

Both fragments elongated, flattened lobes, about 20 mm. thick and twice as wide, each prolonged above into a slender digitate solid process, rounded at the end. Total length of longest fragment 120 mm. Oscula, few in number, about 3 mm. diameter, all on one side. Consistency firm and hard; surface nearly covered with incrustations. Color: Exterior, dark slate-brown, with tinge of purple; colorless within.

Subdermal cavities fairly well developed. Granular pigment cells (brown), 16 to 20μ diameter, are scattered through whole body, but are densely crowded in dermal membrane, and internal to it for a varying distance, in places throughout the thickness occupied by the cortical brushes of spicules. Pores, about 40μ diameter, are grouped, four or five together, in small transparent pore areas, separated by heavily pigmented tissue. The arrangement is such that the pigmented tissue forms a network of trabeculae. (In this species, as elsewhere, the appearance of the dermal membrane must vary from time to time.)

Skeleton.—Megascleres: (1) Oxea, smooth, somewhat curved, 1 mm. by 28μ . Smaller sizes, doubtless younger stages of this, the chief, spicule, are common. These large oxeas are arranged: *a*, in radial cortical brushes; *b*, from some of the latter, bundles are prolonged into the interior; *c*, in numerous longitudinal main bundles, which are not very distinctly marked off from one another, the bundle arrangement most distinct in transverse section; *d*, scattered irregularly through the sponge body. The oxea is occasionally found with one rounded end (strongyloxea). It is noteworthy that occasionally a triene spicule is found properly placed among the cortical oxeas. In looking

through a number of preparations, I have seen three such spicules. Their position possibly indicates that they are not foreign. (2) Small smooth oxæas (microxæas Sollas), 60 by 3 μ , are abundant in the dermal membrane, where they are arranged tangentially; also scattered sparsely through interior.

Microscleres: (3) Minute chiasmata, 6 μ diameter, incrusting the dermal membrane in great abundance. Similar but somewhat larger chiasmata, 8 to 10 μ diameter, are sparsely scattered through interior.

In spiculation this species closely approaches *Coppatias (Stelletinopsis) purpureus* Carter (Carter 1886, p. 459), from Port Western, South Australia. Carter's description does not include details as to distribution of spicules.

Family TETHYIDÆ Topsent.

Body spheroidal or massive, with radiately arranged skeleton, and a more or less differentiated ectosome. When microscleres are present, the chief microsclere is some form of euaster.

Genus TETHYA Lamarck (1815).

Ectosome differentiated into a well-developed fibrous cortex. Megascleres are fusiform strongyloxeas. Microscleres are euasters of two kinds (spherasters and chiasmata).

Tethya seychellensis (E. P. Wright) Sollas.

Almo seychellensis, E. P. Wright, 1881, p. 13, pl. I.

Tethya seychellensis, Sollas, 1888, p. 427, pl. XLIV, figs. 1-6.

Ensenada Honda, Culcra, one specimen.

Sponge more or less spherical, attached or free, surface conulose, conules sometimes appearing as wide polygonal plates with denticulated margins. Oscules one or more in number; pores in sieves, situated in the depressions between the conules, leading into extensive intercortical cavities (Sollas).

Skeleton.—Megascleres. (1) Large strongyloxeas, 1.2 to 1.5 mm. long, with diameter 20 to 24 μ . Similar smaller spicules of varying size down to 300 by 4 μ are abundant.

Microscleres. (2) Cortical spheraster, 40 μ diameter. (3) Somal chiasma, 8 to 10 μ diameter. (4) Choanosomal aster, with a ray length 20 to 28 μ .

Tethya lyncurium (Lin.) Lamarck.

Tethya lyncurium, Sollas, 1888, p. 435, pl. XLIII, figs. 15-18; pl. XLIV, figs. 17-19.

Playa de Ponce light-house reef, three specimens; Ponce reefs, two specimens.

Body spheroidal, attached. Diameter of specimens 15 to 22 mm.; small oscula present on some, absent on others. Buds on some of the specimens. Outer non-fibrous part of cortex 800 μ , inner fibrous part 650 μ thick.

Skeleton.—Megascleres. (1) Large strongyloxeas, 1.2 mm. by 20 μ to 1.4 mm. by 28 μ ; oxæate end rounded, though often quite small. Essentially similar spicules of varying size, down to 340 by 4 μ , are abundant; in the smaller forms the oxæate end is sharp-pointed.

Microscleres. (2) Cortical spheraster, 72 μ diameter. (3) Somal and choanosomal chiasma, 12 to 16 μ diameter.

Genus TUBERELLA Keller (1880).

Without a fibrous cortex, and without microscleres. Chief megascleres are fusiform strongyloxeas, with small strongyloxeas at the periphery.

Tuberella aaptos (O. Schmidt) Topsent.

Ancorina aaptos, O. Schmidt, 1864, p. 33, Taf. IV, fig. 11.

Suberites aaptos, Lendenfeld, 1896, p. 140, Taf. VII, XII.

Tuberella aaptos, Topsent, 1900, p. 285, pl. VIII.

Mayaguez Harbor, one specimen.

Body is massive, higher than broad, 60 by 35 mm., attached below to coral; subdivided above into two short lobes, one with small (nearly closed?) terminal osculum opening into a short axial cavity. Surface smooth or covered with short papillæ. Consistency firm and fleshy. Color: Surface of specimen very dirty; clean parts light brown. In a gross section peripheral layer is slate colored; interior light.

Skeleton.—Strong spiculo-fibers about 0.5 mm. thick course, at oblique angles to vertical axis of body, through interior; breaking up 5 mm. or thereabouts from surface into smaller bundles, which radiate out to the surface. These fibers cross frequently, fusing at the points of intersection, and thus give rise to scattered, sometimes star-like, centers, from which the fibers seem to radiate. The outer smaller radiating bundles frequently (always?) arise from peripherally situated nodal points of this sort. Abundant scattered spicules lie between the fibers and peripheral bundles. At the surface are closely set diverging bundles of small strongyloxeas.

Megascleres. (1) Chief spicule is a smooth fusiform strongyloxea, 1.5 mm. by $40\ \mu$ or thereabouts; strongylate end greatly narrowed. Smaller stages in development of the same spicule are found. Occasionally oxeate end is rounded, spicule becoming nearly isoactinate. (2) Strongyloxeas of about same size as (1), not fusiform; with basal end rounded but not narrowed, and with tapering end also rounded at apex; not common. Both (1) and (2) make up the fibers and peripheral bundles, and are also found scattered. (3) Small strongyloxeas, frequently about 300 by $7\ \mu$, with basal end rounded not narrowed, make up the surface brushes; also scattered in interior, together with smaller slenderer forms, probably stages in development of same spicule.

Suborder II. HALICHONDRINA Ridley & Dendy.

Typically noncorticate; skeleton usually reticulate; megascleres usually either oxeas or styles.

Family HOMORRHAPHIDÆ Ridley & Dendy.

Megascleres all diactinal, either oxeas or strongyles; no microscleres.

Subfamily RENIERINÆ Ridley & Dendy.

The spicules may be united together by a small proportion of spongin, but are never completely enveloped in it.

Genus PETROSIA Vosmaer (1885).

Sponge usually hard; skeleton more or less confused; spicules oxeate to strongylate, packed together in tracts.

Petrosia halichondrioides, n. sp.

Station 6079, one specimen.

Sponge a cake-shaped fragment, about 50 mm. diameter, with a thickness of 15 mm.; outer surface convex and bearing one small eccentrically placed osculum 3 by 1.5 mm. Surface even and slightly pilose. Consistency very dense and firm, though not hard; sponge becoming hard and brittle on drying. Color: Exterior, chocolate-brown; interior, somewhat lighter.

Canal system of such a character that the sponge body is divided into trabeculae of a more or less uniform width (commonly about $60\ \mu$), the canals between being as wide or wider than the trabeculae. In the superficial region, the trabeculae and intervening canals in some places, but not universally, run more or less vertically to the surface; in the interior, they pursue a meandering course. Spicules in the trabeculae form tracts (scarcely bundles), which are vaguely defined, because the spicules are so loosely packed, without perceptible spongin. The tracts vary in thickness and distinctness, the larger ones sometimes running more or less vertically to the surface, again pursuing a tangential course. Following the anastomoses of the meandering trabeculae, the tracts of spicules form a quite irregular and vaguely defined reticulum. The tracts of spicules in the trabeculae of the superficial region pass, often very obliquely, into vaguely defined brushes of spicules which project radially from the surface.

Dermal membrane indistinctly differentiated from subjacent tissue, perforated by numerous, diffusely scattered, rounded pores about $40\ \mu$ in diameter. The spicules lying between the pores give rise to a loose reticulum. These spicules are merely the outermost layer of the main skeleton.

Spicules are slender for a *Petrosia*. Oxea $160\ \mu$ by 4 to $5\ \mu$, smooth and slightly curved; very commonly somewhat irregularly bent in the middle, or sometimes with a slight prominence at that point.

On comparing this species with a more typical *Petrosia*, such as *P. (Schmidtia) aulopora* Schmidt, we find that the regularity of arrangement in the canal system and skeleton of the latter, produced by the crossing of radial and tangential canals and spicule bundles, is absent in the Porto Rico species. Again, in the latter the spicules are much less closely bound together to form bundles, and the canals separating the trabeculae are not so wide. Hence *P. halichondrioides* is the denser of the two species. The loosely arranged spicules of the Porto Rico species suggest a close affinity with *Halichondria*. The spicules of the Porto Rico form are slenderer than in *P. aulopora*. In a specimen of the latter species, in the Museum of Comparative Zoology, the oxea measures 152 by 7 to 8 μ , is smooth, sharp-pointed (with exceptions), and somewhat curved or bent at the middle.

Genus FOLIOLINA O. Schmidt (1870).

Sponge a hollow stem with horizontal, lamellate processes embracing the stem. Upper end closed. Oscula absent. Texture loose, spongy. Spicules rather stout oxeas, which form polyserial tracts as well as a network. Tracts developed especially in the stem, though also radiating out into the processes.

Foliolina peltata O. Schmidt.

Foliolina peltata, O. Schmidt, 1870, p. 42, pl. IV, fig. 4.

Station 6067, seven specimens.

One specimen nearly perfect, 120 mm. long, with stem diameter of 6 mm.; radial length of lateral processes, 7 to 10 mm. Processes, of which there are six in this specimen, are at upper end of stem; lower end broken across, open. There are six other fragmentary specimens, in three of which the stem divides near upper end.

The lamellate appendages are flattened hollow lobes into which the axial cavity of stem is prolonged. Appendage convex above, concave below, and more or less incised round the margin. The only pores visible are on lower surface of appendages.

Skeleton.—Oxea, 320 by 10 μ , somewhat curved or bent in the middle, rounding off at each end to a sharp point. Wall of the stem, which is firm and 0.5 mm. thick, is supported by a dense renierine reticulum strengthened internally by polyserial bundles, which cross so as to produce a coarse network; superficially armed with projecting spicules. Skeleton of lower wall of appendage consists of a reticulum strengthened internally by radiating bundles of spicules. Upper wall supported by a reticulum, without the bundles; outer surface armed with projecting spicules. Cavity of lobe contains a good deal of sand. Soft parts of this interesting sponge have been almost completely macerated out.

Subfamily CHALININÆ (CHALINEÆ) O. Schmidt.

Spongine unites, usually envelops, the spicules so as to give rise to a distinctly fibrous skeleton.

Genus PACHYCHALINA O. Schmidt (1868).

Not tubular; skeleton composed of stout fibers, containing numerous spicules, arranged in several rows.

Pachychalina mollis, n. sp.

Station 6072, ten specimens; station 6075, one specimen; station 6079, two specimens.

Sponge body branching from the base. Branches, which themselves may divide, subcylindrical, long, 8 to 15 mm. diameter. Surface nearly smooth. Consistency compressible and elastic; rigidity insufficient (in the wet specimen) for the body to stand erect; body, on drying, becoming stiff and capable of standing, retaining its elasticity. Oscula 2 to 3 mm. diameter, arranged on one side of the branch in a not strictly uniserial row, commonly 10 to 15 mm. apart. Height of a specimen, from base to tip of longest branch, 400 mm. Color, grayish-brown, but with abundant traces of purplish-red, probably the natural color.

Skeleton.—Characteristic spicule is an oxea, about 140 by 7 μ , slightly curved and terminating suddenly in points. Oxea occasionally straight; rarely with one end strongly tylate; still more rarely, with one end strongly tylate and the other tylote. A slender modification (stage in the growth?) of the characteristic oxea, present in some abundance; 140 by 2 to 3 μ , with tapering ends.

Arrangement of spicules in body complex and irregular. Spiculo-fibers fairly abundant, 20 to 40 μ diameter, spicules crowded. Most conspicuous fibers (primary) extend vertically to surface; others cut these at a varying angle; others curve, following course of canals. In addition the parenchyma contains spicules in part scattered without order, in part arranged in uniserial or slender polyserial tracts. Such tracts, together with the scattered spicules and spiculo-fibers, give rise to an irregular meshwork; mesh varying greatly in shape, frequently with diameter equal to the spicule length. Spongin pale, not forming a distinguishable sheath over larger spiculo-fibers (needs to be demonstrated in glycerin).

In the dermal membrane similar spiculo-fibers, 20 to 80 μ diameter, make a close meshwork; meshes rounded and commonly 150 to 250 μ diameter.

Species closely akin to *P. megalorrhaphis* R. & D. (Ridley & Dendy, 1887, p. 23; pl. v); also to *P. lobata*, var. Ridley (Ridley, 1884, p. 404).

Pachychalina amaranthus (Duchassaing et Michelotti).

Phorbas amaranthus, Duchassaing de Foubressin et Michelotti, 1864, p. 92, pl. xxi.

Phorbas amaranthus, Carter, 1882, p. 287.

Station 6079, three specimens.

Sponge more or less cylindrical, branching from an attached, sometimes creeping, base; branches often bent. Diameter, 10 to 20 mm.; length of longest branch, 150 mm. Color, purplish brown.

Surface covered with numerous slender conuli, 2 to 3 mm. high, projecting outward and upward; conuli in lower part of body becoming smaller, less abundant, projecting outward. Dermal membrane supported by a skeletal reticulum with meshes sufficiently coarse to be easily seen with the eye when the pores are open. Dermal membrane overlies abundant subdermal spaces or canals, and through it the sponge tissue separating such spaces may be seen as a coarse reticulum, surface of the sponge thus acquiring an areolar appearance. This areolar appearance may be absent in certain parts (is absent over nearly whole surface in one specimen); dermal membrane appearing imperforate to the eye, and concealing the internal arrangement of cavities and trabeculae. Dermal membrane in such places shows under the microscope but few pores; and the appearance of such parts is therefore probably due to closure of the pores, and not to greater age, as Carter (l. c.) believed was the case.

Scattered abundantly over the surface are depressed, more or less circular, areas, about 2 mm. diameter, each consisting of a continuous membrane perforated in the center by a small aperture. On or in the membrane are scattered sand grains, foraminifera, broken pieces of foreign spicules, together with many spicules, most of which are foreign, arranged radially. The physiological significance of such membranous areas, which are present in other chalinine sponges, demands further study. Oscula, for the most part about 3 mm. diameter, are abundant over the upper surface; a few present on that part of the surface which looks down. Inner mass of body coarsely porous; in section, total canal area visible to eye is greater than the sponge tissue seen. Consistency firm, but body moderately compressible and elastic.

Skeleton.—(1) Characteristic spicule is an oxea, 200 to 220 μ by 6 to 7 μ , slightly curved or somewhat bent in the middle, and gradually pointed. (2) Much slenderer, raphid-like oxeas are abundant, 160 by 2 μ , or somewhat smaller; slightly curved, occasionally in an undulating fashion, and with tapering points. Transitional forms between (1) and (2) are found. A modification of the characteristic spicule is fairly abundant, in which one end is strongly latic.

In the dermal membrane spiculo-fibers, diameter of which varies greatly, between 20 and 250 μ , form a coarse reticulum; meshes commonly 200 to 500 μ diameter, irregular, but sometimes rectangular. From the strands of this reticulum tufts of spicules project outward at short intervals. Such tufts are about a spicule in length, and more often consist of a very few, about 3 to 6, spicules; sometimes stouter, containing a dozen or more spicules. In the interior similar spiculo-fibers form an irregular reticulum, meshes varying in size greatly. Free spicules are scattered in some number through parenchyma, and a few such lie in the dermal membrane. Spongin very pale and scanty, not forming a distinct sheath for the spiculo-fiber, although a thin film probably extends over surface of the fiber. This film, in a glycerin mount, is obvious in places, particularly in the angles between bundles and over projecting separate spicules.

Pachychalina rubens (Pallas)

Amphimédon arborescens, Duchassaing de Fonbressin et Michelotti, 1864, p. 79, pl. xiv, fig. 2.

Chalina rubens, Carter, 1882; p. 276.

Euchalinopsis rubens, Lendenfeld, 1887, p. 744.

Playa de Ponce light-house reef, one specimen; station?, one specimen.

Form variable, but often "extended into long processes characterized by large round vents. Texture firm, resilient. Color dark or light crimson-red" (Carter). Thickly set, rounded, squarish, or polygonal subdermal spaces, which are continued directly into canals, give the surface a porous appearance. In places, particularly at the upper end of specimens, these spaces have the linear arrangement shown by Duchassaing et Michelotti (l. c., pl. xiv, fig. 2), the tissue between the spaces corresponding to the "nervures." Interior excavated by large cavities, about as wide as the comparatively solid tissue separating them. Margin of the oscula ("vents") not usually elevated as in Carter's specimens, but as a rule forming a sharp inwardly projecting edge.

Skeleton.—The oxeas measure commonly about 160 by 4 μ . In the spiculo-fibers the spicules are not arranged very compactly, not filling the fiber. Main fibers (vertical to surface) commonly about 100 μ thick, with spicules in about eight rows; connectives 60 μ and less, with spicules in six or fewer rows. Regularity of meshwork, formed by main and connecting fibers, is interfered with by numerous spicules, scattered individually or in slender, loose tracts (in both cases surrounded by spongin), which irregularly subdivide the mesh. Spongin of spiculo-fiber abundant, though pale. Skeletal meshwork close; meshes with rounded corners (glycerin preparation), and about twice width of intervening fibers. Meshes of dermal reticulum squarish or polygonal, about 170 μ diameter; dermal fibers lying over the subdermal spaces slenderer than those over intervening regions.

Pachychalina areolata, n. sp.

Station 6088, one specimen.

Species evidently very close to *P. amaranthus* D. et M. A larger number of specimens may show transitional forms.

Sponge body a flattened mass rising up into lobes, some of which are digitate, others compressed. Thickness of lobes, and likewise of connecting basal portion, varies from 10 to 20 mm. Conuli absent. Surface smooth and coarsely reticular; studded with circular membranous areas, 1.2 mm. in diameter, perforated in the center. Oscula 3 to 5 mm. diameter abundant, at or near ends of lobes, on lateral surface of digitate lobes, on edges of flattened lobes. Oscula open into large single undivided canals, which in many cases extend for some distance into body of sponge, which is nevertheless not tubular (siphonochaline). Consistency firm, but compressible and elastic. Alcoholic specimen colorless.

Interior extremely porous, as in *Pachychalina amaranthus*. Directly beneath dermal membrane is a single and fairly regular layer of rounded subdermal spaces, about 1.2 mm. in diameter, separated by narrow-vertical trabeculae of spiculo-fiber, which support the dermal membrane. Owing to the coarseness of dermal reticulum, these trabeculae may be seen in surface view. Pores in meshes of dermal reticulum rounded, 50 to 350 μ diameter; absent in some of the meshes.

Skeleton.—Spicules. Oxea smooth, slightly curved, tapering to sharp points, 200 by 8 μ ; occasionally rounded at one end. Very slender raphid-like oxeas, 160 by 2 μ , are found; transitional forms between these and the typical spicule common.

Spongin of spiculo-fiber abundant, containing numerous and not very compactly arranged spicules. Fibers in general coarse, of variable diameter, often about 140 μ ; though varying from 80 to 425 μ . Except in the peripheral region where there are fibers vertical to surface with some transverse connectives, fibers form an irregular and coarse network. Abundant free spicules scattered through the parenchyma.

Supporting reticulum of dermal membrane consists of spiculo-fibers, like those of interior, of varying thickness, often 60 to 70 μ , forming meshes about 600 μ in diameter. Meshes sometimes subdivided by one or two slender, often uniserial fibers. Tufts of spicules united by some horny matter and usually less than a single spicule in length, project outwards at frequent intervals from dermal reticulum. The perforated circular membranous areas, referred to above, are loaded with sand grains and spicules, many of the latter being foreign fragments.

Pachychalina aurantiaca (Lendenfeld) Dendy, var. **dura**, n. var.

Cladochalina aurantiaca, Lendenfeld, 1887, p. 768.

Pachychalina aurantiaca, Dendy, 1894, p. 241.

Station 6079, one specimen.

Body digitate and branched. Total height, 90 mm.; diameter, 8 to 15 mm. Surface smooth. Abundant small subdermal cavities. No oscula. Pores where open, round and 60 to 80 μ diameter. *Consistency very firm.* Color, light brown.

Skeleton.—Spicules. Oxea 160 to 200 by 4 μ , smooth, slightly curved, and sharp-pointed. Very slender young stages of same spicule common.

Stout longitudinal spiculo-fibers, 130 to 170 μ thick, lie in axis of body. From these equally stout branches curve outward, dichotomizing more or less as they go, toward surface; just below which they expand, breaking up into radial tufts. The tufts are connected by tangential fibers, which support the dermal membrane. Connectives present both between longitudinal and radial main fibers, transverse or oblique polyserial bands always short, slender or about as thick as main fibers. In places proper connectives can not be said to exist, the main fibers here being so closely approximated as to fuse. The connectives for the most part are placed at such varying levels that the meshwork is irregular. In places, however, they form continuous lines, which may be approximately straight and parallel to surface; or, when deeper in interior, curvilinear and arching from surface to surface across the branch. Meshes very coarse, and as a rule much longer than wide. Fibers thickly packed with spicules; spicules also strewn in great abundance between the fibers. (Thick slices from which parenchyma has been removed with potash particularly useful along with ordinary sections.)

Dermal membrane in addition to the radial tufts contains abundant tangentially strewn spicules, especially noticeable where pores are closed. The tangential fibers above alluded to, which lie directly beneath and support the membrane, are about 50 μ thick, and of same character as fibers of interior; meshes inclosed by them, polygonal, frequently triangular, and about 170 μ wide.

Genus SIPHONOCALINA O. Schmidt (1868).

Tubular forms; tubes smooth both inside and out, each with a large opening at the summit.

Siphonochalina procumbens (Carter) Dendy.

Patulosecula procumbens Carter, 1882, p. 635.

Siphonochalina procumbens Dendy, 1890, p. 355.

Siphonochalina procumbens Dendy, 1894, p. 245.

Station ?, one specimen.

Sponge a repent, compressed, cylindrical mass, not excavated by a *continuous* cavity; bearing a number of short vertical inflated oscular tubes. Specimen macerated; skeleton light amber color.

Skeleton.—Spicules slightly curved oxeas, about 75 by 4 μ . "The skeleton is a beautifully symmetrical, rectangularly meshed reticulation of stout, horny fiber, rather sparsely cored by short, hastately-pointed oxeas. In the secondary fibers the spicules are arranged uniserially, and at some distance from one another; but in the primary fibers they are polyserially arranged and form a continuous axial core. The diameter of the fibers is about 0.07 mm., there being little difference between the primaries and secondaries in this respect. Toward the inner surface of the tube wall the network becomes irregular and very wide-meshed. The dermal skeleton is a polygonally meshed reticulation of stout, horny fiber, cored by sparse, uniserially arranged, oxeate spicules" (Dendy).

The Porto Rico specimen differs from the descriptions given by Carter and Dendy only in the character of the dermal skeleton, which is not quite smooth, but covered with villi. The villi are short, horny processes, including each a number of loosely arranged oxeas; produced by the extension of the main and secondary radial fibers. Secondary radial fibers are those intercalated between the main fibers; confined to the peripheral region. Villi, as well as a special network, are absent over the gastral surface.

Siphonochalina procumbens (Carter) Dendy, var. **infirmis**, n. var.

Station 6079, one specimen.

Sponge body divided into three tubular, probably repent, branches, fused with one another in spots; longest tube divided terminally into three short, wide, diverging branches, each with terminal osculum; one of the other tubes with single terminal osculum; remaining tube broken. None of the

short upright oscular tubes characteristic of type are present. *Paragastric cavity continuous throughout sponge*, and about 15 mm. diameter. *Tube wall thinner than in type*, only 2 to 3 mm. thick. Length of longest tube, 150 mm. Color dark amber, with purplish tint.

Skeleton.—Fibers of the general skeleton slenderer than in type, about 40 μ diameter. Dermal skeleton, a network of *slender* fibers, commonly about 8 μ thick, with meshes 100 to 120 μ diameter. From dermal surface small horny villi project, containing a few, sometimes only one, spicule; villi not exclusively situated at nodes of network, viz, not all peripheral extensions of radial fibers. Gastral surface also provided with a special skeletal network very similar to that of dermal surface; villi longer and thicker than on dermal surface, spicules of a villus often forming a pretty compact bundle. The origin of the dermal and gastral networks can readily be made out in this variety. In places the most superficial meshes of the general skeleton are simply subdivided by finer fibers, which extend between and only exceptionally overlie the coarser skeletal fibers. Elsewhere the system of fine fibers has reached a further stage of development and forms a *continuous* reticulum overlying the skeletal fibers.

Siphonochalina spiculosa Dendy.

Siphonochalina spiculosa Dendy, 1890, p. 254, pl. LVIII, figs. 2, 2a; pl. LXII, fig. 3.

Station 6079, three specimens, fragmentary.

The habitus of these fragments is interesting when compared with the typical *Siphonochalina* form of body. One specimen is 160 mm. long, of a cylindrical or in places flattened cylindrical shape; diameter 10 to 20 mm., except in the middle where body is twice as thick; broken off at both ends. On this specimen are five of the large pseudogastral orifices, which in *Siphonochalina* are typically found at the ends of tubular branches. Here all five are lateral, and distributed round the surface; two are flush with the surface; two are at the ends of very short, wide elevations; and one is near, but not at, the end of a somewhat more marked elevation. Another specimen consists of a cylindrical piece 60 by 20 mm., broken off at both ends, and bearing a somewhat slenderer and longer branch, also broken at the end. On this specimen are two of the large apertures, both strictly lateral (not at the summit of any elevation whatever).

Pseudogaster is narrow, somewhat winding in its course, diameter for the most part about 5 mm.; in places pseudogaster so narrowed as to be nearly interrupted. The transition in habitus and with respect to the pseudogastral system offered by these specimens to the *Pachychalina* type is obvious. Should the pseudogaster become quite discontinuous and the orifices strictly lateral, the sponge would have assumed the character of a *Pachychalina*. In both *S. intermedia* R. & D. and *S. annulata* R. & D. (Ridley & Dendy, 1887, pl. vii), it may be noticed that some of the orifices are not at the ends of tubular branches, but at the summit of small protuberances on the side of a branch or main axis.

The outer surface in two of the specimens, where intact, is marked with abundant depressed membranous areas, more or less circular, perforated in the center, about 1 mm. diameter. Such areas frequently connected together so as to form grooves or channels of varying length, often meandering. In the third specimen, surface shows faintly marked, irregular indentations, but the membranous areas are absent. The membranous areas overlie subdermal spaces of corresponding shape. Color of intact surface reddish purple. Consistency firm, hard; body incompressible.

Skeleton.—Spicules. Characteristic oxea, 140 to 160 μ by 4 to 6 μ . Very slender forms of the same spicule, often about 120 by 2 μ or somewhat smaller, are fairly common; transitional forms to characteristic spicule present. A modification of characteristic oxea, with one end strongylate, occasionally found. Spiculo-fibers stout, containing very numerous spicules, with but little spongin. Primary fibers about 60 μ diameter, and somewhat slenderer secondary fibers, may be distinguished, meshwork more or less rectangular, but rather irregular; meshes wide. On inner surface of tube-wall longitudinal fibers distinguishable. Spicules also scattered freely in parenchyma. "The dermal skeleton on the outer surface of the tubes consists of a fairly close, polygonally meshed reticulation of stout spiculo-fiber, containing a very large proportion of spicules and but little spongin; the average diameter of the fibers is about 0.03 mm. The ends of the primary fibers of the main skeleton form projecting nodes in the dermal network" (Dendy).

Genus *SPINOSELLA* Vosmaer (1887).

Tubular forms; inner surface of tubes smooth, outer covered with "spines, warts, or prominent ridges" (Dendy).

Spinoseella sororia (Duchassaing et Michelotti) Dendy.

Tuba sororia, Duchassaing de Fombressin et Michelotti, 1864, p. 46, pl. VIII, fig. 1.

Siphonochalina papyracea, O. Schmidt, 1870, p. 33.

Spinoseella sororia, Dendy, 1890, p. 360.

Station 6063, one specimen (dried); station 6079, one specimen.

The dried specimen consists of eight tubes, somewhat fused, radiating from the base. Other specimen consists of three tubes, somewhat fused, radiating in one plane, in a fan-like fashion, from base. All tubes open terminally by large apertures. Typical tube 150 by 25 mm.

Skeleton.—Spicules are slightly curved oxeas 75 to 90 μ by 3 μ . Main skeleton consists of a polygonally meshed reticulation of stout horny fiber, sparsely cored with spicules, which are much more abundant in the primary than in the secondary fibers. Dermal skeleton, a polygonal reticulation of slender fibers, 8 to 24 μ thick; fibers cored by uniserially arranged spicules; meshwork close, side of mesh about equalling length of spicule.

Inner surface of tubes marked with longitudinal veins, in which the skeletal fibers are stouter and make a closer reticulation than elsewhere; veins project freely round margin of terminal orifice. Inner surface also provided with projecting plumose bundles of spicules. Outer surface covered with strong spines, which project upward and outward from above-mentioned veins.

Family HETERORRHAPHIDÆ Ridley & Dendy.

Skeleton reticulate, never plumose. Megascleres of various forms. Microscleres usually present, but never chelæ.

Genus OCEANAPIA Norman (1869).

"Sponge consisting of a central body with closed or open tubular processes (fistulæ) projecting from it. Megascleres oxea or strongyla. Microscleres in the form of sigmata, or altogether absent. Skeleton usually coarsely spiculo-fibrous; with a bast-like reticulation beneath the dermal membrane." (Dendy.)

Oceanapia oleracea (O. Schmidt).

Rhizoachalina oleracea, O. Schmidt, 1870, p. 35, pl. IV, fig. 1.

Station 6079, one specimen.

Body tuber-like, with tubular processes arising from both upper and lower surfaces. In Schmidt's specimens "the flattened upper end is surrounded by tubes, dividing two or three times, and ending in numerous vesicular inflations clustered in rows." In the Porto Rico specimen the upper processes are stout and stiff, and do not divide; vesicular inflations elongate, narrowing toward apex. The lower processes, "roots," are also undivided, long, slender, and flaccid.

Skeleton.—The only spicules are oxeas, about 140 by 5 μ , with variable points; points often suddenly sharpened, end of spicule becoming concave; or end may taper gradually, without terminal concavity; or end may rarely be rounded. Spiculo-fiber forms a reticulum. Spicules very abundant in the fiber, also scattered in meshes of reticulum.

Genus TEDANIA Gray (1867).

"Megascleres of two kinds: (1) Monactinal; smooth styli forming the main skeleton; (2) Diactinal; tylota, strongyla, or tornota, typically dermal. Microscleres always present in the form of hair-like raphides." (Dendy.)

Tedania digitata O. Schmidt.

Reniera digitata, O. Schmidt, 1862, p. 75, pl. VII, fig. 11.

Tedania, O. Schmidt, 1870, p. 43.

Tedania nigrescens, Vosmaer, 1887, p. 338.

Tedania digitata, Ridley & Dendy, 1887, p. 51, plate XI, fig. 3.

Tedania digitata, Dendy, 1887, p. 158.

Tedania brucei, H. V. Wilson, 1894, p. 320, pls. XIX, XX.

Mayaguez Harbor, several fragments.

The fragments, which seem to have formed a large massive sponge, are coarsely porous, tear very easily, and are of a brown-yellow color. Preservation very imperfect.

Skeleton.—Spicules: (1) Style slightly curved and smooth, 240 by $8\ \mu$, the chief spicule. (2) Tylole 220 by $4\ \mu$, with slightly enlarged heads, which are minutely spined, sometimes only very slightly so spined or not at all. (3) The rhabdites are oxeas from 200 by $2\ \mu$ down through successive sizes to spicules only $40\ \mu$ long. The large forms, about $200\ \mu$ long, are the more common. In these one end is often less slender and tapering than the other, and a most minute roughening of the surface can be made out. The spicules are scattered irregularly through body, though there are ill-defined polyserial tracts (largely made up of styles), some of which extend vertically to the surface; also brushes of tyloles supporting the dermal membrane. Where several of the styles intersect they are cemented together by a small amount of spongin, and thus a vague and quite irregular reticulum is formed.

Schmidt (1870, p. 43) has shown how extremely variable is the habitus of the widely-spread sponges possessing the spicules mentioned above, and declines to erect new species for the West Indian forms.

Family DESMACIDONIDÆ Ridley & Dendy.

"Megasclera of various forms, usually monactinal. Microsclera always present and always including chelæ."

Subfamily ECTYONINÆ R. & D.

"Skeleton fiber echinated by laterally projecting spicules."

Genus MICROCIONA Bowerbank (Topsent emend. 1894).

Incrusting sponges. Skeleton a basal plate bearing short, upright plumose columns. Megascleres monactinal, smooth and spined. Microscleres: isochelæ, often accompanied by toxas, sometimes by sigmas.

Microciona spinosa, n. sp.

Station 6079, two specimens.

Sponge is a thin, firm incrustation covering a conglomerate mass of branched millepore coral and small lamellibranch shells. Total size of mass in one specimen 110 by 60 mm., in other 80 by 50 mm. Incrustation 0.5 mm. or less in thickness, and closely beset with spine-like radiating processes, frequently divided terminally, 1 to 2 mm. high and about $600\ \mu$ thick. (Where incrustation is apparently young the body is particularly thin and the radiating processes are just beginning to develop.) From ends and sides of the processes, and from the general surface, stout styli project $200\ \mu$ or more beyond dermal membrane. The styli, which are the echinating spicules of the horny skeleton, may be in small tufts or distributed singly. Color a dull pink.

Skeleton.—Horny skeleton consists of an extremely thin basal membrane, bearing stout radiating columns, latter forming the support of the spine-like processes. In the thicker parts of the incrustation the basal membrane may develop on its outer surface rather vaguely marked ridge-like thickenings, which by their union give rise to a strengthening network of tangential bands, thus suggesting on a most minute scale the arrangement of the trabecule in the honey-combed species of *Echinoclathria*. (Ridley & Dendy, 1887, pl. 31.)

Spicules.—Megascleres: (1) Stylus smooth, with the merest trace of a constriction just below rounded end, tapering to sharp point, 340 by $20\ \mu$, with smaller sizes present; echinating the radiating columns, issuing for the most part in tufts—especially from ends, though also from sides—of columns; projecting, also, singly or in small tufts, from the basal membrane; also included as an axial string (though in places absent) in radiating columns; included much less abundantly in basal membrane. (2) Slender subtylostylus, smooth and tapering to point, $280\ \mu$ by $3\ \mu$ a common size; abundant in parenchyma; also included, but not abundantly, in the several parts of the horny skeleton, especially in basal plate. Microscleres: (3) Small palmate isochelæ 12 to $14\ \mu$ long, very abundant throughout parenchyma. (4) Toxa $64\ \mu$ long, smooth, and so slender as to be inconspicuous in balsam preparations; fairly numerous in parenchyma, abundant in places. (5) Rhabdite oxea $300\ \mu$ long, straight or somewhat curved; sparsely present here and there in parenchyma. These spicules are probably elongated toxas, as in some species of *Clathria*. I have not, however, seen transitional stages, owing possibly to the scant numbers of this spicule.

A comparison of the Porto Rico form with *Microciona prolifera* Verrill (Verrill & Smith, 1874, p. 741) is interesting. The latter species is an incrusting form on shells and stones, common from

Cape Cod to South Carolina. In it the surface exhibits no spinose projections, but bears, at comparatively great intervals, large projecting processes. Beneath the comparatively uniform surface, buried in the sponge body, are, however, small, closely set, horny columns, projecting upward from the basal plate. These columns may anastomose, the radial growth which leads to the production of the columns continuing from the new level thus formed. Where the sponge body is thin and the columns are free from one another, the horny skeleton is essentially like that of *M. spinosa*, except that the columns are closer and the surface is not molded over them, as in the latter form. The megascleres are very similar in the two species. In *M. prolifera* the large stylus measures about 250 by 16 μ ; and the head, which may or may not be (in same specimen) most minutely tuberculate, is somewhat more marked (tylostylole condition) than in *M. spinosa*. Isochele 16 μ long, and toxas 40 μ long, are present, but in very small number. The data given relate to Beaufort (North Carolina) specimens of *M. prolifera*. The indication is that the two sets of forms may intergrade.

Genus **CLATHRIA** O. Schmidt (1862).

"Skeleton a reticulation of fiber, usually with much spongin, cored by smooth styli and echinated by spined styli. Typical microscleres, small palmate isochelæ" (Dendy). In addition to isochelæ, toxas may be present.

Clathria clathrata (O. Schmidt).

Tenacia clathrata, O. Schmidt, 1870, p. 56.

Station 6079, one specimen.

From Schmidt's description, the following is drawn: Sponge body consists of cylindrical branches, which may anastomose freely or may be widely divergent. Horny skeleton exceedingly well developed. Fibers yellow, echinated abundantly with spined styli; including long styli, more commonly tylostyli, and many spined styli. In the spined stylus the shaft, immediately below spinose head, is smooth; rest of shaft spinose; the sharp-pointed end again smooth. Chelæ something over 10 μ long. Very slender toxas and sigmas? (*Spangen*) present. Ends of the horny fibers extend out into the easily separable dermal layer. From each such end radiate spicules, not united by spongin, in a thick bundle. In the dermal layer are numerous brushes, spicules in a brush radiating in very divergent fashion. Between the brushes lie the same spicules, partly in tracts, partly scattered.

In the Porto Rico specimen the body is divided dichotomously into a few slender subcylindrical branches, 5 to 8 mm. diameter. Branches widely divergent on one side of specimen, on other confluent, in typical *Clathria* fashion. Surface smooth, except for scattered, mostly small, protuberances. No oscula visible. Consistency firm, hard. Color, light gray. Total height of specimen, which is not entire, 150 mm.

Skeleton.—Reticulum, formed by the stout, horny fiber, is dense and massive, nearly filling the sponge body, but stopping short of the surface. From it extend out, vertically to surface, closely set, short, strong, horny processes, which are very thickly echinated with the spined styli.

Spicules: (1) From the ends of the processes, comparatively stout, smooth styli, 300 by 10 μ or somewhat smaller, radiate; mingled with these may be equally long but slenderer subtylostyli or styli. (2) Megascleres, imbedded in horny fibers and scattered in parenchyma, are chiefly slender, smooth, subtylostyli, 200 by 4 μ to 350 by 6 μ ; with some strictly stylole forms. (3) Spined stylus, echinating and included in horny fiber, 50 to 60 μ by 5 μ . (4) Dermal brushes and tracts made up of smooth, slender subtylostyli, 100 by 2 μ to 200 by 4 μ . Microscleres. (5) Isochelæ commonly 12 μ long; smaller ones present. (6) Toxas about 60 μ long, together with elongated toxas, passing by transitions into greatly elongated raphides, all together forming a loose bundle. No sigmas found.

Clathria jugosa, n. sp.

San Antonio Bridge, San Juan, one specimen.

I follow Dendy (1895, p. 31) in merging *Rhaphidophlus* Ehlers (1870) in *Clathria*. If *Rhaphidophlus* were to be retained, the species here described would fall in that genus. But such a form as *Clathria clathrata* Schmidt shows how impracticable it is to divide forms with, from those without, a dermal crust.

Sponge body laminate, 130 by 50 mm. with thickness of 10 mm. Lamina bifurcates at one end, plane of division being that in which lamina is compressed; both surfaces covered with conuli about

2 mm. high. Over most of the surface the conuli are arranged very distinctly in rows, which extend in parallel lines across the lamina; conuli close together, so that the rows form ridges, intervening depressions appearing as furrows 2 to 3 mm. wide. Over a part of the surface the conuli are irregularly distributed. Dermal membrane distinct and tough. No pores visible. A few small apertures, presumably oscula, 1 mm. and less in diameter, perforate the dermal membrane at the bottom of the furrows. Sponge very firm, flexible, and elastic. Color, light gray.

Skeleton.—Main skeleton consists of an irregular and dense reticulum of stout spiculo-fiber, processes from which extend up into conuli. Spiculo-fiber very variable in thickness, largely composed of horny matter, cored with (1) smooth styli 250 to 300 μ by 4 μ , tapering to sharp point, sometimes slightly bent. (2) Spined styli, 60 by 6 μ , echinating the fiber; also scattered in parenchyma. The shaft directly beneath spined head is smooth; rest of shaft spinose, terminating in smooth, tapering, sharp-pointed end (like corresponding spicule in *Clathria clathrata* Schmidt). (3) Styli similar to (1), but somewhat thicker and longer, lie freely scattered in parenchyma. (4) Stouter styli, 200 to 250 μ by 8 μ , also occur, both in parenchyma and in spiculo-fiber as well. (5) From projecting points of the skeletal reticulum multispicular bands of slender styli, similar to (1), radiate out toward the surface, expanding and becoming continuous with the dermal brushes. (6) There is a dermal crust, consisting of closely-set brushes of diverging styli similar to (1); pointed ends of styli, projecting a considerable distance beyond the surface.

Microscleres: (7) Isocheke 12 to 14 μ long, abundant. (8) Toxas smooth, abundant. When small, 50 to 60 μ long, the shape is typical, although the curving is frequently such that the spicule does not all lie in one plane. All transitions are found between the toxas and long, hair-like oxate spicules, up to 300 μ in length, which may be nearly straight or variously curved. Toxas and hair-like spicules frequently form loose bundles.

Genus AGELAS Duchassaing et Michelotti (1864).

“Of various form; with well-developed, horny fiber echinated by verticillately spined stylote spicules. No microsclera and no other megasclera” (Ridley & Dendy).

***Agelas schmidtii*, n. sp.**

Siphonochatinopsis sp., O. Schmidt, 1880, p. 80.

Station 6079, one specimen.

Sponge body elongated, tubular, with a few short branches. Diameter of tube, for the most part, about 12 mm.; thickness of tube wall about 2 mm. Total length of specimen 130 mm. Surface smooth and finely pilose. Consistency firm and, in the thinner places, parchment-like. Color yellowish-brown, with a tinge of washed-out red here and there.

Oscula, 1.5 to 2.5 mm., are found at the ends of branches; also scattered over surface of the sponge body in general. In some cases osculum appears as a perforation of a smooth, depressed, membranous area, which may be rounded or irregularly elongate. In other cases osculum is not surrounded by such a membranous border. Membranous areas of this sort, which are not perforated, are scattered over the general surface. It seems probable that oscula may appear in such areas.

Dermal membrane is pierced by the thickly scattered, radially projecting spicules, which echinate the superficial skeletal fibers. Membrane also thickly incrustated with the spores and hyphae of a fungus. No pores visible on outer surface of sponge. Membrane lining the tubular cavity exhibits scattered pores or pore areas; pores 20 to 40 μ diameter. Flagellated chambers, 16 μ diameter.

Skeleton.—Skeleton consists of a reticulum of horny fiber, echinated sparsely in the interior, abundantly at the surface, with verticillately spined stylotes. Primary fibers, 50 to 60 μ thick, about 500 μ apart; extending more or less radially, often very obliquely, from inner to outer surface; both echinated and cored by the stylotes, coring spicules abundant in some places, scanty in others. Secondary fibers, 30 to 40 μ , echinated, but not cored, by stylotes, though a spicule, imbedded longitudinally, may here and there be found; forming with one another, and with the main fibers, irregularly arranged rounded polygonal meshes of variable diameter, commonly 140 to 250 μ .

The stylote spicule, in addition to echinating and coring the horny fiber, is scattered freely in parenchyma. Spicule varies a good deal in size, from 200 by 8 μ to 90 by 4 μ ; base usually truncated, occasionally pointed; distal end tapering to sharp point; as a rule four spines in each whorl. Spines are relatively longer, and the whorls more conspicuous, in the smaller and medium-sized spicules than in the largest.

Schmidt (loc. cit.) divides his *Chalinopsis* species into two groups, the one including solid forms (*Pachychalinopsis*), the other tubular forms (*Siphonochalinopsis*). Of the latter group he had but a single specimen, which he mentions was 9 cm. high, with a wall 3 mm. thick, and with spicules like those of *Chalinopsis* (Agelas). Schmidt thought it unnecessary to found a species name on such slight material. Schmidt's specimen in the Museum of Comparative Zoology is essentially identical with mine, although the wall is thicker, color is dark brown, and the whorls of spines on the spicules are somewhat more distinct, the number in a whorl usually exceeding four (6 to 8, about).

Carter (1883, p. 312) makes mention of a British Museum specimen of *Agelas* (*Ectyon*) which consists of several thick ($3\frac{1}{2}$ in. maximum), hollow cylinders. It seems to me unnecessary at present to separate the tubular forms of *Agelas* (*Chalinopsis*) from the solid forms.

Family AXINELLIDÆ Ridley & Dendy.

"Skeleton typically non-reticulate, consisting of ascending axes of fibers from which arise subsidiary fibers radiating to the surface. Fibers typically plumose. Megasclera chiefly styli, to which oxea and (or) strongyla may be added. Microsclera rarely present, never cheke." (R. & D.)

Genus PHAKELLIA Bowerbank (1864).

"Sponge more or less flabellate or cup-shaped. Skeleton often more or less reticulate. Megasclera styli and often oxea. No microsclera" (R. & D.). Styli may be represented by tylostyli.

Phakellia lobata, n. sp.

Station ?, four specimens.

Sponge body usually a flattened vertical lamina 5 to 7 mm. thick; wide in the larger specimens, narrow and even club-shaped in the smallest; narrowing below to an irregular and, in some cases at any rate, incrusting base. Lamina in its upper portion is split into lobes; other lobes arise through the excessive development of ridges on either of the flattened surfaces. The underlying flabellate character is thus partially disguised by a frutescent appearance. The irregularity in the general shape may be further increased through the partial coalescence of lobes, and through the curving of the lamina by which local concavities may be produced.

Surface smooth and in a drying sponge velvety in appearance, owing to the fine projecting spicules. Very few oscula to be seen; these small, 1 to 2 mm. diameter, and disposed irregularly over one of the flattened surfaces. Pores not visible. Dermal membrane, containing the cortical brushes of spicules, is thick and well marked off from the internal body. Sponge firm, the bundles of spiculo-fiber having a cartilage-like consistency. Color, grayish brown, the inner spiculo-fiber much darker. Height of largest specimen 150 mm.

Skeleton.—Internal skeleton made up of coarse bundles which radiate upward through sponge body, occupying a large part of the interior. These are composed of correspondingly arranged, vaguely defined spiculo-fiber (tracts the spicules united by a small amount of horny matter) and scattered spicules, the whole forming a loose reticulum. From this internal skeleton bundles pass out to the surface, where they meet and mingle with closely set cortical brushes of small, diverging spicules. Latter project a short distance beyond the surface.

Spicules. (1) Tylostyli, composing the cortical brushes, 200 to 300 μ by 3 to 4 μ , with conspicuous rounded heads which frequently are pointed or slightly knobbed at the apex. (2) Similar but much larger tylostyli, commonly 650 to 850 μ by 10 to 15 μ , although forms of all sizes are found, grading down to the small ones at the surface; composing the bundles, and also scattered freely. In the large tylostyli the head, which frequently exhibits a low, knob-like elevation at the apex, is not so conspicuously developed as in the smaller forms. The tylostylote character of the spicules is a marked feature of the species.

In its external appearance this species resembles the frutescent (*staudenartig*) forms mentioned but not specifically described by O. Schmidt (1880, p. 81). It is evidently closely related to *P. flabellata* R. & D. (1887, p. 171); name of this species now changed to *P. jacksoniana* Dendy (1896, p. 236). The brushes of surface spicules are not developed round an axial larger spicule, as in the latter species.

Genus *AXINELLA* O. Schmidt (1862).

"Sponge typically ramose, but may be massive. Skeleton fiber plumose. Megasclera stylote and sometimes oxeate. No microsclera." (R. & D.)

Axinella reticulata Ridley & Dendy.

Axinella reticulata Ridley & Dendy, 1887, p. 184, pl. xxxvii, figs. 4, 4a.

Station 5079, one specimen.

Specimen consists of a cylindrical, upright lobe, 80 mm. by 20 mm., rising from an enlarged and broken basal part. Dermal membrane *minutely reticulate*, containing a few scattered spicules, and the brush-like ends of the radial fibers. Reticulation of dermal membrane (best seen with lens, surface under fluid) not due to skeleton, but to thickenings of dermal membrane itself. Rather numerous oscula, 2 to 3 mm. diameter, distributed over surface, not as in type at summits of oscular tubes. Surface beset with numerous small conuli. Consistency firm, sponge almost incompressible. Color, salmon-pink (type, pale yellow).

Skeleton.—"There is an extremely irregular reticulation of scattered spicules, among which one can distinguish rather loose plumose fibers running more or less vertically towards the surface" (R. & D.). In the Porto Rico specimen there are longitudinal fibers, from which radial fibers curve outward toward surface. Fibers are loose, but coarse and distinct, except in regions where the scattered spicules are crowded. Spicules in the fibers very abundant.

Spicules. (1) Chief spicule is a stout, smooth, slightly curved style, 340 by 16 μ (type, 450 by 20 μ), usually with a bend toward the base. (2) Smooth, slightly curved oxeas, of about same size as the styles, are infrequently met with.

Genus *THRINACOPHORA* Ridley (1885).

"Sponge ramose, with a dense central axis of spiculo-fiber; megasclera styli and (or) oxea, and (in some species) cladostrongyla. Microsclera present in the form of trichodragmata." (R. & D.)

Thrinacophora spinosa, n. sp.

Station 6072, three specimens.

Sponge body cylindrical, erect, and branching from the base. Branches lateral, but all more or less parallel; tapering gradually toward the end; after forming, may again fuse with one another. Surface covered with closely set, stiff, conuli, 2 to 3 mm. long, and about 2 to 3 mm. apart; each tapering distally to a point; and all pointing outward and more or less upward. A few divergent spicules (spicule 1), about equal in size, in number up to 5 or 6, protrude from apex of each conulus. Oscula, 2 mm. and less in diameter, are scattered, not abundantly, over surface of branches. Common diameter, excluding conuli, about 7 mm; height of largest specimen 220 mm. Color, brown. Between axial core and dermal membrane are fairly numerous subdermal spaces and canals.

Skeleton.—Skeleton of axial core consists of compact mass of spiculo-fiber; from which bundles radiate obliquely upward and outward into the superficial conuli, as may best be seen in a macerated sponge. Spiculo-fiber consists of abundant spongin, in which some of the spicules are completely imbedded, while most are only partially imbedded. Spiculo-fiber of axial core forms a network; meshes more or less rounded in transverse section, elongated in longitudinal section.

Characteristic spicules of the spiculo-fiber are (1) style, about 1,100 by 10 to 12 μ , smooth and evenly rounded at the base, tapering to a point, slightly curved. (2) Oxea, about 250 by 8 μ , smooth, tapering to not very sharp points, slightly curved or bent at the middle. Smaller forms of these two spicules are fairly common, style measuring often only 800 by 8 μ , oxea 200 by 6 μ . A less characteristic spicule is (3) style, very slender and of very variable length; often 800 to 1,100 μ by 5 μ ; much smaller forms, down to 400 μ by 3 to 5 μ , also common; frequently somewhat curved in an undulating fashion.

Microsclera. In the dermal membrane (4) trichodragmata are abundant; bundles measuring about 120 μ by 8 to 12 μ . I have not been able to find them in the interior of the sponge, but this part of body is badly macerated.

Order 4. KERATOSA Grant.

Sponges in which the skeleton is composed of horny fibers without proper spicules.

Family SPONGIDÆ Poléjaeff.

Skeleton consists of reticulating fibers with very slender axial core. Flagellated chambers small, opening by special canaliculi into exhalent cavities.

Genus CHALINOPSILLA Lendenfeld (1889).

Branching, generally digitate *Spongidae*, with smooth surface and reticulate dermal skeleton. Connecting fibers generally unbranched, forming with the simple main fibers a network with square meshes 0.2 to 1 mm. wide. Imitating Chalinids.

Chalinopsilla pilosa, n. sp.

Station 6080, one specimen.

Sponge body solid, consisting of two diverging somewhat flattened cylindrical processes united at the base. One process has a length of 100 mm., the other of about 30 mm.; diameter varying from 8 to 17 mm. Both processes have rounded ends. Color a dull purple, pinkish inside.

Surface with minute conuli, which may be rather vaguely arranged to form ridges. Main skeletal fibers protrude slightly, giving surface a pilose character. Pores thickly scattered, leading into small rounded subdermal cavities. Small oscula, 1 to 2 mm. diameter, are found on the sides and at the ends of the digitate processes. Several of the more conspicuous lead into longitudinal efferent canals, which for some distance course along the sides of the digitate processes, separated from the exterior only by the dermal membrane; latter sunken so that the position of the canal is indicated by a superficial groove.

Skeleton.—Longitudinal fibers lie in the axis, sending off radial branches, which pass upward and outward toward the surface. The axial main fibers are about 400 μ apart, somewhat closer together than the radial main fibers, the interval between which is about 550 μ . Axial and radial fibers are alike, about 40 μ thick, with a granular core about one-third the thickness of fiber, containing spicule fragments very sparsely imbedded. Connecting fibers about 24 μ thick, without inclusions, meeting main fibers with an expanded base, which is frequently perforated. When the perforation is large the fiber appears to arise by two roots. In most connecting fibers in a glycerin preparation a very thin axial granular core may be indistinctly made out (doubtless universally present). Spongin in both main and connecting fibers faintly stratified. Connecting fibers may be quite simple, stretching from main fiber to main fiber, thus giving rise to large rectangular meshes. Such meshes may be subdivided by the intercalation between two of the main radial fibers of one or two comparatively short radial fibers, the resulting meshes being still rectangular. Or the connecting fibers are frequently somewhat bent and branched, so as to give rise to irregularly polygonal meshes, commonly with a diameter one-half or one-third the interval between the main fibers.

The radial fibers, as already mentioned, protrude some little distance beyond the surface. The most superficial connectives lie in the dermal membrane, and thus form a dermal reticulum. The closeness of the meshwork varies greatly. In places the meshes are 200 to 250 μ in diameter, while elsewhere the diameter may be three times as great. Fibers of the dermal reticulum are alike and somewhat slenderer than the average skeletal fiber, about 20 μ in diameter.

The species resembles *C. dichotoma* (Lendenfeld, 1889, p. 142, pl. 2, fig. 4; pl. 3, figs. 3, 11) perhaps more closely than it does the other species of the genus. It differs from *C. dichotoma* mainly in the character of the surface, in the frequent irregularity of the skeletal meshwork, in the variable character of the dermal reticulum, in the greater slenderness of the fibers in general, and in the exceeding scarcity of foreign inclusions.

Genus EUSPONGIA Bronn (1859).

Skeletal network pretty evenly developed throughout the, in general, massive body; fibers slender and meshes very small. Simple main fibers usually with inclusions, and finer connecting fibers without inclusions easily distinguishable, the latter branching and continually anastomosing.

Euspongia officinalis (Linnaeus) var. **rotunda** Lendenfeld.

Euspongia officinalis var. *rotunda*, Lendenfeld, 1889, p. 269.

Ensenada Honda, Culebra, two small, flattened, massive specimens; station (?), one somewhat larger, elongated, massive specimen 80 mm. high, waterworn. Upper surface covered with minute sharp-pointed conuli, which disappear on the sides as the edge of attached under surface is reached. Color of upper surface blackish, fading away on the sides into livid.

Skeleton.—Main fibers have a diameter commonly between 40 and 60 μ , occasionally widening in spots; about 800 μ apart; abundantly cored with spicule fragments, rarely with sand grains. Secondary fibers measure, for the most part about 20 μ diameter. Mesh is polygonal, frequently five-sided, with both rounded and angular corners, diameter commonly in neighborhood of 200 μ , but varying considerably.

The distinctive features of the numerous varieties of the "bath sponge" are of such a vague intangible character, that I refer the Porto Rico specimens to a particular variety with considerable hesitation.

Genus HIPPOSPONGIA F. E. Schulze (1879).

Sponges with fine skeletal fibers, forming a network with comparatively small meshes, 0.1 to 0.5 mm.; in the network thicker main fibers may or may not be distinguishable. Body permeated by a system of large canals (vestibular spaces), the intervening sponge tissue appearing as septa between the canals.

Hippospongia intestinalis (Lamarck) Ridley.

Spongia intestinalis, Lamarck, 1813, p. 434.

Spongia velata, Hyatt, 1877, p. 534, pl. xvii, fig. 8.

Hippospongia intestinalis, var. Ridley, 1884, p. 590, pl. LIII, fig. D.

Station 6079, five specimens.

Ridley (l. c.) says: "The tortuous perforated tubes are sometimes single, but sometimes form confused reticulate masses; * * * their diameter varies from about 5 to 20 mm." The Porto Rico forms differ from Ridley's and Lamarck's in the great scantiness of main sand-cored fibers. As to the relationship between my specimens and the skeletons described by Carter (1881, p. 366), under the name of *Hircinia clathrata*, I am unable to reach an opinion. Ridley regards Carter's species as a variety of *Hippospongia intestinalis*.

Sponge body in four specimens divided into two or three elongate lobes, extending out from the central body, which is insignificant, appearing merely as a fusion of the lobes. Lobes which may branch are in general free from the substratum, mostly subrepent, though in some cases ascending; irregularly cylindrical, rounded at the end, with length of about 30 to 50 mm., and diameter of about 20 to 30 mm. Lobes may be incrusting, in which case they become flattened, attached surface taking shape of substratum. The fifth specimen has a slender, somewhat tortuous, subcylindrical body, 30 mm. long by 8 mm. wide, attached by entire under surface to a *Hircinia variabilis*.

Surface, which is much incrusting, especially with polyzoa, is for the most part smooth, though areas of very small sharp conuli are found here and there. Color of surface varies from nearly black to livid purple; light-brown inside.

Large vestibular spaces having the shape of irregularly cylindrical canals, 5 to 10 mm. diameter, extend longitudinally through the lobes and excavate the central body. Diameter of the spaces as a rule considerably exceeds the thickness of the sponge tissue lying between them. Spaces separated from the exterior by the dermal membrane alone, or by only a thin sheet of sponge tissue; connecting with exterior by numerous rounded or elongate apertures, 2 to 5 mm. diameter, which are apt to form groups. Such apertures (pseudoscula) are present both at the ends and over the surface of the lobes, being mere perforations of the dermal membrane, which in immediate neighborhood of aperture, or group of apertures, forms an especially smooth area, usually, but not always, depressed below the general surface. Such areas are sometimes seen unperforated.

The lining of the vestibular spaces is smooth only where the wall consists of thin membrane. It is for the most part roughened by minute and irregularly intersecting ridges produced into excessively minute conuli. Ridges are supported by the most superficial, tangentially lying, skeletal fibers (ridges, conuli, and fibers must be examined with a lens). There are degrees in the roughening: in places, the ridges are comparatively far apart, with intervening smooth areas, and here the general surface becomes

nearly smooth. In the lining membrane of the vestibular spaces are many groups of pores, but they are not so numerous as in Schulze's figure of the, in many respects, similar form *Cacospongia cavernosa* (1879a, Taf. xxxvii, fig. 14); nor are the individual groups (pore-areas) so well defined. Frequently, in place of a group of small apertures, there is one comparatively large opening. Flagellated chambers, 25 to 30 μ diameter.

Skeleton.—The macerated and dried skeleton is hard, though compressible and elastic; reddish brown externally, lighter inside, and especially light on attached surfaces. Skeletal network consists of fibers mostly about 40 μ diameter, without inclusions, forming polygonal meshes; diameter of typical mesh, 350 μ ; abundant smaller meshes, and larger ones up to 500 μ diameter common. In places, both in the interior and on the surface, the meshwork becomes much closer, meshes here having diameter of about 100 μ or even less; fibers a thickness of 10 to 20 μ . On surfaces of attachment this fine network may form a continuous coating (diteliform veil). Sponge spicules are abundant in the dermal membrane and in the membrane lining the vestibular spaces.

Main fibers are variable in abundance. In particular parts of the sponge they may be abundant, about 1 mm. apart, but in general they are sparsely scattered, interval between them being about 5 to 6 mm. They extend, branching acutely as they go, from the attached surface, or simply from the interior out to the dermal surface, meeting the latter often very obliquely. Main fibers are frequently so curved that through a part of their course they lie tangentially in the walls of the vestibular spaces (course of the fibers is best seen in macerated and dried skeletons). They are cored with sand grains and sponge spicules; may be simple and about 60 μ in thickness, or double that thickness, and with irregular perforations so as to be fascicular.

Genus CACOSPONGIA O. Schmidt (1862).

Meshes of skeletal network large, many easily distinguishable with unassisted eye. Main and connecting fibers clearly differentiated. Dried skeleton less elastic and more brittle than in *Euspongia*; some of the fibers, at any rate, thick as compared with *Euspongia*.

***Cacospongia spongeliformis*, n. sp.**

Station 6072, one specimen; station 6079, one specimen.

Sponge body cylindrical, somewhat branching. Diameter 5 to 7 mm.; larger specimen 250 mm. long. Sponge solid; with evident subdermal cavities between outer ends of radiating main fibers. Surface covered with small conical conuli about 0.5 mm. high, and 1 to 2 mm. apart; in places arranged so as to produce vaguely marked longitudinal ridges. Small oscula, 1 to 2 mm. diameter, distributed sparsely over surface. Flagellated chambers about 36 by 32 μ , with distinct canaliculi leading into the efferent canals, quite like those of *Cacospongia scalaris* as figured by Schulze (1879a, Taf. xxxvii, fig. 12). Consistency rather yielding; rigidity scarcely great enough for the slender sponge body to stand erect. Color: one specimen dull lilac, color faded out in spots; other specimen colorless.

Skeleton.—There are main longitudinal fibers 80 to 120 μ thick, and from 500 to 1,000 μ apart, packed thickly with sand grains and some spicule fragments; acutely forking, branches terminating in the conuli. Secondary fibers extending between main fibers, and between their branches, have a diameter commonly between 20 and 40 μ ; mostly without, or with very few foreign inclusions, although the larger ones are pretty abundantly cored with inclusions (sand grains, spicule fragments). Secondary fibers join main fibers in some cases by an expanded base; in others by such a base with one or more perforations; in others again, the perforations are large enough to divide the base into two or three distinct roots. Many of the secondary fibers simple, passing undivided from main fiber to main fiber; others branch, forming coarse, irregular networks, with a mesh frequently about 400 μ diameter, variation in general being 250 to 850 μ .

In the dermal membrane are many broken and entire foreign spicules, also sand grains and foraminifer shells. Conuli round termination of main fibers particularly full of broken spicules. A commensal alga, apparently identical with the form *Oscillaria spongelix*, discovered by Schulze in *Spongelia pallescens* (Schulze, 1879b, p. 147; Taf. viii, figs. 9, 10), is abundant throughout the body, although most abundant in the peripheral region.

The species in habitus resembles *Spongelia elegans* Nardo (Schmidt, 1862, p. 28; Taf. iii, fig. 5). Its skeleton is very similar to that of *Cacospongia vesiculifera* Poléjaeff (Poléjaeff, 1884, p. 59; pl. iv, fig. 2; pl. vi, fig. 9); and this, as Poléjaeff has pointed out, is essentially *Spongelia*-like. The peculiar cortical cells present in *C. vesiculifera* are absent in the Porto Rico form.

Genus *STELOSPONGOS* O. Schmidt (1870).

Fibers of the skeletal network comparatively stout; distinct radiating bundles (fascicular fibers) always developed, in which, radial main fibers and short transverse connectives may be distinguished.

Stelospongos sp.

Station?, one specimen.

I am unable more exactly to identify a macerated skeleton, having the shape of a flattened irregular mass 210 by 70 mm. with a thickness of 20 to 40 mm. I append the following description for the use of those who may collect in the Porto Rico waters:

Body consists of trabeculae and plates anastomosed together with irregular spaces between. Surface in places covered with conuli 1 to 2 mm. high, and about 2 mm. apart, which may be arranged in rows; and which in such regions may fuse more or less completely to form imperfect ridges. Between the conuli lie the closely set round openings, 1 to 2 mm. in diameter, of canals running vertically to surface. Elsewhere conuli are absent; and here are found closely set oscula about 2 mm. diameter, the bounding wall of each osculum being a short tubular projection about 1 to 2 mm. high. Transitional stages between these two conditions are found, from a consideration of which it becomes plain that the tubular oscular projections are formed by a fusion of conuli.

In still other regions, in place of the conuli or oscular projections, the surface may exhibit grooves 1 to 2 mm. wide and deep, sometimes meandriform. Such grooves are here and there imperfectly covered over by a few fibers. On the bottom of the groove the round openings of canals may be seen, or the groove appears as the oblique superficial continuation of an oscular aperture.

Conuli are the extensions of the fascicular fibers. Wall of oscular tube made up of closely set fascicular fibers with looser network between. A very loose open network of fibers, with meshes plainly visible to the eye (up to 1 mm. diameter) extends superficially between the conuli or oscular projections. The fascicles include radial, more or less parallel, fibers about 50 μ thick, some of which (sometimes one, sometimes more) are cored with spicule fragments, sand grains, and foraminifer shells. Between these run short, simple connecting fibers, often about 20 μ thick, commonly giving rise to a scalariform arrangement. Skeletal network of interior with irregularly polygonal meshes; diameter of fiber commonly 40 to 50 μ . Foreign inclusions found only in the radial fibers of the fascicles. Consistency, for a horny sponge, hard and rigid. Color of skeleton, light brown.

Genus *HIRCINIA* Nardo (1834).

Skeletal reticulum in general coarse, meshes 0.5 to 3 mm. wide; tracts of finer reticulation may be developed. More or less fascicular radial (main) fibers always present; and parts of internal network may also become fascicular. Fascicular fibers vary from a nearly simple condition, in which the horny mass of the fiber exhibits scattered mesh-like perforations, to a state in which the perforations are so numerous and large as to give the fiber the character of a bundle. Filaments present in the parenchyma.

Hircinia acuta (Duchassaing et Michelotti) Hyatt.

Polytherses acuta, Duchassaing et Michelotti, 1864, p. 72, pl. xiii, fig. 3.

Hircinia acuta, Hyatt, 1877, p. 548, pl. xv, figs. 20, 21; pl. xvii fig. 26.

Station?, two specimens.

Smaller specimen massive, irregular, about 50 mm. high; with one osculum, 2 by 3 mm., on the upper surface at apex of rounded protuberance; four smaller oscula flush with the surface on one side. Larger specimen also massive, 100 mm. high with transverse diameter of 50 mm.; two oscula about 3 mm. diameter at apex of truncated conical protuberances on upper surface; one smaller osculum at apex of fistular protuberance on upper surface. From the bases of the prominent conuli radiate lines, the most conspicuous of which are ridges which pass from conulus to conulus, thus dividing the surface up into a system of polygonal depressed areas, diameter of which may be as great as 20 mm. (Hyatt). In the Porto Rico specimens conuli are about 2 mm. high, 4 to 6 mm. apart; frequently divided, as Duchassaing et Michelotti state, at the summit into two or three very small projections, each of which marks the termination of one of the ridges separating the surface areas. Dermal membrane very tough. Subdermal cavities, often about 2 mm. diameter, fairly abundant; in places so

extensively developed as widely to separate the dermal membrane from underlying tissue except in immediate neighborhood of skeletal pillars supporting the conuli. In the interior, canals 1 to 2 mm. diameter are abundant. On the surface are several small funnel-shaped depressions, leading into tubular holes occupied by messmates. Color: surface light gray; interior about the same; sandy fiber brown; horny matter itself amber. Living sponge, according to Duchassaing et Michelotti, is blackish.

On one and the same specimen surface in places is porous to the eye, in places non-porous. In the non-porous areas sand grains and bits of spicules are uniformly distributed through the dermal membrane, there being no reticular arrangement and no visible pores. In the porous regions the sand grains and bits of spicules present in the dermal membrane are arranged so as to form a reticulum, with more or less rounded meshes having a diameter of about 100 μ , the intervening sand cords themselves having a diameter of about 50 μ . The dermal membrane in each mesh is, as a rule, perforated by pores, of which there may only be one, more often several, up to nine; diameter of pores 40 to 80 μ . Porous and non-porous regions fade gradually into each other. Moreover, in the non-porous regions scattered here and there, in places in some abundance, are small more or less well defined circular areas approaching the size of the reticular pore areas. The dermal membrane occupying such areas is without pores and without sand grains, the arrangement of the latter round margin of area suggesting that such areas are spots from which the sand grains are withdrawing to become concentrated in bands as in the reticular region. The facts in general suggest that the pores and reticular arrangement of the sand grains may appear and disappear.

Skeleton.—In the inner portion of the sponge the skeleton consists of a coarse irregular network, main threads of which are irregularly disposed fascicular fibers with diameter 400 to 700 μ . Between the fascicles extends a very loose reticulum with meshes from about 500 to 1,200 μ diameter, formed by fibers frequently about 80 μ thick in the middle, which are usually simple, but which in vicinity of the nodes may widen out and become fascicular. Extensive areas, sometimes 3 mm. in diameter, are here and there left unoccupied by the skeleton. The distinction between main fascicular fibers and the intervening comparatively simple network can not always be made out; in places network can only be described as irregular and consisting of fibers which are simple or more or less fascicular.

From this inner skeleton strong fascicular fibers, 0.5 to 1 mm. diameter, radiate outward and upward, terminating in the conuli. Near its peripheral end the fascicular fiber narrows, becoming denser, and runs out to a point. The tracts of tissue between the radiating bundles, which are in the neighborhood of 10 mm. long and 3 to 4 mm. apart, are unoccupied by fibrous skeleton, except in the cases (which do not seem to be common) where a connecting fiber extends between the radiating bundles. Such connecting fibers as I have seen vary in diameter from 85 to 170 μ , and are simple except at the ends, where they become fascicular.

Meshes of fascicular fibers (both internal and radiating fibers), and the individual fibers of the bundle, vary greatly in size. Meshes, which frequently are elongated in the direction of the fiber, may in places appear as mere rounded perforations, frequently 100 to 200 μ in diameter, in a continuous mass of horny matter. Elsewhere the structure is much more open, but with large and small meshes in close neighborhood, meshes measuring in typical cases 850 by 170 μ , 800 by 300 μ , 180 by 180 μ . The individual fibers frequently have a diameter of about 50 μ , but vary between 20 and 100 μ .

Sand grains, together with broken pieces of spicules and some foraminifer shells, are present and usually abundant in all the fibers of the skeleton, both the individual fibers of the fascicles and the separate simple fibers. Similar foreign particles unassociated with horny matter are scattered freely through the parenchyma, and are abundant in the dermal membrane and tissue directly beneath it, forming a layer from about 40 to 120 μ thick. Throughout the sponge body the characteristic "filaments" are exceedingly abundant, in many places exhibiting an arrangement in bundles. Filaments are without spots; diameter in the middle region about 6 μ ; terminal enlargement about 8 μ wide.

Hircinia variabilis F. E. Schulze.

Hircinia variabilis, F. E. Schulze, 1879c, p. 13, Taf. I, figs. 1-5; Taf. III, fig. 1; Taf. IV, figs. 1-15.

Hircinia variabilis, Lendenfeld, 1889, p. 557, pl. 36, figs. 11-14.

Station 6079, two specimens.

Shape very variable in the species. One of the Porto Rico specimens, a hemispherical mass attached by whole under surface to a *Hippospongia intestinalis*, horizontal diameter about 40 mm.,

with no evident oscula. Other specimen very irregular in shape, partly incrusting on shells, also associated with *Hippospongia intestinalis*; about 90 mm. long, with greatest width of 50 mm.; with several very small oscula, and one osculum 3 mm. diameter. According to Lendenfeld, the oscula are "always large and conspicuous." Pores uniformly distributed. Conuli 1 to 2 mm. high, 1 to 3 mm. apart, and rather blunt. Subdermal cavities extensive having the character of tangentially disposed canals. Filaments abundant, and about $6\ \mu$ thick in the middle. Color: exterior, a rather light reddish purple; grayish inside.

Skeleton.—Main fibers about $200\ \mu$ thick, and 1 to 2 mm. apart, radiate from interior. These fibers for the most part simple, here and there becoming fascicular; cored with sand grains and spicule fragments. Similar foreign particles are found sparsely distributed in the connecting fibers. Lendenfeld says: "The connecting fibers are generally slightly branched, and are attached to the main fibers by two or more roots. The connecting fibers on an average are $50\ \mu$ thick. The larger meshes are about 1 mm. wide and irregularly polygonal." This description of the connecting fibers applies to parts of the Porto Rico specimens; but a commoner condition is one in which the connecting fibers form a reticulum with meshes 300 to $500\ \mu$ in diameter.

***Hircinia foetida* (O. Schmidt) F. E. Schulze var. *cuspidata*, n. var.**

Sarcotroqus fatidus, O. Schmidt, 1862, p. 36.

Hircinia fatida, F. E. Schulze, 1879 c, p. 29, Taf. II, fig. 3; Taf. III, figs. 2, 3.

Hircinia fatida, Lendenfeld, 1889, p. 577.

Station 6079, one specimen.

Variety differs from Mediterranean type in having very small, sharp conuli; in absence of a differentiated axial fiber in the main bundles; in abundance of foreign bodies with which the fibers in general are cored; in greater diameter of the filaments.

Sponge massive, amorphous, about 80 mm. high. Conuli about 1 mm. high, conical, and 2 to 3 mm. apart. Several rounded oscula over upper end and over dark surface (see below), one 4 mm. diameter, others 1.5 to 2 mm. diameter. Filaments very abundant, 6 to $8\ \mu$ thick in middle. Color, blackish-brown above and on one surface; basal portion, which is somewhat peduncular, and lower part of other surface, much lighter.

Skeleton.—Main fibers radiating and projecting into conuli, densely (i. e., meshes small) fascicular; about 0.5 mm. thick and 1.5 to 2 mm. apart; individual fibers often about $50\ \mu$, cored abundantly with sand grains, spicule fragments, and foraminifer shells. Connecting fibers freely cored with sand grains and some spicules, commonly about $40\ \mu$ thick; forming band-like reticula in the plane in which the main fibers lie (Schulze's figures, 2, 3, Taf. III, are characteristic). These band-like reticula in the Porto Rico specimen vary in radial length from 0.5 mm. to about 3 mm.; meshes fine. Between successive band-like reticula, large rounded meshes 1.5 to 2 mm. diameter, occupy the space separating the main fibers. Such meshes frequently much longer in a radial direction than wide; radial diameter up to about 4 mm. Connecting fibers just below dermal membrane, simple or only slightly reticular.

Family APLYSINIDÆ Vosmaer.

Skeletal fibers without inclusions and with thick and conspicuous axial core. Flagellated chambers small.

Genus APLYSINA Nardo (1834).

"Spongidae with small ciliated chambers 0.025–0.035 mm. wide, and a skeleton composed of a loose network of pithed fibers, which are not clearly distinguished into main and connecting fibers. The surface is conulated and not protected by a stout sand cortex." (Lendenfeld).

***Aplysina flagelliformis* (Carter) Lendenfeld.**

Hircinia flagelliformis, Carter, 1886, p. 373.

Aplysina flagelliformis, Lendenfeld, 1889, p. 412.

Station 6079, two specimens.

Body cylindrical, branching; diameter 5 to 7 mm.; length of longest specimen 100 mm. Consistency firm, but not hard. Color, a dull dark red. "The surface is uneven or slightly undulating, and covered with very small conuli 0.3 mm. high, which are about 1.2 mm. apart. In the specimens with more slender branches the conuli are smaller and closer together than in the stouter specimens.

The oscula are 1 to 2 mm. wide, scattered or arranged more or less regularly in longitudinal rows." (Lendenfeld.) Lendenfeld's specimens measured 8 to 15 mm. diameter, and reached a length of 700 mm.

Skeleton.—Skeleton is a uniform reticulum. Mesh polygonal, sometimes oval, axes about equal or unequal; diameter 600 μ to 1.2 mm. Fiber about 100 to 120 μ thick; core commonly 0.3 of entire thickness, though frequently greater or less. Fiber bright amber. Macerated skeleton moderately compact and firm, though compressible and elastic.

Carter (l. c., p. 373) says, skeleton includes sand-cored main fibers ending in conuli on surface, and transparent lateral fibers "interuniting the sand-cored filaments." No such distinction exists in my specimens, which I might, therefore, conclude are not to be identified with Carter's. Von Lendenfeld, however, who has examined Carter's type specimen, does not mention this distinction in his diagnosis.

***Aplysina flagelliformis* (Carter) Lendenfeld var. *anomala*, n. var.**

? *Luffaria nuciformis*, Duchassaing et Michelotti, 1864, p. 60, pl. x, fig. 2.

Station 6079, one specimen.

Specimen consists of two vase-like tubes united basally, 60 by 50 mm. and 70 by 40 mm., respectively, the narrower tube tapering below. Cavity in each tube about 10 mm. diameter, extending nearly the length of the tube; opening above by large terminal aperture, which is surrounded in one case by a rim of smooth membrane. A few small oscula about 1 mm. diameter are scattered over surface. Surface extremely uneven, produced into somewhat meandering rounded ridges or rounded outgrowths, 5 to 7 mm. wide and about as high, with depressions between. The depressions are commonly a little wider than the separating ridges. At several points on the sponge surface, the ridges project as free subcylindrical processes, up to 20 mm. long. Such processes are in no wise different from short portions of the body in the elongated (typical) forms of this species. Consistency firm, rather fleshy above, hard below. Color, dull red.

The surface in its finer character (alike on and between the above-mentioned ridges) is intermediate between the type and my var. *rugosa*. In places, especially in the more fleshy portions, the conuli are no higher than in Lendenfeld's type specimens; and the ridges caused by the most superficial, tangentially lying, skeletal fibers are so slightly developed that the latter part of Lendenfeld's description, "surface is uneven or slightly undulating," applies very well. Over most of the surface the conuli, which are sharp, are 0.5 mm. or something over in height, and about 1.5 mm. apart, the connecting ridges being feebly developed. In places the surface ridges connecting the conuli are higher than elsewhere, and sharp-edged. Such ridges may appear as short, independent, meandering structures; or they may intersect, the furrows between the ridges thus becoming converted into separate, depressed, polygonal areas. In the latter case the surface acquires a honeycombed appearance; the cell-like areas having a diameter of 1.5 to 2 mm., with a depth of about 1 mm.

Skeleton.—Skeleton in color and texture is like that of the type; average diameter of the mesh being somewhat higher, meshes as large as 700 by 1,500 μ occurring. Fiber diameter 120 to 140 μ , with core 0.1 to 0.15 total thickness.

This tubular variety is closer to var. *rugosa* than to the specimens which I have assigned to the type. So close is the resemblance to var. *rugosa*, that if one of the projecting subcylindrical processes had been found as a fragment, I should undoubtedly have assigned it to this variety.

***Aplysina flagelliformis* (Carter) Lendenfeld var. *rugosa*, n. var.**

Station 6076, one specimen; Station 6079, seven specimens.

Body cylindrical, branching; diameter 10 to 15 mm.; greatest length 400 mm. Color, reddish brown to purple. Sponge hard. Skeleton a uniform reticulum. Skeletal fiber bright amber; diameter commonly 120 to 180 μ , with a pith from 0.2 to 0.3 whole thickness; pith occasionally occupying scarcely more than 0.1 whole thickness. Diameter of the polygonal, often rounded or oval mesh, commonly 750 to 1,500 μ ; one axis of mesh usually longer than the other.

Over the surface small oscula 1 to 2 mm. diameter are scattered, in some cases forming longitudinal rows. Surface here and there approaches condition found in the type. In general the surface is characterized by the development of sharp ridges connecting the conuli. The ridges may, as in var. *anomala*, appear as independent meandering structures. More commonly they intersect, giving rise to the honeycombed surface already described as occasionally found in var. *anomala*.

***Aplysina fenestrata* Carter.**

Spongia fenestrata, Duchassaing et Michelotti, 1864, p. 36, pl. III, fig. 7.

Aplysina fenestrata, Carter, 1882, p. 272.

Station 6079, one specimen.

Carter describes the species as "massive, sessile, lobate, hollow," with "vents large, on the prominent parts of the body." In the figure given by Duchassaing et Michelotti, the large apertures are represented on the apices of mammillary lobes. The Porto Rico specimen is an irregular mass, 150 mm. long, with an average thickness of 50 mm., and apparently without a surface of attachment. It may have been held in place by a branching coral, or something of that sort. The mass is excavated by large concavities, some of which extend entirely through the body. It is thus imperfectly and very irregularly divided into lobes. At one end is a rounded aperture, 18 mm. diameter, leading into a cloaca-like depression 35 mm. deep, having a smooth inner wall. At the opposite end is a similar but smaller aperture, leading into a shallower depression. These apertures probably correspond to the "vents" of Carter's specimens. Sponge body itself is solid, and with no discoverable true oscula. Color: surface black, purplish-brown where water-worn; interior, olive-brown.

Surface is divided into polygonal concave areas, having an average diameter of about 5 mm. Such areas sometimes shallow, mostly deep; sometimes regularly 5 or 6 sided; again rounded or irregular, often owing to confluence. (Figure given by Duchassaing et Michelotti is schematic.) Dermal membrane lining concavities, shining. Where the concave areas are deep, the separating ridges become thin walls (as in the description of *D. et M.*). From the sharp edges of the bounding ridges, skeletal fibers may protrude, occasionally to such an extent that the lamellar structure of the skeleton is shown.

Dermal membrane over almost entire surface, quite smooth and without pores. Here and there a tract is found with a few pores, and in which the reticulate condition exhibited by the dermal membrane of many horny sponges (*Aplysina fragilis* for example) is imperfectly developed.

Skeleton.—Skeletal fibers form strong reticulate lamellae, extending directly inward from bounding edges of the surface areas. These lamellae meet one another at about a right angle. Skeleton is thus given a honeycomb-like character; the outer open end of each "cell" of the honeycomb embracing one of the surface areas. In each lamella the meshes are squarish, or polygonal, and 1 to 2 mm. diameter. Fiber about 200 μ thick, of deep amber color; core 0.3 to 0.5 whole thickness, and distinct (indistinct, as given by Carter). Sand grains sparsely scattered in parenchyma.

There seems to be no doubt that the Porto Rico specimen belongs to the same species as the sponges described by Carter under *A. fenestrata*. Von Lendenfeld, however (1889, p. 413), lists this species as a synonym of *A. archeri*, although the two are very different.

***Aplysina fragilis*, n. sp.**

Station 6097, one specimen.

Sponge incrusting on coral, becoming massive at one end. Greatest length, 80 mm.; thickness, 5 to 15 mm. Color: surface dark violet, almost black; reddish violet inside. Low conuli in neighborhood of 1 mm. high, scattered over surface, usually 3 to 4 mm. apart, in places nearly disappearing. Surface reticulate except at extreme edge of specimen, where it is smooth. Reticulate character is caused by a network of low solid ridges, 85 to 170 μ thick, including depressed areas about 1 mm. diameter, which are, however, more or less subdivided by lower and narrower ridges. In each depressed area there is a considerable number of pores, 12 to 30 μ diameter, opening into subdermal cavities. No large oscula to be seen. A few small round apertures (oscula?), 0.5 mm. or less in diameter, are scattered over surface.

Subdermal cavities numerous and fairly extensive. Canals of interior numerous and large. In outer layer of ectosome are crowded granular cells giving color to surface. Remaining ectosome lighter in color, containing numerous fine spindle or branched cells in a clear ground substance. A similar light-colored tissue is abundant round some of the larger canals.

Skeleton.—Skeletal fibers form reticulate lamellae, lying vertical to surface and meeting one another about at right angles, so as to produce a honeycomb-like structure. From outer edge of lamellae single fibers extend radially into conuli. Diameter of the "cell" formed by lamellae, about 4 mm. The

lamellæ themselves rather vaguely developed (as compared with *A. fenestrata*), owing to fact that the meshes are not uniform in size, often irregular and large; diameter of mesh frequently 2 mm., or even larger. Skeletal fiber light brown to dark reddish-brown, fragile; 100 to 250 μ thick; core, 0.8 to 0.9 whole thickness. Sand grains and foreign spicules scattered in parenchyma, especially in basal part.

***Aplysina hirsuta* (Hyatt) Lendenfeld.**

Verongia hirsuta, Hyatt, 1875, p. 403.

Verongia hirsuta, Poléjaeff, 1884, p. 70, pl. 10, figs. 1, 2, 3.

Aplysina hirsuta, Lendenfeld, 1889, p. 415.

Station 6079, one specimen,

Sponge consists of two cylindrical tubes, 40 mm. and 60 mm., respectively, in diameter, fused throughout their course so as to produce a roughly cylindrical, somewhat flattened mass, 320 by 100 mm. Basal surface of mass flat, slightly smaller than the likewise flattened upper end. A very large osculum, narrowed in one diameter, at upper end of each tube. Small oscula, 2 to 3 mm. diameter, abundant on lateral walls. Thickness of tube wall fairly uniform, about 12 mm.

Sponge rather fleshy and compressible. Surface very uneven, elevated here, depressed there; marked by sharp, more or less meandering ridges, or by separate conuli, both about 1 mm. high. Intervening, smooth, depressed areas, 2 to 3 mm. wide, may be polygonal, or may not be so definitely circumscribed, in which case they appear as vaguely marked furrows.

Skeleton.—Skeleton a uniform reticulum. Fiber about 100 μ diameter; pith one-third whole thickness. Mesh polygonal or irregular, 1.5 to 3 mm. wide. Skeletal fibers, protruding from the conuli and surface ridges, unite to form an extra-superficial network, having an average thickness of 5 mm., in places twice that thickness. Beneath this network the dermal membrane is intact. A similar but much thinner extra-superficial growth is found, in patches, on inner walls of the tubes. Macerated skeleton very compressible; loose.

Von Lendenfeld says "sponge rose color. The skeleton is dark brown." The Porto Rico specimen is purplish, showing a lighter olive tint in the hollows. Color of fiber in the interior is a bright amber; extra-superficial fiber is light brown.

Genus *DENDROSPONGIA* Hyatt (1875).

Skeleton composed of dendritic fibers, which may anastomose to a slight extent, but do not form a reticulum, as in *Aplysina*.

***Dendrospongia crassa* Hyatt.**

Dendrospongia crassa, Hyatt, 1875, p. 401, pl. 13, figs. 1, 2, 7.

Aplysina crassa, Lendenfeld, 1889, p. 423, pl. 35, fig. 3, pl. 38, fig. 7.

Station 6079, three specimens; station ?, one specimen.

Sponge irregularly lobate, lobes massive; in some cases attached to coral, then passing at the base into incrusting condition. Porto Rico specimens have greatest length of 100 to 120 mm. Surface covered with low, sharp conuli, often about 5 mm. apart; skeletal fibers frequently projecting from conuli. Color: Surface dark violet, almost black; interior dark violet, appearing reddish in sections.

Dermal membrane over nearly entire surface, smooth, shining, and without pores. Here and there are tracts in which surface is reticulate. Reticulate appearance is caused by a network of low, flat, solid ridges about 140 μ wide, which inclose depressed pore areas about 260 by 160 μ . Pores of each area considerable in number (15 in a typical case), 12 to 20 μ in diameter, opening into subdermal cavities. In spots the reticulate condition of surface is distinct, but the pores are absent. In other places the reticulate condition is imperfectly developed. The varying character of the surface suggests that not only do the pores appear and disappear, but that with them possibly comes and goes the reticulate arrangement. Minute apertures (oscula?), about 0.5 mm. diameter, scattered over surface in some abundance. An occasional osculum, 2 to 3 mm. diameter, is also found.

Ectosome densely crowded with spindle-shaped cells; light in color. Similar tissue extends into interior, especially abundant round larger canals. Subdermal cavities are found here and there, but in general their place is taken by small canals in the ectosome. Flagellated chambers in one of my specimens measures 32 by 24 μ .

Skeleton.—The dendritic fibers composing the skeleton may anastomose to some extent, without, however, producing a reticulum; although an occasional squarish mesh, about 2 mm. diameter, may

be formed. Diameter of fiber, for the most part, about 500 μ ; core 0.6 to 0.8 whole thickness. Sand grains scattered sparsely, more abundantly in places, through parenchyma.

The peculiar character of the skeleton marks off *Dendrospongia* from the species of *Aplysina*. The interesting similarity between *Dendrospongia* and the *Aplysillidæ* has been pointed out by Von Lendenfeld (1889, p. 424).

Family SPONGELIDÆ F. E. Schulze.

Flagellated chambers open directly, by means of a wide mouth, into exhalent cavities. Skeletal fiber with thin axial core. Fibers in general cored with foreign inclusions.

Genus SPONGELIA Nardo (1834).

Flagellated chambers large and sac-shaped. Skeletal fibers form an irregular reticulum. Main fibers abundantly cored with inclusions; connectives also so cored, or more or less free from inclusions.

Spongelia pallescens (O. Schmidt) subsp. *fragilis* var. *ramosa*, F. E. Schulze.

Spongelia pallescens, O. Schmidt, 1862, p. 30, Taf. III, fig. 8.

Spongelia pallescens subsp. *fragilis* var. *ramosa*, F. E. Schulze, 1879 b, pp. 150, 154, Taf. v-viii.

Spongelia pallescens, Polcjaeff, 1881, p. 42, pl. III, fig. 1.

Spongelia fragilis var. *irregularis*, Lendenfeld, 1889, p. 662, pl. 37, fig. 10.

One specimen, "off Punta de Melones."

Sponge consists of several upright, digitate (some cylindrical, some flattened) lobes, united at the base and here and there fused laterally. Total height of mass, 60 mm.; greatest width, 50 mm. Diameter of lobes, 5 to 15 mm. Lobes, with exception of one, solid and without terminal osculum. Exceptional lobe tubular, with a terminal osculum 3 mm. diameter leading into an axial cavity. Remaining oscula (three) about 3 mm. diameter, and on sides of lobes. Flagellated chambers measure 60 to 70 μ by 40 to 50 μ . Conuli, 1 mm. high, 2 to 3 mm. apart. Consistency fleshy, yielding, and somewhat elastic, with sufficient firmness for the sponge lobes perfectly to retain their natural shape and position when sponge is removed from the fluid. Color, blackish gray.

From the conuli radiate band-like ridges, which branch and anastomose so as to form a network, in meshes of which lie the pore areas. Only a few of the ridges are supported by skeletal fibers. Most contain merely scattered sand grains and spicule fragments, such as are found throughout the dermal membrane; also many fibrous cells; also, as a rule, closely packed cords of the commensal alga, *Oscillaria spongeliæ* (Schulze, 1879 b, p. 147, Taf. viii, figs. 9, 10). The latter is extremely abundant in and just below the dermal membrane, but is nearly absent from the interior. The band-like ridges are everywhere distinct to the eye, and in regions where the pores are opened to their widest extent they become very obvious.

Skeleton.—Main longitudinal fibers, 350 μ thick, narrowing down in places to diameter of 170 μ , lie about 2 mm. apart; somewhat fascicular, and densely crowded with sand grains, spicule fragments, and foraminifer shells. Main fibers branch at acute angles, branches extending outward and upward to terminate in the conuli. Connectives vary in thickness from 100 to 60 μ , and also are for the most part thickly crowded with inclusions. In some of the smaller fibers, the inclusions are only abundant enough to form an axial string.

The system of connectives is fundamentally ladder-like, giving rise to large squarish meshes, each occupying the whole space between a pair of main fibers and having a longitudinal or radial length of about 1.5 mm. Connectives separating successive meshes of this sort are occasionally simple, but usually branch and form secondary reticula with meshes commonly 300 to 700 μ diameter. The large squarish meshes, just alluded to, are in places broken up into smaller ones by the branching of the connectives. Connectives extending between outer ends of main fibers are in many places, but not everywhere, sufficiently branched to give rise to a superficial reticulum with meshes commonly 400 to 700 μ diameter.

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*I have been unable to consult directly the memoirs marked with an asterisk.