REPORT

OF THE

CANADIAN ARCTIC EXPEDITION 1913-18

VOLUME VIII: MOLLUSKS, ECHINODERMS, COELENTERATES, ETC.

PART G: ALCYONARIA AND ACTINARIA

By A. E. VERRILL
PROFESSOR EMERITUS, YALE UNIVERSITY

OTTAWA
F. A. ACLAND
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1922

Issued April 28, 1922

Report of the Canadian Arctic Expedition, 1913-18.

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I.

The Alcyonaria of the Canadian Arctic Expedition, 1913-1918, with a Revision of some other Canadian genera and species.

By A. E. VERRILL,
Professor Emeritus of Yale University.
(With nineteen plates and thirteen text figures).

I.

Suborder ALCYONACEA Verrill, 1865.

Family NEPTHYIDÆ.

Gersemia Marenzeller (emended).

Alcyonium (pars) of early authors.

Gersemia MARENZELLER, op. cit., p. 375, 1878. Type *G. fruticosa* (as *G. florida, non* Rathke).

Væringia (pars) DANIELLSSEN, N. Nordhavs—Exped., Alcyonida, p. 1, 1887, + *Krystallofanes* + *Fulla* + *Sarakka*, DAN., op. cit., 1887.

Eunephthya (pars) KÜKENTHAL, Deutsch. Tiefsee—Exped. (Valdivia Exped.), Alcyonaria, Vol. XIII, pp. 73-74, 1906 (*non* VERRILL, 1869). JUNGERSEN (*pars*), op. cit , p. 9, 1916.

Paraspongodes (pars) KÜKENTHAL, 1896. MAY, Alc. Ost-Spitz., Zool. Jahrb. Syst., Abt. Vol. xi, pp. 388-97, 1898. STUDER, Camp. Hirondelle, p. 31, 1901

Gersemia MOLANDER, Northern Arctic Invert. Alcyonacea, p. 48, 1915.

Polypidom, when well grown, more or less branched from a flexible main stalk, which may be naked or bear some scattered polyps: cortex or wall of the stalk and of stems of branches are muscular and capable of considerable contraction. It contains numerous minute rough, spinulose, lobed, or warted spicules, mostly short spindles and double spindles, ellipsoids, dumb-bell forms, etc., but usually not enough to form a firm crust: often hardly enough to give a fine granulose appearance under a lens: so that the surface often appears nearly smooth, except for the wrinkles caused by contraction.

Interiors of stalks of branches and main stem contain a number of large longitudinal tubes, separated by rather thin muscular walls, usually containing a few spicules. The branches may be absent when young, but numerous and subdivided when full grown.

The polyps, in expansion, are elongated, arising from low, or often obscure, calicles, mostly clustered on the sides and tips of the branches. The calicles may be separated by an evident amount of cœnenchyma, often very little or none.

The polyp-bodies, outside of the calicles, are distinctly divided into two regions by differences in spiculation, and often by a constriction or change in size. The distal or stomodeal region, called the anthocodia, is often larger and always firmer than the mesenterial or proximal region, because it is filled with more abundant and larger spicules.

The anthocodia[1] has eight double rows of elongated spicules arranged in chevrons, followed proximally by a wreath or zone of similar spicules arranged more obliquely or transversely, thus forming a boundary more or less obvious between the two regions of the polyp body.

The mesenterial or proximal part of the body usually has eight double rows of similar but generally smaller, shorter, and rougher, spicules, often arranged almost transversely in contraction, but typically chevronwise. These may be nearly or quite lacking in some species.

Owing to the abundant and closely arranged spicules in the anthocodia this part often cannot be withdrawn into the calicle, but remains seated over it, in preserved specimens, while the mesenterial region is withdrawn. In some species both regions can be retracted, especially when young.

The tentacles also contain, on the aboral side, a double row of small, usually warted, fusiform or oblong spicules, fewer at the bases and tips, none in the pinnules, hence the tentacles are rather stiff and usually only partly concealed in contraction, their spiculose bases forming a sort of 8-lobed operculum for the polyps, above the anthocodia.

The spicules of the polyps and calicles, etc., do not project in the form of spinules, as in typical species of *Eunephthya*. Molander, op. cit., 1915, has I believe, determined more accurately the relations of this and some related northern genera than have some other writers, but like others he has erred in the application of the name *Eunephthya*, as shown below.

He has reexamined the types of many species and has described the internal structure of the stalk and branches, etc.

Gersemia rubiformis (Pallas.) Molander. Sea Strawberry.

Lobularia rubiformis Ehrenberg, Corall. Roth. Meeres, p. 58, 1834.

Alcyonium rubiforme Dana, U.S. Expl. Exped. Zoophytes, p. 625, 1846. Verrill, Review Polyps E. Coast U.S. in Mem. Boston Soc. Nat. Hist., Vol. 1, No. 1, p. 4, 1864: Proc. Boston Soc., Vol. X, p. 355, 1865; Trans. Conn, Acad. Sci. Vol. 1, part 2, p. 459, 1868. Marenzeller. Intern. Polarforsch. Jan. Mayen, Vol. XIII, Zool., p. 15, 1886. Jungersen, Kara-Havets Alcyonider, Dijmphna-Togtets Zoologisk-Bot. Udbytte, p. 379, pl. xxxii, figs. 14-22, 1887.

Paraspongodes rubra May, Ostspitz., Zool. Jb. Syst., Vol. XI, p. 393, figs. 3a, b, 1898 (t. Jungersen).

Eunephthya rubiformis Kükenthal, Alcyonaria "Olga" Exped., H. 1, p. 21, 1906: Tiefsee Exped. (Valdivia), XIII, p. 72, 1906; Revis. Alcyon. Fam., Nephthyidæ, No. 3, Zool. Jb. Abt. Syst. Vol. XXIV, pp. 331, 335, 1907; Alcyon. Siber. Eismeeres, Mem. Imp. Sci. St. Petersburg, Ser. 8, Vol. XVIII, No. 15, p. 2, text cut, 1909. Jungersen, Bergens Mus., Aarbok, for 1915-16, h·2, p. 10, 1916.

Gersemia rubiformis Molander, A. R. Northern and Arctic Invertebrates in Coll. Swedish State Mus., Alcyonacea, Kungl. Svenska Vetenskapsakademiens Handlingar, Bd. 51, No. 11, vii, p. 51, pl. 1, fig. 7, 1915.

Plate I; Figs. 1-1f. Plate II; Figs. 1–4a, 6. Plate XVIIa; Fig. 1.

This species, as it usually appears in dried or strongly contracted specimens, consists of rounded, ovate, or pyriform clusters of rather hard, short, thickish branches or lobes, convex externally, and attached to the main stalk by short

[1] The term anthocodia should properly be confined to the distal or stomodeal part of the polyp-body, which is very commonly protected by eight double rows of elongated spicules arranged "in chevron" followed by a wreath or zone of similar spicules, arranged obliquely and transversely, differentiating it from the mesenterial or proximal region of the polyp.

Molander (op. cit. 1915), applied the term to the entire polyp-body, beyond the calicle. This is an error and liable to cause confusion.

stems, smaller than the enlarged ends. The main stem may be very short or somewhat elongated and free from branches or calicles near the base, which usually spreads out in a thin expansion for attachment to pebbles, shells, etc. The lower part of the stem and basal expansion may often be nearly destitute of the close covering of red spicules that occurs elsewhere, and then, when dried it has a cartilaginous appearance, and is rather tough—not friable. Its surface is strongly wrinkled. The surface of the branches carrying polyps is covered with a thin but firm layer, consisting largely of a compact aggregation of minute rough spicules, bright red or pale red in colour, which give the surface a finely granular appearance under a pocket lens, and impart a red colour to the entire corallum. These spicules are of several forms, but mostly to be classed as irregular, short, lobed, or warty spindles, double spindles, and ellipsoids, mixed with fewer elongated rough spindles. (See Pl. II, figs. 1-4).

The polyps, in preserved specimens, are usually completely contracted, and their calicles mostly appear as small, convex, slightly elevated mammillæ, with a small roundish central cavity, sometimes with its border slightly eight-lobed, or little stellate, but often entirely closed in extreme contraction. (Pl. I, fig. 1e). Sometimes the calicles are close together or separated only by their walls, with scarcely any cœnenchyma properly called; in other cases they have a notable amount between them.[1]

Occasionally the polyps do not contract entirely, and then they show a conical anthocodia, containing eight feeble double rows of minute elongated, rough, fusiform spicules, arranged in chevrons. (See Pl. I, figs. 1a, s-s'').

In transverse sections the stem contains a considerable number of large longitudinal tubes separated by thin walls, which contain a relatively very small number of minute spicules, similar to those of the surface.

The proximal or mesenterial part of the polyp-wall is thin and nearly or quite destitute of spicules; when any are present they are mostly small spindles.

Sections of the branches show a number of similar tubes of smaller size, increasing in size downward. These tubes are often so crowded that they appear polygonal in contracted specimens, but are roundish when less contracted. When dried their walls are very thin, but in well-preserved specimens or fresh specimens, they are thicker and muscular. (See Pl. I, fig. 1d). In the smaller branches a central larger tube can often be distinguished, surrounded by a number of smaller tubes, as in fig. 1d. These tubes usually contain two or more longitudinal mesenterial infoldings, which are continuations of some of the mesenteries of the polyps. They also frequently contain the eggs. (See Pl. I, fig. 1f). Fresh or well-preserved specimens, when not much contracted, have a very different appearance. (Pl. XVIIa, fig. 1). In these the naked stem is more or less elongated, and the branches are also elongated, and have the proximal part naked, while the tips are enlarged, rounded, or thick club-shaped and bear a cluster of more or less numerous elongated polyps, translucent in expansion, giving a very elegant appearance to the whole corallum, in life. The polyps, in expansion, are two or three times longer than broad. They are often nearly destitute of spicules, except on the distal anthocodial portion, just below the bases of the tentacles, where there are eight usually inconspicuous double rows of slender spicules, arranged in chevrons. (See Pl. I, figs. 1a). These spicules are about 0·13 to 0·15 mm. long, and 0·02 to 0·022 mm. thick. Sometimes a few smaller spicules occur in the proximal part of the tentacles.

The expanded polyps, when mature, are about 2 to 2·5 mm. long and 0·7 mm. thick. Their tentacles are usually nearly destitute of spicules, translucent, and have plump, roundish stalks and elongated pinnæ. Each fully-developed polyp is usually surrounded by a number of smaller, young ones, of various sizes, produced as buds, as in fig. $1a^1$.

[1] Several bright red specimens from Alaska (Station 20D) have unusually small polyps; in contraction the calicles are like small pinholes. These I have named as a new variety, *parvistella*.

The eggs are relatively large, being about 0·25 to 0·32 mm. in diameter. They are mostly in the central canals. The abundant red spicules, covering the surface of the calicles and intercalicinal spaces with a continuous, thin, firm layer, are well-illustrated on Pl. II, figs. 1-3, which show the principal forms of the larger and fully developed ones, but there are also large numbers of smaller and less matured spicules similar in form and ornamentation. The most numerous forms are very rough, short, thick, warty spindles, double-spindles, and ellipsoids, with prominent subdivided lobules, and ornamented ends, as shown on Pl. II, figs. 1a-h: 2a-d: 3a-c. Some of these are stellate when seen endwise, as shown in fig. 1, and fig. 2, e, f. Some of the smaller forms are shown in fig. 1 k-p. With these more abundant forms are some odd irregular forms, like fig. 1i and fig. 3f; some might be called popped-corn-shaped, and there are also elongated simple warty spindles, like fig. 1, q, r, s. These last are very similar to those of the distal part of the polyps, forming the chevrons, but are not quite so slender.

The walls of the stems of the branches and of the main stalk contain a very much smaller number of similar spicules, averaging perhaps rather smaller, but the larger ones are about as large as those of the calicles. Some of these from the main stalk are shown in fig. 2 h-j. These are mostly white.

The larger spicules of the surface of the calicles measure 0·14×0·05: 0·14×0·045: 0·09×0·045: 0·09×0·04: 0·07×0·045 mm. The elongated spindles measure about 0·15×0·025: 0·13×0·02 mm.

The species has a wide circumpolar distribution in Arctic and Sub-Arctic waters. It was recorded by me in 1865, from the North Pacific. It is known from the northern coasts of Europe, and from eastern America, from the Bay of Fundy and from the fishing "Banks" off Nova Scotia and Newfoundland, and from the gulf of St. Lawrence (Orphan bank) to Hudson bay and Greenland. It is the only common shallow water Alcyonarian of the coasts of Alaska and Arctic America generally.

It occurs in shallow water and down to 140 fathoms or more, mostly on hard bottoms with pebbles and shells.

The following specimens were obtained by the Canadian Arctic Expedition:—

6, Station 20D, Beach at Grantley harbour, Port Clarence, Alaska, July 31, 1913. In alcohol. Var. *parvistella*. Polyps unusually small. Bright red spicules.

1, large. Station 20G. Same locality, in 2 to 3 fathoms, mud bottom, with algæ. Aug. 4, 1913. Fine specimen in alcohol. See Pl. XVIIa, fig 1.

5, Station 23, Lat. 70° 24′ N. Long. 161° 25′ W, in 9 to 10 fathoms, mud and pebbly bottom. Aug. 19, 1913. In alcohol.

9, dry. Station 24, on beach, sandspit at Point Barrow, Alaska, Aug. 23, 1913.

1, dry. Station 28M. Beach at Collinson point, Camden bay, Alaska, June 1914.

21, dry. Station 48G. On beach at Locker point, Coronation gulf, North-west Territories, June 1916.

Mr. F. Johansen and Dr. R. M. Anderson collected the above, and some specimens have been sent from the Geological Survey of Canada, collected by Rev. W. G. Walton on the east shores of Hudson bay, while Dr. A. G. Huntsman, Atlantic Biological Station of Canada, has sent some specimens. The Hudson bay examples were from a locality ten miles north of Great Whale river, July, 1919.

The North Pacific Exploring Expedition collected it in Bering straits, west coast in shallow water, and in the Arctic ocean in 35 fathoms. (Verrill, 1865.)

Mr. John Murdoch, in the Reports of the International Polar Expedition, Point Barrow, p. 162 (1885) records it as found on the beach, and dredged abundantly west of Point Franklin, in 13½ fathoms, and also off Port Clarence, in 7½ fathoms, and with one "pale specimen" in Norton sound, 5 fathoms, on cod lines, and in Plover bay, 25 fathoms, "bright strawberry red." Brandt recorded it from Seniavin strait, Siberia. Molander, 1915, recorded it from Port Clarence, Bering sea, and the Siberian sea, in 7 to 57 meters, in several localities, and in many other places. It is known from Greenland, Spitzbergen, Kara sea, northern Norway, and numerous other localities. On the east American coast it extends southward to the bay of Fundy.

Variations.

This species is very variable in form and general appearance, largely because of its great powers of contraction, when preserved. In life, when well-grown, it is tall and much branched, with conspicuous bare portions of the stalk and stems of the branches, which carry clusters of the delicate translucent polyps at the tips, very much as in *G. carnea* (see Pl. IV, fig. 1). But as preserved in alcohol, or when dried, the stalk, branches and branchlets are much contracted, and the polyps are retracted, so that it looks like a cluster of crowded roundish knobs or lobes. In this state it often resembles in form and colour a large coarse strawberry. Hence the fishermen call it the "sea strawberry."

Although its colour, even after long preservation in alcohol, up to sixty years at least, is usually bright red, due to the red colour of the spicules, pale red or even white varieties occasionally occur, sometimes in the same localities as the red ones. In certain cases all the specimens taken in a certain locality may be of the pale kind. Some red specimens, when dried and long exposed to strong light, fade to pale red or yellowish white.

Generally speaking, the bright red colour of the spicules is diagnostic of this species, as contrasted with the allied northern species. Several of those are bright red, or light red, when living, but quickly lose their colour in alcohol, because the colour is confined to the soft parts, the spicules being white.

Some varieties of *G. carnea* are light red or pink in colour, when living, and their spicules may be pale red, but so far as I have observed, perhaps a thousand examples or more, it never has the bright red spicules seen in this species. The spicules of the cortex, also, are smaller and not nearly so numerous, as well as different in form.

All the species of this group are liable to vary considerably in the abundance of spicules, and to the same extent, in their sizes and forms, even when adult examples are studied. Young specimens often appear very different in form, have larger calicles, and often larger spicules. All are very contractile when killed or much disturbed, thus entirely changing their forms. They are also variable in colour, when living. Some vary from dark red to light red, pink, or orange; some are brownish or yellow; some rarely violaceous. Most of them, when living and expanded, are very beautiful objects.

This species, when very young, forms small, slightly convex, roundish, encrusting groups, with a central polyp surrounded by one or two circles of smaller polyps. In that stage it resembles a *Sympodium*.

Distinction of Closely Related Species.

With preserved specimens this is often by no means easy, and thus experts differ. This particular species, usually one of the easiest to identify, is liable to be confused with three or four other similar Canadian species, which grow in the same way, and have similar and variable modes of branching. In general the mode of branching is not to be relied upon as diagnostic, as it is variable. A careful microscopic study of the forms of the spicules, and their arrangement in the polyp bodies and tentacles affords the most reliable characters.

The nearest related form is, perhaps, *G. canadensis*, a new species described below, (see Pl. I, figs. 2-2 d, Pl. II, fig. 5) This has more numerous spicules in the distal part of the polyp-body, which form, with the very spiculose bases of the tentacles, a larger and stronger anthocodia, which is seldom retracted into the calicles in the case of full grown polyps. The proximal and usually narrower part of the polyp-body also has eight double rows of smaller spicules in open chevrons, but this part can be much contracted and withdrawn into the calicles, which are larger and more stellate than in *G. rubiformis*.

G. studeri, new name for *G. danielsseni* Studer, not of Marenzeller, op. cit. 1901, p. 31, pl. iii, figs. 7, 9; pl. x, figs. 1-3, 7, from off Newfoundland, in 155 meters, is closely related to this species. It is pale yellowish in colour. It has the same forms of branching and abundant cœnenchyma, with retractile polyps and distinct calciles. Its spicules appear to be more sharply spinose and occur transversely placed in the proximal part of the polyps.

G. carnea (Ag. sp.) is a more southern species but is sometimes found in the same localities. It is a much softer and smoother species with fewer and smaller spicules in the stalk and branches, and when full grown is more branched and taller, and in expansion it is more translucent (see Pl. IV, fig. 1). But it often contracts into a mere mass of roundish or clavate branches, closely crowded together, when preserved in alcohol. Its colour, in life, is usually pale salmon or flesh-colour, but it may be pink or light red. Its spicules are white or nearly so, and differ from those of *G. rubiformis* in size and form, nor do those of the stalk and branches form a firm crust (see Pl. IV, figs. 2-3). These spicules in *G. rubiformis* are so numerous that it keeps its form very well when dried.

Some varieties of *G. fruticosa* (Sars), and especially the form *clavata* (Dan. sp.), considered a distinct species by Molander, 1915, have a close resemblance to this species in modes of branching and general appearance, but they have less cœnenchyma between the calicles and more spicules in the anthocodial region and proximal part of the polyps.

Gersemia uvæformis (May, sp.) was united to *G. rubiformis* by Jungersen and by Broch, but kept as a separate species by Molander (1915). It is a nearly allied form, if not the young stage of the latter. Its polyps, judging by the figures, are considerably larger and the spicules more numerous and somewhat different in forms. I have not seen any American specimens that seem to agree with it. Molander recorded it from off Newfoundland, in 66 meters. Another species which might be confounded with this was recorded by me in 1865, from the Okhotsk Sea; but was not then named nor described owing to the immaturity of the single specimen. Nevertheless Dr. J. E. Gray, in *Ann. and Mag. N. Hist.*, Feb., 1869, gave it a name, *Lobularia verrillii*. That name has no more status than a manuscript name.

The specimen, long in alcohol, was still bright red, and the calicles were glomerate and verruciform, and much larger than in *G. rubiformis*, and more spiculose. The original specimen was probably burned in the great Chicago fire, which destroyed all the Chicago Museum specimens.

It may very likely belong to *Gersemia*, and in that case it most resembled *G. uvæformis*. Its spicules were red, but were not carefully studied. Its stalk was very short and not branched, and it was doubtless the young stage of a larger species. The polyps were more or less retractile, usually leaving the anthocodia exposed.

It is remarkable that Danielssen did not recognize this species among the numerous related forms described by him. Some of his figures, however, closely resemble varieties of this species, particularly *Gersemia clavata* and *capitata*, and should be compared with this.

Ehrenberg quoted Pallas as the author for this species. I do not know in what work Pallas described it.

II.

Revision of additional Canadian Alcyonaria, with descriptions of two new genera and some new species.

By A. E. Verrill.

The late Dr. J. F. Whiteaves, in his Catalogue of the Marine Invertebrata of Eastern Canada[1] gave a pretty complete list of the Alcyonaria recorded up to that date by me and others.

Most of those species were known only from the Grand Banks, and the deep-water fishing grounds off Nova Scotia, many having been brought up on the long trawl-lines used by the cod and halibut fishermen or dredged by the U.S. Fish Commission Steamer "Albatross" in the deep waters on or near the Banks. Some of them were of great size and many were species and genera then new to science.

A few additions to the list have been made since that time. Several, however, need revision as to their generic affinities and nomenclature. A few species have been discovered on the North Pacific coast that have not hitherto been recorded as belonging to the Canadian Fauna.

In the following report I have endeavoured to supply some of this additional information, together with some illustrations of species that have not yet been figured at all, or only imperfectly illustrated.

In the Alcyonaria group the forms, sizes, and arrangement of the microscopic spicules are matters of much importance for the determination of the genera and species, or even, in many cases, to determine the families to which they belong. In other words, the "architecture" of the polyp bodies and calicles is of great importance in the study of the group. The modes of branching and forms of the colonies are generally variable, and therefore of much less importance, though frequently characteristic.

Danielssen[2] has given excellent and elaborate illustrations of the forms of the colonies, polyps, and spicules of various species and varieties of Alcyonacea that are found also off the coasts of the American continent in deep water.

Suborder PENNATULACEA Verrill, 1865.

Family **PENNATULIDÆ** Verrill, 1865.

Ptilella borealis (M. Sars) Gray. Great Sea-Pen.

Pennatula grandis Ehrenberg, Corall. Roth. Meeres, p. 66, 1834 (not of Pallas, 1766, p. 366).

Pennatula grandis Kölliker, Voy. Challenger, I, part 2, p. 4, 1881 (*non* Pallas).

Ptilella borealis Gray, Cat. Sea-Pens, p. 21, 1870: Verrill, Amer. Jour. Sci., Vol. XVII, p. 241, 1879.

Pennatula borealis Sars, Fauna Lit. Norveg., Vol. I, p. 17, pl. 2, figs. 1-4, 1856. Kölliker, Pennatuliden, I, p. 136. Richiardi, Monog. Pennat. p. 31, pl. 2, figs. 15-17. Verrill, Amer. Jour. Sci. Vol. XVI, p. 375, 1878: op. cit. Vol. XXIV, p. 364, 1882. Bull. Mus. Comp. Zool., Vol. XI, No. 1, p. 3, 1883; Ann. Rep. U.S. Fish. Comm., 1883, pp. 509, 532, pl. IV, figs. 8, 8a, 1885 (sub-genus *Ptilella*).

[1] Geological Survey of Canada, 1901, No. 722.
[2] N. Nordhavs-Exped. Alcyonida. 1887.

Pennatula (Ptilella) borealis VERRILL, Amer. Jour., Sci. Vol. XXIII, p. 310, 1882; J. F. WHITEAVES, Catal. Inverteb. East. Canada, p. 35, 1901.

Ptilella grandis KÖREN and DAN., Fauna Litt, Norveg., pp. 82-86, pl. XI, figs. 1-7, 1877.

This species is very common in deep-water on and between the fishing banks off Nova Scotia and Newfoundland. It ranges between 120 and 1,255 fathoms. It grows to a large size. Kören and Danielssen recorded one 780 mm. high. Some of our specimens are over 25 inches high and 5 inches broad. From the fishing banks 33 lots were received up to 1881, including 120 specimens. Its range extends to the region south of Nantucket.

Some recent writers have endeavoured to apply the name *grandis* to this species, apparently overlooking the fact that Pallas had long before used that name for a very different Polynesian species, figured by Rumphius (Mus. Belg. p. 43) as *Sagitta marina nigra*.

Pallas gave a good description for that early date. He described the stalk as smooth and terete and the colour as grayish green, etc.

It is evident therefore that the very appropriate name *grandis* cannot be used for this species.

Kölliker ascertained that the *grandis* of Ehrenberg is the same as *borealis*, but that fact does not warrant the use of *grandis* for this species.

This species differs so much from all other species of the genus that it has been made a distinct genus by J. E. Gray, Kören and Danielssen, and some others under the name *Ptilella*. The most obvious if not the most important character by which the genus *Ptilella* may be distinguished is the existence of a strong bulbous muscular enlargement near the top of the stalk. The arrangement of the siphonozooids is also characteristic. Kören and Danielssen (op. cit.) have given a pretty full account of its internal structure; but some of the peculiarities mentioned in respect to the curvature of the axis, etc., are due to the strong contraction of the specimens preserved in alcohol.

It varies considerably in colour but is usually some shade of orange-red or purplish red on the edges of the pinnæ and bulbous part of the stalk, while the lower part of the stalk and proximal part of the pinnæ or wings may be yellowish or orange. The spicules of the wings are red. The tentacles are without spicules. The siphonozooids are usually red, very numerous, and some of those at and between the bases of the pinnæ are usually large—generally there are two larger ones.

Ptilosarcus gurneyi Gray. Stout Sea-Pen.

Sarcoptilus (Ptilosarcus) gurneyi GRAY, Ann. and Mag. Nat. Hist., Vol. V, p. 23, pl. iii, fig. 2, 1860.

Ptilosarcus gurneyi VERRILL, Proc. Essex Inst. Salem, Mass., Vol. IV, p. 183, 1865; Trans. Conn. Acad., Vol. I, part 2, p. 382, 1868. KÖLLIKER, Anat., Syst. d. Alcyon. Pennat., p. 146, Pl. IX, fig. 79, 1869.

Plate XII; Figs. 1, 2.

This is a large stout and conspicuous "Sea-Pen," often a foot or more long in life, living in shallow water, as far north as Prince William sound, Alaska. The naked stalk in life is large swollen and bulbous; when much contracted in alcoholic specimens it is nearly half the whole length. The pinnæ or "wings" are nearly semi-circular, broadly rounded, with a broad base, the posterior edge extending as a rounded lobe beyond the basal attachment; their sides are smooth; the edge is thickened and bears four rows of polyps; each calicle is armed with two spiniform spicules.

The siphonozooids are small, papilliform, and form two broad rows along the back of the rachis. Kölliker gives the length of one specimen as 283 mm. and the breadth 45 to 50 mm.

One example studied by me had 52 pinnæ on each side; total length 250 mm., breadth 50 mm., height of pinnæ 20 mm., breadth 38 mm., length of stalk 118 mm., diameter 106 mm.

The type was from Monterey, Cal. (Gray). Most specimens that I have seen came from Puget Sound and adjacent waters. It has been taken off Cape Flattery on fishing tackle. A single specimen, lacking the stalk, was sent to me with the other Canadian specimens. This was from off Ucluelet, west coast of Vancouver island, in 9 fathoms, collected by W. Spreadborough in 1909.

Professor W. R. Coe, on the Harriman Expedition, took a large and fine specimen, a little below a very low tide at Orca, Prince William sound, Alaska. It was standing upright in soft black mud. He stated that it was "gorgeously coloured," the stalk being bright orange, and the polypiferous portion was bright red. The colour soon fades in alcohol.

This specimen has 44 wings on each side, counting the very small ones at the proximal portion, where the first is only about 5 mm. broad, and the second about 10 mm. about a dozen being small and gradually increasing. (See Pl. XII).

Professor Coe states that it was very much longer and wider in life than when preserved, especially the bulbous stalk. At present the stalk has a thick bulbous part distally, but tapers to the lower end.

In alcohol its length is 210 mm., breadth 60 mm., length of stalk 98 mm. diameter at distal bulb 48 mm., of middle of stalk 35 mm., breadth of larger wings 40 mm. and height of the same 22 mm.

In this specimen some of the larger wings have a small secondary wing growing out of the upper side and rising to the same height as the parent wing.

When living the stalk was perhaps twice as long and much thicker, and Professor Coe states that in life the wings are notably separated, but in alcohol they lie in close contact. This specimen greatly extends its geographical range. No doubt it occurs all along the coast of British Columbia.

Family **VIRGULARIDÆ** Verrill, 1869.

Stylatula columbiana Verrill. New Species.

Plate III; Figs. 1–4a.

This species belongs to that section of the genus having short supporting spicules, shorter than the polyp bodies. The only specimen is incomplete, the naked basal part of the stem being absent. The portion remaining is 116 mm. long, and 5 to 6 mm. thick in the middle.

The wings are relatively large and crowded, about four occur in the distance of 10 mm., where best developed, or nine to the inch. They are about 5 to 6 mm. wide and 2·5 mm. high, and nearly surround the stalk, broadly overlapping from opposide sides. Each of the larger ones has about 20 to 24 polyps, arranged in a crowded row. At the beginning of the polypiferous portion the wings are small and crowded, about 10 to 10 mm.

The polyps are relatively large, swollen distally, free for more than half their length when fully developed, and grouped in clusters of two to six.

The supporting spicules are short, forming a fan-shaped group, not reaching a third of the width of the wings; none are truly spiniform, the larger ones are scarcely more than 1 mm. long, and 0·06 to 0·065 mm. thick, while many are not more than half as long, and they are linear, somewhat irregular in outline with the ends more or less acute (see Pl. III, figs. 1a, 1b, 1c), and one tip sometimes ends in two or three points as if split. In transverse section they are more or less triquetral. They are usually so arranged as to form about eight to ten longer pointed groups, with one or two of the longer ones in the middle, giving a semi-stellate effect.

Another group of spicules, about eight to ten in number, runs down from the fan-shaped group along the stalk between the pinnæ. These are about as large as the larger of the supporting spicules. The spicules appear white by reflected light, but by transmitted light they seem to contain an internal dark pigment. The axis is slender and rather rigid.

The pinnæ of the tentacles are seldom well-preserved, and the tentacles themselves are mostly incurved and partly contracted. When best preserved the tentacular pinnæ are short and closely crowded.

Many of the polyps contain a small number of small eggs, both mature and partly grown. No embryos were seen (see fig. 1c). The distal end of this specimen is not quite perfect. The pinnæ, best-preserved near the end have about ten polyps, rather smaller than those of the middle (fig. 1b), but are otherwise similar.

The type was collected at Ucluelet, west coast of Vancouver island, June, 1909, in 13 fathoms (C. H. Young).

The only additional species of shallow water Pennatulacea, from the Pacific coast of Canada, known to me, is the following species, remarkable for its great size—certainly the longest yet discovered—and for the number and variety of names it has received.

Family **PAVONARIDÆ Dana** (Emended)

Verrillia blakei Stearns.

Pavonaria blakei STEARNS, ROBERT C., San Francisco Mining and Scientific Press, Aug. 9, 1873, (first description of soft parts).

Verrillia (subgenus) *blakei* STEARNS, Proc. Calif. Acad. Sci. Aug. 18, 1873, pl. IX, figs. 1-6; op. cit. Mar. 16, 1874; Amer. Jour. Sci. vol. VII, p. 68, 1874 (reprint).

Osteocella septentrionalis GRAY, Ann. and Mag. Nat. Hist. IX, p. 406, 1872; Nature, Nov. 6, 1873, axis only.

Halipteris blakei STEARNS, Proc. U.S. Nat. Mus., vol. VI, p. 99, 1883.

Verrillia blakei or *Halipteris blakei* STEARNS, Amer. Nat., Jan., 1882.

Verrillia blakei WHITEAVES, Canadian Nat. vol. VIII, p. 465, 1878; STEARNS, Contrib. to Nat. Hist. of Cœlenterata, Washington, 1883, Historical Sketch and Reprint of articles (privately printed).

?Balticina blakei NUTTING, Proc. U.S. Nat. Mus., vol. XXXV, p. 706, 1909.

?Pavonaria dofleini MOROFF, Zool. Jahrb. Abth. Syst. Geog. and Biol. Thiere, Vol. XVII, p. 393, 1902.

?Pavonaria willemoesi (KÖLL.) KÜKENTHAL Zool. Jahrb., p. 226, 1913.

This species grows to a great size, sometimes becoming eight feet in length, with over 7,000 polyps. When living with polyps expanded, it is over an inch in diameter. Ordinary specimens are three to five feet long.

Dr. J. F. Whiteaves (op. cit.) recorded a specimen in alcohol that was seven feet eight inches long, with the barren stalk two feet long. This had by actual count, in one series of rows, 3,802 polyps, in 369 oblique rows, or about 7,600 polyps in the two series.

Mr. Stearns recorded one that was five feet six inches long, with the polypiferous part four feet long; this had 245 oblique rows on each side; the number of polyps in each full row was from 8 to 11; some have fourteen. The sterile stalk was $17\frac{1}{4}$ inches. He gave the average length of 36 specimens as 5 feet $6\frac{1}{3}$ inches.

Usually in well preserved specimens, the oblique rows are closely crowded together or in contact, but this is due to strong contraction. In life they are more or less separate and more erect. They are arranged chevronwise, and the rows nearly meet in front. The siphonozooids are in two, long narrow streaks on the opposite side of the rachis, grouped into open clusters, opposite the base of each row of polyps. Others occur more or less in lateral lines on the front side.

The polyps appear to arise directly from the rachis, without being united even into rudimentary "wings," and their summits, in the specimens I have seen, seem to be simple, or but faintly bilobed, not acutely bilobed nor armed with projecting spicules, as in true *Balticina.* Spicules appear to be lacking or very few. Nutting states that the calicles have two feeble teeth in those he examined, and that the calicles are united at their bases by "rudimentary band-like pinnæ". This was not apparent in the examples that I have seen. He found no spicules in the calicles, or tentacles. This, if correct, would make this a genus distinct from *Balticina* and *Pavonaria.*

The rachis on the back or siphonozoidal side is swollen and strongly convex, when well preserved.

This notable species was pretty fully described and figured by Mr. Stearns in August, 1873, (op. cit.) when the soft parts first became known. The bare axis had been noticed, both in America and England, before that time, and various opinions had been expressed as to its nature.

Dr. Phillip Slater had exhibited specimens at the meeting of the British Association, in 1872, and he supposed that they were the axial supports of some unknown fish. Dr. J. E. Gray, of the British Museum, in 1872 referred it to his previously proposed genus *Osteocella,* based on an Australian naked axis, (perhaps of a *Pennatula* or *Pteroides*), but he was in doubt whether it belonged to a fish or to a Pennatulid. It was also discussed by Dr. James Blake (Proc. Cal. Acad. Sci., July 17, 1871); by Moseley (Nature, vi, Sept., 1872); by Whiteaves (Nat. Hist. Soc., Montreal, 1872); W. H. Dall (Amer. Nat. vol. VII, p. 488, 1873); Verrill (Amer. Jour. Sci. vol. VII, p. 70, note, 1873); Mr. Stearns in February, 1873 (Proc. Cal. Acad.) referred the bare axis provisionally to the Umbellularidæ. Dr. Blake thought it more likely belonged to the sponges. Prof. Kölliker referred the axis to the Pennatulacea, as did Verrill, in 1874.

The name *Osteocella septentrionalis,* given by Gray in 1872, to the bare axis, with only a few words of description, should be regarded as having no standing, for the remarks made about it would not distinguish it from the axis of various other genera and species of Pennatulacea. Clearly it could not be congeneric with his type of *Osteocella,* whatever that may be. Even up to this time, its exact generic position is more or less doubtful. Personally I have never had an opportunity to microscopically study a well-preserved specimen, and cannot say with certainty whether *Verrillia* is or is not a valid genus. Mr. Stearns did not give the microscopic structure, nor state whether it had spicules or not. Professor Nutting thinks it is identical with *Balticina finmarchica* of the North Atlantic.[1] This I do not believe for the numerous specimens of the latter that I have studied all had two prominent calicinal teeth filled with spicules and also spicules in the tentacles. The calicles were united into obvious wings not present in this species.

All the earlier specimens came from Burrard inlet, on which the city of Vancouver is situated, and Dr. W. H. Dall has recorded specimens from the Shumagin islands, where, he says, it is troublesome to the cod fishermen by entangling their lines. No doubt it occurs all along the coast of British Columbia

[1] Nutting has described a form from off Japan, in 66 to 428 fathoms, that he thinks is identical with this and with *Balticina finmarchica.* It appears to have no spicules in the polyps or stalk. (Proc. U.S. Nat. Mus. vol. 43, p. 38, 1912). It certainly is not *B. finmarchia* and probably not *V. blakei.*

in suitable places. Some of Nutting's specimens which he identified with others from British Columbia, came from off Pacific Grove, Cal. *Pavonaria willemoesi* Kölliker was from Japan.

The earlier specimens were accompanied by statements that it was in the habit of "swimming" or "darting" actively about with "other fishes." It may be believed that it ordinarily stands erect in the mud like all the related species. In that position it may have been easily caught up on fish lines.

Suborder GORGONACEA Verrill, 1865.

Family **PRIMNOIDÆ** M. Edw., 1857; Gray, 1859.

Primnoa reseda (Pallas) Verrill.

Gorgonia resedæ forma GUNNERUS, Trondhjemske Selsk. Skriv., 2, p. 321, pl. IX, 1763.

Gorgonia reseda PALLAS, Elenchus Zooph., p. 204, 1766.

Gorgonia lepadifera LINNÉ, Syst. Nat. Ed. XII, part 2, p. 1289, 1767; ELLIS and SOLANDER, 1786, p. 84, pl. 13, figs. 1, 2.

Primnoa lepadifera LAMOUROUX, Hist. Polyp .flex., 1816, p. 442, and of many later writers.

Primnoa reseda VERRILL, Bullet. Mus. Comp. Zool. vol. I, p. 37, 1864; Revision Polyps U.S. Coast, p. 9, 1864; Proc. Boston Soc. Nat. Hist. X, p. 355, 1866; Ann. Rep. Comm. of Fish and Fisheries, p. 533, 1885. J. ARTHUR THOMSON, Proc. Royal Phys. Soc., Edinburgh, vol. 17, pp. 65-72, pls. 1, 2, 1907.

Primnoa resedæformis BROCH, Kongl. Ved. Selsk. Skr., 1912, No. 2, p. 32. KÜKENTHAL, Zool. Anz. vol. 46, No. 5, p. 146, 1915. JUNGERSEN, Bergens Mus. Aarbok, 1915-16 (2), p. 26 (distribution).

Plate IV; Figs. 4-6. Plate IX; Fig. I.

A well-grown much branched specimen of this species was taken many years ago off the northern coast of British Columbia (Pl. IV). I have seen a good photograph of the entire specimen, and have examined some of the well-preserved branches. I have been unable to find any characters distinguishing it from the well-known North Atlantic form. The latter is found on the American coast of large size, often two or three feet high, with a stout trunk, hard and calcified at the base. It is common on the fishing banks off Newfoundland and Nova Scotia, and rare on the fishing banks off the coast of Maine. It occurs in 50 to 150 fathoms, usually on rough rocky bottoms, nearly always attached to rocks of considerable size, so that it is often difficult to bring it up entire, or to detach it from the rocks when well grown, for its axis is very hard and strong, and its base is broadly attached. For these reasons it is seldom taken by dredging, though sometimes it has been taken by using the "tangles" on the "Albatross" expeditions. All the larger entire specimens have been brought up entangled on the deep-water trawl-lines of the fishermen on the "Banks."

It was taken by the "Albatross" in 1883, on Brown's bank, south of Nova Scotia, in 100 to 131 fathoms. It is not known to occur south of the mouth of the bay of Fundy and gulf of Maine.

It is rather widely distributed on the northern coasts of Europe, from Scotland to Norway, to Iceland and to West Greenland, etc., and is therefore probably circumpolar.

A similar form occurs in the Sagami sea, described as *P. japonica* by Kinoshita.

When seen living, or fresh from the sea, it is light red or delicate salmon-pink in colour, but the colour soon fades when exposed to the light, and in drying or in alcohol, so that museum specimens are always white or nearly so. The spicules are white. Thomson gives (op. cit. 1907, pl. 2) a good coloured figure of a branch drawn soon after its capture from the Faroe channel. He also ascertained that it is viviparous, the planulæ developing within the polyp-bodies.

The name *P. resedæ forma* (Gunnerus) as quoted by Pallas, in his "Errata" (op. cit.) has priority over the name *reseda*, given by Pallas. In case the work of Gunnerus is to be considered strictly binomial, his name should be adopted, as has been done by some recent writers, who however spell it *resedæformis*. According to Pallas it was printed by Gunnerus as two words "*resedæ forma*," indicating that it was only a descriptive polynomial name, similar to those given to it by still earlier polynomial writers. I have not had the work of Gunnerus, and therefore use the name now in general use.

Calligorgia compressa Verrill.

Primnoa compressa Verrill, Proc. Essex Inst., vol. IV, p. 189, 1865; Trans. Conn., Acad. Sci., vol. I, part 2, p. 454, 1869.

This species was originally described from a large specimen denuded of calicles. It forms a large, much-branched, flattened corallum. The branching is alternate at acute angles. The axis of the branches and branchlets are compressed, and taper to slender tips. The coral is hard and calcareous.

The type described was taken off Alaska, on fishermen's lines.

Family **MURICEIDÆ** Gray, 1859.

The following large species, which has hitherto been referred to *Paramuricea*, differs so much from the typical species of that genus that it should be made the type of a distinct genus.

Lepidomuricea Verrill. New genus.

Coral large, much branched, the branches extending more or less in one plane.

The calicles are somewhat prominent, cylindric or truncate-conical, the margin armed by one or more rows of sharp pointed spines arising from bases that are flat, lobed, or irregularly branched or foliated; these are imbricated with submarginals that have similar bases and less acute tips. The cœnenchyma is hard, rather thick, very spiculose but not spinose, and covered externally, in life or in alcohol, with a soft skin that conceals the spicules more or less completely. The polyps, in the type, can retract into the calices, exposing the anthocodia, which is of moderate size. The opercular spines of the tentacles are arranged in chevrons, and the wreath of curved spicules is well developed.

The spicules of the cœnenchyma are various in size and form. The most characteristic are rather large, flat, often scale-like, irregularly oblong, subcircular, or angular, and often, some are lobed or branched (Pl. VIII, figs. 1 a-f). Some of these are 0·63 by 0·33 mm., 0·56 by 0·24 mm., 0·67 by 0·33 mm. in dimensions. With these are some narrower, irregular forms (figs. g-k) of various shapes. Some of the spine-tipped spicules of the calicles are 1·03 by 0·55 mm., 0·86 by 0·25 mm. and 0·77 by 0·33 mm. (figs. 2 f-i). There are also, imbricated towards the base, many thin flat spicules, mostly oblong, with the edges foliated or deeply lobed (figs. 2 a-e). The spicules of the anthocodia are slender spindles; those of the collar are curved (figs. 2, j, l-p).

Lepidomuricea grandis Verrill.

Paramuricea grandis VERRILL, Bull. Mus. Comp. Zool. Vol. XI, p. 37, pl. III, figs. 3-3b, 1883.

Plate VIII, Figs. 1-2 (spicules). Plate X, Fig. 1 (general).

The structural characters of this species are sufficiently indicated in the generic description. It grows to a large size, with stout trunk and branches, black or dark sepia brown, as preserved, but is reported by the fishermen to be light orange or salmon colour when living. It often reaches a height of two feet, and one and a half broad, with the larger branches half an inch thick. Most of the larger specimens examined have been taken on the deeper fishing grounds around the Grand Banks, and off Nova Scotia by the Gloucester fishermen and presented to the U.S. Fish Commission. It was taken by the "Albatross" at Station 317, Lat. 31° 57′ N. in 333 fathoms, and at Station 253, Lat. 40° 53′ N. and Long. 66° 24′ W. in 956 fathoms. It was also taken by the "Blake", off Georges Bank, in 524 fathoms.

Jungersen (op. cit., 1916, pp. 28, 31) has doubtfully referred this species to *Paramuricea placomus*. It is very different from that species in its spicules as well as in some other characters, and apparently grows to a much larger size. The larger spicules of *P. placomus* are very irregular and roughly branched and lobed, and those of the cœnenchyma are not scale-like. (See Pl. VI, figs. 8, 8a, representing spicules from a large Norwegian specimen).

Family **BRIAREIDÆ** Gray, 1859.

Paragorgia pacifica Verrill. New species.

Paragorgia; species, WHITEAVES, Canadian Naturalist, vol. VIII, p. 466, 1878.

Plate VIII; Figs. 3-4 b (details).

This species was described by me for one of Dr. Whiteaves' reports, about 1877, but the description seems not to have been published. I have seen only the original specimen mentioned by Dr. Whiteaves in 1878.

It is a more delicate and smoother species than *P. arborea* of the North Atlantic, and the spicules differ considerably (see Pl. VIII, figs. 4-4b). The type was a profusely branched specimen. The internal structure as seen in a cross section (fig. 3) is finer and more compact, and the longitudinal canals (a, a, d, d) are relatively smaller. The central axial portion (e) is quite distinct, being harder, more compact, and lighter in colour than the surrounding middle layer (d), its larger spicules are longer and larger, and mostly with fewer warts (fig. 4b); some are forked. The outer layer or cœnenchyma proper (c) contains an abundance of smaller spicules, mostly very irregular warted spindles of various sizes (see Pl. VIII, fig. 4). The type was from Jervis inlet, British Columbia, taken on fishermen's lines in about 10 fathoms. (Mr. Richardson's Collection, 1875). Another was collected by Mr. Wm. Spreadborough, at Ucluelet, Vancouver island, B.C., in 9 fathoms, June, 1909. (Col. No. 51, Cœlenterates, Victoria Memorial Museum, Ottawa).

Paragorgia arborea (L.) E.dw. and H.

Text Figure 1. Plate XIII. Plate XIV; Fig. 1.

This has been recorded by Professor Hickson.[1] from the Kadiac islands, and by others from the North Pacific, together with the form or variety *P. nodosa* Kören and Dan. Nutting[2] recorded the latter with doubt, from Lat. 54° 30′ N. and Long. 179° 14′ E. in 344 to 372 fathoms, and also from off the Hawaiian islands, in 423 to 435 fathoms, in 1908.[3] Kinoshita recorded both *P. arborea* and *P. nodosa* from Sagami bay.[4]

Whether any of the above records refer to the *P. pacifica* I am unable to say. There may be doubt whether *P. pacifica* is not a variety of *P. arborea*. This can hardly be determined until more specimens come to hand. Careful study of the spicules in this group is necessary for the determination of species.

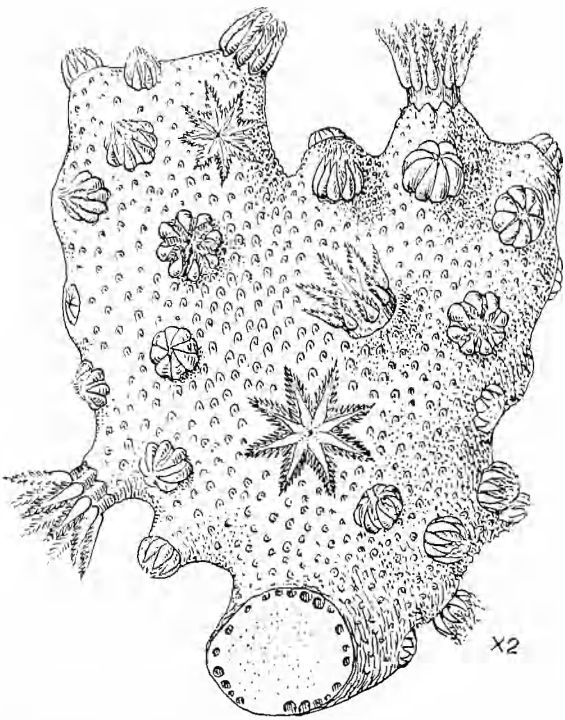

Fig. 1. *Paragorgia arborea* (Linn.). Swollen end of a branch, with ployps and numerous siphonozooids, partly expanded. From Atlantic Fishing Banks. x 2.

Paragorgia arborea (Text fig. 1) is very common on the deeper fishing banks off Nova Scotia and Newfoundland, where it grows to a great size. Some of the specimens from there have been 4 to 5 feet high, with the main trunk 4 inches in diameter at the base. Specimens two or three feet high are not uncommon. It branches irregularly, often in truly arborescent forms, but in other cases the branches are irregular and sometimes reunite in various ways. They often have nodes or bunches, and very often the tips of the branches are swollen or bilobed (see fig. 1). It has numerous siphonozooids.

[1]Proc. Zool. Soc. London, p. 548, 1915.
[2]Proc. U.S. Nat. Mus. vol. 24, p. 99.
[3]Nutting. op. cit. vol. 24, p. 568, 1908.
[4]Jour. Coll. Sci. Imp. Univ. Tokyo, vol. 32, p. 32, 1913.

It is often infested with a small actinian (*Synanthus mirabilis V.*) which has a base that entirely surrounds a branch, like a ligature, and girdles it, sometimes causing it to break off readily, if not spontaneously.[1] (See text Fig. 18).

Nearly all the numerous specimens that I have studied were caught entangled on the long trawl-lines set for halibut and cod, by the Gloucester fishermen on the "Banks," and presented to the U.S. Fish Commission. They are now mostly in the U.S. National Museum, and Yale University Museum. Such donations were received from about thirty schooners. Large specimens were often saved with great trouble and at great risk by the boat crews.[2]

Anthothela Verrill.

Anthothela Verrill, Proc. U.S. Nat. Mus., 1879, p. 199.

Briareum (*pars*) M. Sars, Fauna Litt. Norvegiæ, p. 63, pl. X, figs. 10-12.

Polyps elongated in expansion, arising from elevated calicles, into which they are partially retractile, leaving the large anthocodia exposed. Seldom entirely retractile. The calicles arise either from an extended rather thin spiculose basal membrane or from slender irregular stems. In the stems there is a spiculose axis, well differentiated, but not very firm. Spicules are mostly elongated, strongly warted, often irregular spindles; those of the axis are more irregular, and with fewer and larger warts and knobs or lobes.

Anthothela grandiflora (M. Sars) Verrill.

Briareum grandiflora M. Sars, op. cit., p. 63, pl. X, figs. 10-12.

Anthothela grandiflora Verrill, op. cit., p. 199, 1879: Bullet. Mus. Comp. Zool. Vol. XI, No. 1, p. 40, pl. IV, figs. 6, 6a, 1885: Ann. Rep. U.S. Fish. Comm. for 1883, p. 535, 1885. J. F. Whiteaves, Catal. Mar. Invert. E. Canada, p. 32, 1901.

Plate VI; Figs. 1–4. Text Fig. 2.

This species when young consists of a rather thin, spiculose, crust-like basal membrane, upon which the prominent erect calicles are irregularly scattered. When more developed it rises up into thin, irregular, and often interlaced or adherent branches, which bear the rather prominent calicles irregularly scattered. In the branched form it has a distinct spiculose axis. In this form it may be 50 mm. to 60 mm. or more in height. The polyps seem capable of nearly complete retraction within the calicles; the anthocodia are left exposed. They are covered with eight large groups of many convergent spicules contained in the stalks of the tentacles and arranged chevronwise; below these there is a collar or wreath containing numerous slender spicules placed obliquely and transversely in many rows. Those of the basal part of the anthocodia are shorter and arranged transversely in about six rows; proximally they are smaller. Most of the calicles are distinctly 8-ribbed, especially distally, and 8-lobed at

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[1]See Amer. Jour. Science, vol. 7, pp. 211, 217, fig. 23, 1899.

[2]Lists of the numerous valuable donations made by captains and crews of each schooner were published in the Cape Ann Advertiser, weekly in 1878 and 1879, and were subsequently reprinted in the Annual Report of the Fish Comm. for 1879, p. 783. Most of the Invertebrates were identified by me, except Crustacea, identified by Prof. S. I. Smith. They included over 700 lots, and contained many new genera and species in nearly all classes of Invertebrates as well as various strange fishes. That list should be consulted for the fauna of the Fishing Banks

the summit. The cortex of the calicles and cœnenchyma is finely granulous under a lens, when dried, and the surface is filled with an abundance of very small irregular and pop-corn shaped spicules, with roughly warted and mostly spindle-shaped spicules beneath, mixed with some irregular clubs, rods, and many small irregular forms of various shapes (Pl. VI, fig. 3). The longer spicules of the tentacle-bases and anthocodia (Pl. VI, fig. 2) are slender, acute, warted spindles, often curved or irregular; those more distal in the tentacles are partly smaller warted spindles, but many are oblong warted rods and irregular forms. The larger ones in the anthocodia are from 0·5 to 0·65 mm. long.

The spicules of the axis (Pl. VI, fig. 4) are irregular rods, long narrow clubs, and spindles, with few lobes and tubercles, mixed with many irregular kinds, all closely packed together longitudinally. The larger ones are from 0·40 to 0·65 mm. long; some are regular spindles, longer than any figured.

The cœnenchyma spicules are from 0·40 to 0·45 mm. long. Many are acute spindles, longer and more regular than any figured

The calicles when dried keep their shapes pretty well. They are then up to 3–6 mm. high and about 3 mm. in diameter in the middle; height of anthocodia 2·5 to 3 mm.; diameter 2 to 2·7 mm. The basal part of the calicles is usually somewhat swollen and there is often a constriction below the margin. Colour in life buff or light yellow, fading in alcohol.

It adheres to stones, shells, barnacles, etc., but most frequently to the axis of dead Gorgonians, especially of *Keratoisis ornata* V. When seated near the end of a branch it often grows out from the end of the broken branch, continuing it by a spiculose axis of its own forming.

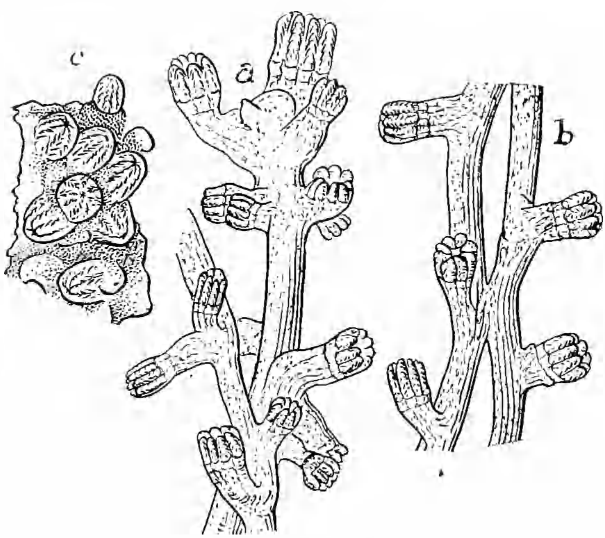

Fig. 2. *Anthothela grandiflora* Ver. a, b, Parts of a branching specimen enlarged; c, part of an encrusting specimen.

It was first discovered in American waters off Sable island, Nova Scotia, in deep water by Captain N. McPhee and crew of the schooner *Carl Schurz*, of Gloucester, Mass. Other specimens were subsequently brought in by several fishing schooners, from the Banks, off Nova Scotia and Newfoundland. It was also taken by the *Albatross* in 1881, at Station 1031, in 255 fathoms.

Suborder ALCYONACEA Verrill, 1865; emended.

Family **ALCYONIDÆ** Verrill, 1865.

Alcyonium siderium. New species.

Alcyonium digitatum (?) VERRILL, Proc. U.S. Nat. Mus., Vol. 2, p. 199, 1879 (description).

Text Fig. 3.

This species has never been taken in our waters but once, so far as I know. The two original specimens were much alike. It has not yet been figured, and therefore I have illustrated it here (fig. 3). It seemed to be distinct from the common European species, *A. digitatum*, to which it is nearly allied. It grows in the form of flattened lobes or fronds, covered to the base with spaced slightly raised calicles, and with a finely granulose cœnenchyma between the calicles, which is filled with small white simple warted spicules, mostly acute spindles.

Off Cape Cod, on the Fishing Bank, in 80 fathoms. It was found where the the bottom is rocky, and probably it occurs on all the more northern fishing banks off Nova Scotia on rough rocky bottoms, where it is hard to use suitable apparatus for collecting adherent species.

The type is in the U.S. National Museum.

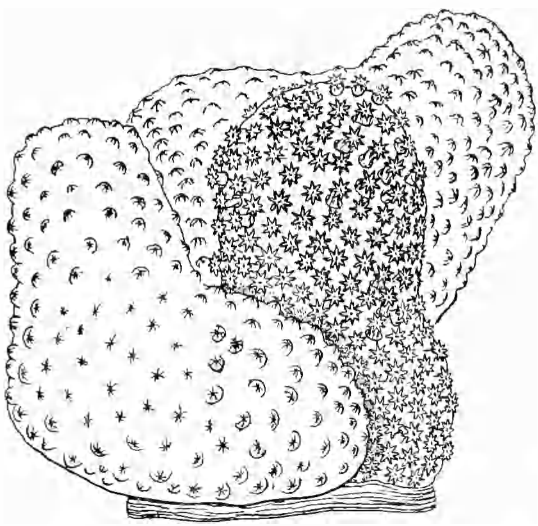

Fig. 3. *Alcyonium sidereum* Ver. sp. nov. Type. Drawn while living. x 1½.

Family **NEPHTHYIDÆ** Verrill, 1865.

Nephthyidæ VERRILL, Proc. Essex Inst., Vol. VI, p. 46, 1869,

Gersemia canadensis Verrill. New species.

Plate I; Figs. 2–2d. Plate II; Fig. 5 a-t. Plate III; Fig. 8.

This species, contracted in alcohol, has various forms, much like those of *G. rubiformis*. The specimens are attached to dead shells and stones by a thin expanded base, which appears finely granulose under a lens, especially when dried. This is due to the abundance of minute rough white spicules (see Pl. II, figs. 5 a–g). The main stalk is naked near the base, or it may have a few isolated calicles, but it soon gives off numerous short branches, which in contraction are mostly clavate or enlarged at the tip, and bear clusters of polyps which are somewhat longer than those of *G. rubiformis,* and more rigid and spiculose, especially distally, so that they seem nearly incapable of complete retraction. These colonies are yellowish brown in alcohol and the spicules are white.

The calicles are somewhat larger and more stellate than in *G. rubiformis,* and are slightly raised above the general surface (Pl. I, figs. 2b, 2c). The margin has eight blunt or rounded lobes; slightly raised riblets often radiate from the lobes. The larger polyps are usually surrounded by some immature ones, with very little cœnenchyma between them. The surface of the calicles and interspaces is so filled with minute, rough, white spicules that it is rather firm or stiff in contraction.

The polyps, in alcohol, are mostly more or less exsert, though very often the narrower proximal part is retracted wholly or partly into the calicles, leaving the thicker distal part exposed, serving as a more or less swollen or conical spiculose anthocodia. This distal part of the polyp body is covered with an abundance of slender spindle-shaped, mostly acute spicules, arranged in chevrons in eight double rows; but proximally the spicules become obliquely transverse in about ten to twelve rows, where the anthocodia narrows down to the smaller proximal region. The latter is much wrinkled, due to contraction, and bears eight double rows of much smaller spicules, arranged chevronwise.

The tentacles are long, swollen near the base, and have rather long and slender pinnæ. Small spicules extend some distance along the aboral side, at first arranged in chevrons, but becoming irregular in contracted specimens. The tentacles seem not to be able to contract very much, but are often incurved over the oral area.

The surface spicules average about the same in size as those of *G. rubiformis.* The most numerous of the larger kinds are shown on Pl. II, figs. 5 h–l; but there are many smaller and irregular forms, and a few compound crossed ones, like fig. 5 p, also a considerable number of elongated simple warty spindles like q, r, r, and s, which are magnified 165 diameters. The slender warty spindles from the distal part of the polyps and anthocodia are shown in fig. 5 t, t, t, which are magnified 165 times.

The main stalk and naked part of the branches also have a layer of minute spicules, some of the larger ones from the base being illustrated in fig. 5 a–g magnified 165 times.

The larger specimens strongly contracted in alcohol are 40 mm. high, and 35 mm. broad with 25 to 30 branches, divided into about 60 to 70 branchlets, which are sometimes again divided. Some of the largest have as many as 35 branches. A young ovate specimen is 24 mm. high, and 11 mm. broad; naked stalk is 5 mm. long, branches simple, about twenty. Many specimens were taken in the gulf of St. Lawrence at Station 31, in about 30 fathoms, off Cheticamp, N.S., Sept. 4, 1917, and at several other stations, by the Biological Board vessel *Prince.* Cat. No. 53, Cœlenterates, Victoria Memorial Museum, Ottawa (cotypes).

This species closely resembles *G. carnea* in its form and mode of branching. Perhaps it may eventually prove to be a variety of that species. The principal distinctive feature is the larger size and the more elongated forms of the cortex spiclues, which are also more abundant, and the more numerous and larger spicules of the anthocodia and tentacles.

Gersemia carnea (Ag.) Verrill.

Halcyonium carneum L. AGASSIZ, Proc. Amer. Assoc. Adv. Sci., 1850, p. 209.
Alcyonium carneum VERRILL, Bull. Mus. Comp. Zool., Vol. 1, page 39, Jan. 1864; Revision Polyps E. Coast U.S. Mem. Boston Soc. Nat. Hist. Vol. 1, p. 4, 1864; Invert. Vineyard Sound, pp. 203 (497), 443 (737), pl. 38, fig. 283, 1873 (Polyps): Ann. Rep. U.S. Fish Comm., 1883, p. 533: Expl. Casco Bay, Proc. Amer. Assoc. Adv. Sci., Vol. for 1873, p. 364, pl. VI, fig. 4 (Polyps); Webster's International Dictionary, p. 37 (figure from life).

Plate IV; Fig. 1 (general), Figs. 2, 3 (spicules). Plate XI; Fig. I.

This elegant species is common from the gulf of St. Lawrence to southern New England, both in shallow water and down to 40 to 50 fathoms

Although very distinct from *G. rubiformis* it has often been confused with that species, especially when its colour is pink or pale red. Usually while living its colour is pale flesh colour or salmon colour, but it is often light orange or pale red. It grows to considerable size, up to 120 mm. high, or more, and is then much branched (see Pl. XI). When fully expanded it is translucent and very elegant in appearance (Pl. IV, fig. 1). The tips of its slender branches are covered with the delicate and almost transparent polyps, in small clusters, and the yellow or orange eggs can be seen in the tubes of the branches and trunk through the integument. In contraction, the branches become short with round or clavate tips, but it does not have a dense coating of spicules, like the other two species already described. Consequently it is much softer, smoother and more translucent. It is often much more branched than the specimen figured on Pl. IV, which was less than half grown. It was photographed while living and fully expanded in a small plate glass aquarium. An example of unusually large size is figured on Pl. XI, from an alcoholic specimen.

The spicules of this species are smaller than in the preceding species, and though somewhat similar in general appearance, their forms are characteristic (Pl. IV, fig. 2). The larger ones of the stalks and branches are partly small short double-heads, "dumb-bells" or double clubs (fig. 2, i–k) with very prominent ornamented processes or warts, as in i, j, which are unusually large forms, or in the form of acute spindles, as in g, h; most however are more irregular and smaller, with relatively large projections (l–p), in popped-corn shapes, as seen enlarged 140 diameters. Under lower powers of the microscope many of the smaller of the spicules appear like small stellate forms, especially when viewed endwise, like q, r, s.

The polyps are long and prominent in expansion, but they are very contractile. They are able to retract entirely, but usually leave the anthocodia exposed when preserved in alcohol. The anthocodia is covered with abundant elongated slender warted spindles, some of which are bent, but usually there are some sub-clavate forms, or even branched forms; the base of the anthocodia contains a wreath of similar spicules placed nearly transversely; the proximal part of the polyp in preserved specimens is smaller, wrinkled and usually has few small transverse spicules or none. The tentacles contain slender, irregular spindles, with rod-like and clavate shapes and other small forms; pinnæ usually have no spicules.

In the anthocodia the slender spicules are rather uniform in size and they are arranged in chevrons,pretty regularly,in eight double rows becoming obliquely transverse and forming a wreath where the mesenterial body-column begins. The walls of the proximal part of the polyp or mesenterial region is nearly destitute of spicules; when any occur they are small slender rods and spindles, decidedly smaller than those of the anthocodia. In preserved specimens it often happens that this more flexible part is withdrawn and the anthocodia remains exsert. This may happen to the entire colony, or part of the polyps may be in this state and part may be entirely retracted, depending upon the intensity of the contraction. Thus the general appearance varies considerably. The mode of branching in the larger specimens is arborescent but quite variable and irregular.

The walls of the main stalk and larger branches, when not greatly contracted show, under the microscope, the small, short, often somewhat stellate spicules scattered and well separated. On the stems of the smaller branches the spicules are usually more numerous, and some are larger, often interlocking, but in some places well separated. The calicles are not at all prominent, usually immersed, and surrounded or separated by a small amount of cœnenchyma. The spicules of the branches vary much in size in different specimens, according to the locality of origin.

In general, the spicules are mostly about three-fourths the size of the corresponding forms in *G. rubiformis*, but sometimes are nearly as large. The figures of the spicules on Pl. IV, are much more enlarged than those of the latter, or those of *G. canadensis*.

This species is common on stony or shelly bottoms from the southern part of the gulf of St. Lawrence to the moderately deep waters near Block island and Watch hill, R.I., and off Stonington, Conn. It is most common in 10 to 30 fathoms but occurs down to 55 fathoms. I have taken it at low water of extremely low tides at Eastport, Maine. It was found by us particularly large and abundant south of Cape Breton, N.S., and off Cape Cod in 15 to 20 fathoms. At the latter place it was associated with great numbers of *Gorgonocephalus* (or *Astrophyton*) *agassizii*, which were clinging tenaciously to the Alcyonarians by their tendril-like arm-branches. It does not appear to extend to the sub-arctic coasts nor to any great depths.

VARIETY OR SUB-SPECIES, *G. carnea microstella* V., Plate IV; fig. 3.

The specimens coming from south of Cape Cod to the eastern part of Long Island sound differ from the more northern ones in having the spicules of the cortex of the stalk and branches much smaller and farther apart. They are also more stellate in form. The modes of branching, form, and colours, are the same as in the trypical form (see Pl. IV, fig. 3, a-m).

Gersemia fruticosa (M. Sars) Molander.

Alcyonium fruticosum M. SARS, Forh. Vid. Selsk. Christiana, 1860, p. 140. KOREN and DANIELSSEN, Fauna Litt. Norvegiæ, Vol. iii, p. 81, pl. III, fig. 8–II, 1877.

Gersemia florida MARENZELLER, Akad. Wiss. Wien, Vol. 35, p. 375, pl. III, figs. 2–3, 1878, (*non* Rathke, t. Jungersen.)

Gersemia danielsseni MARENZELLER, Die Inter. Polarf., 1882-1883 (t. Jungersen).

Væringia fruticosa + *V. arborea* JUNGERSEN, Kara Havets Alcyonider, Dijmphna Togtets, Zool. Bot. Udbytte, pp. 375-378, pl. 32, figs. 1–13; pl. 33, figs. 1–12, 1887.

V. mirabilis+*fruticosa*+*abyssicola*+*polaris*+*pygmæa*+*dryopsis*+*Jan Mayeni*+*clavata*+*capitata*+*Barathrobius digitatus*+*B. palmatus*+*Krystalophanes polaris*+*Fulla schierztii* + *Nannodendron elegans*+*Nidalia arctica*+*Organidus nordenskioldii* + *Sarakka crassa*, etc. (*t.* Jungersen), DANIELSSEN, N. Nordhavs Exped., Alcyonida, 1887, pl. 1, 2, 7, 8–10, 15, 16–21, 22, 23, in part.

Eunephthya clavata+E. fruticosa+Nidalia arctica+Krystallofanes+Sarakka, KÜKENTHAL, Tiefsee Exped., 1898–99, Valdivia, Vol. 13, pp. 73, 74, 77, 1906 (*t.* Jungersen).

Eunephthya fruticosa JUNGERSEN, Danmarks Eksped. til Grønlands Nordostkyst, 1906–1908, B. iii, No. 18, Alcyonaria of East Greenland, p. 489, 1916 (gives full synonmy and distribution).

Gersemia fruticosa MOLANDER, op. cit. pp. 48, 60, pl. I, figs. 2–5, 9, 11, 12, 13, 1915. Includes as varieties:—*arctica*; *loricata+abyssorum*; *membranea+hyalina* and *frigida*; *pallida, nov.*; and *rigida, nov.* He regards *mirabilis; clavata+crassa* as distinct species, though united with it by Jungersen.

Plate III; Figs. 5–7.

This species, when well-grown, consists of a short naked stalk, dividing from near the base into more or less numerous branches, which again may divide and subdivide in large examples. The terminal branchlets may be blunt, clavate or capitate, mostly clavate when contracted. Each branchlet may be terminated by few or many slender, elongated polyps, arising from slightly raised 8-lobed calicles, and varying in age and size. The polyps are so stiffened with small spicules that they are nearly or quite incapable of complete contraction within the calicles, but in alcoholic specimens the proximal part, about a third or half of the length, is often contracted to a smaller diameter and less length than the more or less swollen distal part, or anthocodia, owing to its smaller and less abundant spicules, and it is then usually wrinked both transversely and longitudinally, and in this state it may be partly withdrawn into the calicles. But the enlarged distal part remains above the calicle as a prominent anthodia, covered with an abundance of small, slender, often bent, fusiform warted spicules, which are arranged in chevrons, in double rows on the distal part, but become obliquely transverse, and about twelve in a group, on the proximal part of the swollen region, thus forming a "wreath," as it decreases in size to join the smaller basal part. The latter is much smaller, in alcoholic specimens, cylindric, slightly 8-ribbed, and is strengthened by eight double rows of small fusiform, warted, spicules, arranged in chevrons. These spicules are much smaller than those in the anthocodia (see Pl. III, figs. 5, 6). The tentacles also contain small spicules along the aboral side to near the end of the stalk. The larger of these are small spindles which in a contracted tentacle appear to lie nearly transversely to the stalk, but in the normal extended condition, they appear to have been arranged in open chevrons; none are seen in the pinnules. The tentacles are long, somewhat swollen proximally, but tapered to slender tips; their larger pinnæ are long and slender. The tentacles seem incapable of contraction within the oral depression, but can be incurved rather closely, though in alcoholic specimens they are mostly not more than half contracted, and some are nearly fully distended. The anthocodia terminates in eight small obtuse lobes or scallops, corresponding to the tentacle bases. These lobes are stiffened by small spicules and in alcohol contain a dark pigment. All the spicules are white in alcohol.

The various forms of spicules from the anthocodia and tentacles, are mostly illustrated in Pl. III, fig. 7, but the smaller forms are omitted. The larger spicules on the distal part of the polyps (fig. 7, b–g) are slender spindles, more or less warty, often with one end more attenuated and smoother than the other; both ends may be acute or one may be blunt or bi-lobed while the smaller end may be acute. With these there are a few larger and stouter warted spindles (fig. a), and very many smaller warted forms that come from the proximal part of the polyp-body, from the tentacles and from other parts (fig. 7, h–n), but only a few are figured: l–o were probably also from the tentacles. The slender spindles from the anthocodia are mostly ten to twelve times longer than thick; some are about 0·28 mm. long and 0·03 mm. in diameter; others 0·25 by 0·38, 0·25 by 0·03; the larger spindles are about 0·31 mm. long and 0·05 thick. The superficial layer of the stalk contains very small rough warty spicules, but not enough to make it rigid or firm.

The American specimen, described above, is from Richmond gulf, east side of Hudson bay, in 15 to 30 fathoms, collected by A. P. Low, June, 1899, accompanied by *G. rubiformis*. This specimen, which is a main branch of a large one, is only partially contracted in alcohol. It is 26 mm. long and 30 mm. broad. It divides near the base into three main branchlets, each of which has numerous smaller branchlets, most of which are clavate, with small clusters of exsert polyps; besides these are some single polyps arising both from the stem and from the stalks of the branchlets. The integument of the stalks is everywhere much wrinkled, showing considerable contraction, perhaps 50 per cent or more. The exsert polyps (Pl. III, fig. 5), when full grown, not including the tentacles, are from 1·8 to 2·5 mm. long, and the thicker distal part is from 0·8 to 1·00 mm. in diameter, in alcoholic specimens. Three specimens were collected in Richmond gulf, in 15 to 20 fathoms, 1920, by F. Johansen. Young of *Gorgonocephalus lamarckii* adhered to these.

The numerous generic and specific names that this species has received, are most of them due to too much importance being given to different states of contraction and variations in the forms of the colonies, also due partly to different stages of growth.

According to Jungersen this species has already been referred to thirteen genera, and has had twenty-five specific names. Yet none of the combinations of names given by him seem to be tenable.

This species must be considered the type of *Gersemia* (Marenzeller, 1883), and should receive the earliest specific name, *fruticosa* (M. Sars), as Molander has used it.

It should not be referred to the earlier genus *Eunephthya*, for its calicles contain only minute spicules, not in the least thorny nor with rough spinose projecting lobes, as explained above.

Kükenthal and Jungersen also referred to this species with doubt the *Gersemia longiflora*, described and figured by me in 1883 and 1885, from deep-water off Delaware bay. The latter, however, seems to be quite distinct from all the Arctic forms. It has larger and very much longer polyp-bodies, and its spicules are much smaller and more slender; mostly delicate rods and slender spindles (see Pl. IV, fig. 8, Pl. XIV, figs. 3, 3a).

As shown above in the synonymy, both Kükenthal and Jungersen united under this species a large number of genera and species well described and figured by Danielssen (op. cit. 1887). They were without full agreement in several cases. Molander accepted most of this consolidation, but kept *G. mirabilis*, *G. clavata*, and *G. uvæformis* as distinct species. At the same time he recognized several marked varieties of *G. clavata*, viz.: *arctica*, *loricata*, *frigida*, *pallida*, and *rigida*.[1]

[1] By including in the synonymy given above, so many of the nominal genera and species described and figured by Danielssen, I do not assume to express any personal opinion as to so much consolidation, for I have not seen many of the forms described, nor have I given any adequate study to the larger numbers of forms received from our northern fishing banks, and now in the U.S. National Museum. In general they received only superficial examination when brought in and listed for the weekly records, for other duties required more attention. Danielssen saw all or most of those he described while in the living or at least fresh condition, and gives life-like colours, for he was one of the naturalists of the Expedition. Moreover he evidently made careful studies of the spicules, and other microscopic details. In this group appearance in life should, no doubt, count for considerable value. Therefore those numerous names are included entirely on the authority of Jungersen and Kükenthal. Very likely several should be omitted from this synonymy.

Danielssen described and figured *Nannodendron elegans* as having numerous siphonozooids, which contained ova. I have never seen such structures in any *Gersemia*. In general appearance it is otherwise much like *G. rubiformis*. having the same lobulate form of branches with small retractile polyps, but it has no anthocodial wreath of spicules. It is probably a valid genus.

The specimen described above and figured by me, from Hudson bay, seems to agree best with the typical form from off Newfoundland in 290 meters. I have not seen many specimens from the Fishing Banks. It is known from Baffin bay, 358 meters; Davis sound, 61 meters; Greenland, 70 to 738 meters. It has a wide distribution in the Arctic ocean, and is probably circumpolar. It is common in the Kara sea. In depth it ranges from 10 to 1,300 fathoms.

Gersemia mirabilis (Dan.) Molander.

Væringia mirabilis DANIELSSEN, op. cit., pp. 1–8, pl. I, figs. 1–40; pl. II, figs. 1–2, 1887.

Væringia arborea JUNGERSEN, op. cit., p. 375, pl. XXXIII, figs. 1–12, 1887.

Eunephthya mirabilis KÜKENTHAL, op. cit., p. 345, 1907; Alcyon. Sibir. Eism., p. 5, 1909.

Eunephthya fruticosa JUNGERSEN (*pars*), op. cit., p. 11, 1916.

Gersemia mirabilis MOLANDER, op. cit., p. 48, text cut 12, p. 69, pl. I, fig. 10, 1915.

Plate V; Fig. 5 (spicules). Text Fig. 4.

This is a large luxuriant species (or variety) closely related to *G. fruticosa*, to which Jungersen, in his later works, has united it. But Kukenthal and Molander, who have apparently had abundant materials, have kept it separate. It is a common form near or on the Grand Banks of Newfoundland, where it sometimes becomes 150 to 200 mm. high.

Its spiculation is distinctly unlike that of varieties of *G. fruticosa* that I have seen. Therefore I am led to keep it distinct, for our numerous specimens are not now available for reexamination. It has a large stout trunk, when well grown, which branches arborescently from near the base, giving off large branches with naked stalks; these in turn give off secondary and often tertiary branchlets, which bear clusters of few or numerous elongated polyps, both laterally and terminally. These seem incapable of complete retraction. The anthocodia and the more or less curled up tentacles remaining exposed in alcoholic specimens. Perhaps the immature polyps may retract.

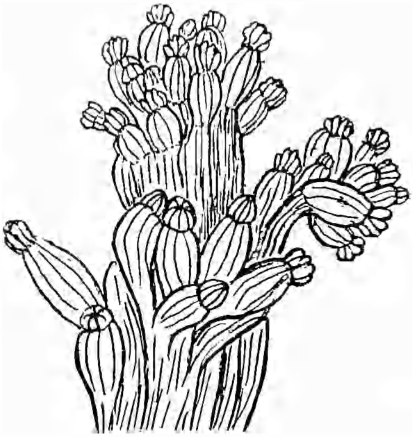

Fig. 4. *Gersemia mirabilis* (Dan). Type. A terminal cluster of polyps, enlarged. After Danielssen.

The anthocodia is commonly smaller than the proximal part of the polyp-body, in alcoholic specimens, but the reverse is often seen. The proximal part is often swollen or inflated. The division between the two regions is not notable.

The anthocodia is filled with numerous spicules arranged chevron-wise in eight double rows. These spicules are slender, elongated, finely warted spindles, and rod-shaped forms, some of them bent in bow shape. These spicules, as warted spindles, extend into the aboral side of the tentacles, often to near the tips, becoming gradually smaller, in contraction appearing nearly transverse, but really in two rows, somewhat in chevrons. They do not enter the pinnules, and are small at the bases of the tentacles. They are mostly stumpy, irregular, warted spindles, and blunt double spindles, with a few clubs and crosses.

The middle portion of the polyp-body also has short, blunt, roughly warted spindles and double spindles, much shorter and rougher than those of the anthocodia.

The proximal part of the polyp-body has somewhat larger and more strongly warted blunt spindles, with some 4-parted spicules or crosses. The spicules of the exterior of the branches and stalk, are short thick strongly warted or lobed ellipsoids, double-spindles, and double-heads, often nearly as broad as long; many are popped-corn shaped. (Pl. V, fig. 5, h–l). The stomodæum has eight rows of small fusiform spicules, according to Danielssen.[1]

The type of this species was from off Spitzbergen, in 267 metres. It is also known from the Siberian sea and Kara sea. Molander recorded it from off Newfoundland in 290 metres. Many specimens of large size were formerly taken in deep water, on and between the fishing banks off Newfoundland and Nova Scotia, and presented to the U.S. Fish Commission. They are mostly in the U.S. National Museum.

The description of the spiculation of this species given by Molander (op. cit. 1915) does not agree well with the original description and elaborate figures given by Danielssen. By the latter the anthocodial spicules are represented as abundant, and so are those of the cortex of the stem and branches, but Molander describes these parts as feebly spiculose. Moreover he gives the forms of spicules unlike those figured by Danielssen in many cases. I have followed Danielssen in this case.

It may prove to be merely the full-grown state of *G. fruticosa,* as Jungersen considered it.

Gersemia clavata (Dan.) Molander.

Væringia clavata DANIELSSEN, op. cit., pp. 29–32, pl. XX, figs. 45–83, 1887.

Paraspongodes clavata STUDER, Res. Camp. Prince de Monaco in "Hirondelle," Vol. XX, p. 31, 1901.

Eunephthya crassa KÜKENTHAL, Revis. Alcyon., Nephthyidæ, Zool. Jahrb. Abt. Syst., Vol. XXIV, 1907: Voy. Olga, 1898; Alcyon. Sib. Eismeeres, 1909, BROCK, Duc d'Orléans, Camp. Arct., p. 19, 1912.

Gersemia clavata MOLANDER, op. cit., pp. 48, 56, pl. 1, figs. 2–3, 8, 1915.

Eunephthya clavata var. *pellucida* KÜKENTHAL, Olga Exped., p. 23, pl. 1, fig. 1, 1906; Alcyon. Siberischen Eismeeres, p. 5, 1909.

Plate V; Figs. 3, 3a, 4 (spicules).

This form has the branches short and thick, often clavate, and covered over most of their length with the polyps, which are usually much crowded in contracted specimens. The smaller specimens are apt to be thyrsiform or ovate in shape. One example before me, from the Gulf of St. Lawrence, is of

[1]Danielssen (op. cit., 1887) gave very excellent illustrations (pl. 1, 2) of the anatomy and histology of this species, including the nerve-cells and ganglion cells, etc., as well as details of the spiculation. The colour in life, according to him, is yellow.

this form. Its height is 35 mm., breadth 15 mm., length of naked stem 10 mm. It is attached to an annelid tube which is entirely enclosed by the base. The polyps are all in partial expansion. They entirely cover the short clavate branches except for a very short naked basal area. Although crowded they show in some places naked cœnenchyma between them.

The anthocoidal area of the polyps is relatively large, strongly eight-ribbed, often half the length of the exposed polyp-body, and is filled with eight double rows of slender warted spicules in chevrons. It is usually separated from the proximal part by a constriction, and by a wreath of spicules, placed obliquely and transversely.

The proximal part of the polyp-body is usually equal in diameter to the anthocodia, and often larger. It is usually eight-ribbed and has eight rows of small spicules. In strongly contracted specimens the anthocodial area is the larger one.

The tentacles have swollen prominent bases, with the tips curled in over the oral area in most cases. They are stiffened by numerous small spindles. Those of the proximal part of the body are similar but shorter, thicker and more strongly warted. The spicules of the cortex of the stem are short and wide, ellipsoidal, ovoid, or short fusiform, partly of those kinds that I have called popped-corn shaped (figs. 4, h–l). Some of these have a narrow naked median zone; others none at all; their lobes are prominent, often divided or lacerate at the tips. Some compound crosses also occur with irregular unequal branches and prominent lobes. For comparison I have reproduced in outline several of the figures given by Danielssen, from his type (see Pl. V, fig. 4). This form was united to *G. fruticosa* by Jungersen (1916), but was kept as a distinct species by Kükenthal (1906, 1909), and by Molander (1915). In general form it seems quite distinct, but there are no marked differences in the spicules. Kükenthal recognized a variety, *pellucida*, from off Spitzbergen and the Siberian coast in 40 and 21 meters.

Molander recognized several varieties:—*crassa*, *pellucida*, and *truncata*.

It is very nearly allied to *G. carnea*, and is widely distributed in the Arctic ocean. Molander records it from off Newfoundland in 164 meters. The specimen described above was from Station 35 or 36, 1873, in the gulf of St. Lawrence, and was sent by the late Dr. J. F. Whiteaves. Studer recorded it from off the Azores in 927 meters.

Eunephthya Verrill (typical).

Eunephthya Verrill, Amer. Jour. Sci., Vol. 47, p. 284, March, 1869, Remarks on Halcyonid Polyps, No. 3. Type designated was *Nephthya thyrsoidea* Ver. from Cape of Good Hope (not *Eunephthya* of Kükenthal, Jungersen and others, nor of Thomson, 1910, South African).

Capnella Kükenthal (*non* Gray), Valdivia Exped., Bd. XIII, 1906; Thomson, J. S., Alcyonaria of the Cape of Good Hope and Natal, Alcyonacea, Trans. Royal Soc. of Edinburgh, Vol. XLVII, part 3, No. 19, p. 375, 1910.

When this genus was originally established by me, *E. thyrsoidea* V. (there misspelled *thyrsoides*) was definitely designated as the type. Several more recent writers have misinterpreted the genus, so as to include several arctic and boreal species that are quite unlike the type in the character of the calicles, spicules, etc.

When it was established, however, I mentioned an undescribed species from Greenland as one to be included in the genus, under the name of *E. glomerata* (Lütken's MS. name on labels). The latter was then briefly described (1869) and was more fully described by me in 1883, as *lütkeni* (on account of erroneously supposed previous use of *glomerata*). It has since had various names both generic and specific (see below).

As originally established, with its designated type, it is identical with *Capnella* Kükenthal,[1] who described my species as *C. rugosa.*

Capnella has been made to include several other Indo-Pacific species, which should be referred to *Eunephthya.* Among these are *E. spicata* (May) from Zanzibar; *E. gilchristi* (Thomson) South Africa, 40 fathoms; *E. fungiformis. E. thyrsoidea* Verrill, was from 20 fathoms, off False bay,Cape of Good Hope.

Unfortunately Kükenthal applied the name *Eunephthya* to the second species mentioned by me, and then extended it to include numerous other Arctic species belonging to the genera *Gersemia* Mar., *Duva* and *Drifa* Danielssen, etc.

My *E. glomerata,* before Kükenthal's "emendation," had already been placed in two new genera by Danielssen, viz., *Drifa* and *Gersemiopsis.* Thus even if *E. thyrsoidea* had not been named by me as the type, it would have become so automatically by reason of the placing of *E. glomerata* in a new genus by Danielssen, in 1887, long before *Capnella* was expanded.

Paraspongodes[2] has been used for these various northern forms by May (1898), and by others. It is a heterogenous group, practically a synonym of *Eunethphya* Kükenthal, in its extended use, and preceded by eight generic names given by Danielssen and others, and therefore it should be dropped for all of our northern genera. Kükenthal described and figured a new species, (*P. crassa,* p. 132, pl. viii, fis. 26, 27) which is apparently generically distinct from any of our forms, and might be considered the type of his restricted genus.

Molander (op. cit. 1915) judiciously adopted *Gersemia* (it being prior to *Væringia* Dan.) for the group typified by *G. fruticosa,* but he still retained *Eunephthya* to include the *glomerata* group (*Drifa*), together with the *florida*-group, named *Duva* by Danielssen. I believe that these two groups should be separated as genera, but *Eunephthya* should not be used for either of them.

Eunephthya thyrsoidea Verrill.

Plate V; Figs. 1, 1a. Type.

This was briefly described by me in 1865, in Proc. Essex. Inst., Salem, Mass., Vol. IV, p. 151, and more fully, with some figures, in the same volume (p. 192, figs. 8-8b); and later, in 1869, the characteristic spicules were described with their measurements. The larger original specimens seem to have been destroyed in the great Chicago fire.[3]

However I still have microscopical preparations from the type-specimen, including the spicules now figured. I also have in my collection, a small co-type, in good preservation. This, so far as I know, is the only one remaining. This specimen is 25 mm. high and 10 mm. broad. The naked stalk occupies about half the height. The whole forms a thyrsoid or club-shaped polypidom. The polypiferous part is thyrsiform, with about a dozen crowded, short, clavate larger branches, entirely covered by the polyps, which are closely crowded, thirty to forty standing on each branch; below these there are several small or incipient branches with three to ten polyps, and some polyps stand singly or in pairs on the upper part of the stem, and, also, sometimes on the branches.

[1]It does not agree with typical *Capnella* Gray (Ann. & Mag. Nat. Hist. Vol. III, p. 129, 1869), type *Ammothea imbricata* Edw. Gray says the outer surface is studded with small flat, smooth, irregular-shaped spicules and that the cells are "campanulate slightly eight-lobed" also that the polyps are retractile, all of which are very different in *Eunephthya* (typical).

[2]Kukenthal, Alcyonaceen von Ternate, p. 171, 1896.

[3]Most of the collections of the North Pacific Exploring Expedition of which I wrote had been returned to Dr. Wm. Stimpson, naturalist of the Expedition, and then Director of the Chicago Museum, before that Museum was burned with all its valuable collections. A few duplicates were previously deposited in the Museum of Comparative Zoology, where they are still preserved. Among them are co-types of the large *Spongodes gigantea* and *S. capitata,* and a few other Alcyonaria, but not *E. thyrsoidea.*

The exsert and strongly incurved polyps are echinate, with about four principal rows of lacerate and spinulose or thorny processes, arising from the larger ends and sides of rudely club-shaped spicules, and projecting through the cortex (see Pl. V, figs. 1, 1a); more proximally the spicules are less clavate and less foliate, with smaller spinule-like projections especially from the outer side; laterally the spicules are mostly coarsely warted spindles and narrow clubs. Spicules are lacking on the incurved inner side. The tentacles are spiculose. In sections the stalk has numerous canals, separated by thick walls. This species has more recently been very fully described and illustrated by Kükenthal, and also by Thomson (op. cit., pp. 575–577, pl. ii, fig. 10, general; pl. IV, fig. 42, spicules) under the name *Capnella rugosa*. Thomson, in the same work (pp. 580, 581, pl. iii, fig. 20, pl. IV, fig. 41, spicules), has described a very different species under the name *E. thyrsoidea* V. It belongs, perhaps, to a different genus, and does not have the clavate and foliated spicules in the polyp-walls, so conspicuous in the former. It resembles rather some northern species of *Gersemia*.

From the above discussion it will be evident that the name *Eunephthya* cannot be used legitimately for any of our northern genera or species. Therefore I propose to restore *Drifa* Dan. with *D. hyalina* D. = *E. glomerata* as the type.

The *D. glomerata* (Pl. V, figs. 2, 2a), originally referred to *Eunephthya* by me, does, however, resemble the type to a considerable extent, for it has the distal polyp-spicules of the anthocodia mostly club-shaped with rough somewhat foliated processes on the larger end, and in alcoholic specimens these processes often project slightly from the surface, but these spicules are much smaller and much less foliated than in the type. The polyps are also often unequal-sided and turned inward, and spicules may, sometimes, be lacking on the inner side, as in the type. The longitudinal canals in the stems are much larger and separated by thinner walls.

Drifa Danielssen (Type *D. hyalina* Dan. = *D. glomerata* V.).

Drifa + *Nephthya* + *Gersemiopsis* DANIELSSEN, op. cit., pp. 59, 64, 81, 99, 1887; *Drifa* type = *E. glomerata*.

Eunephthya (pars) VERRILL, op. cit., 1869, p. 284 (not of Kükenthal, Jungersen, Thompson and others.)

Paraspongodes (pars) KÜKENTHAL. MAY, op. cit., 1898.

Plate V; Figs. 2, 2a. Type:

Polypidom, when full grown, variously branched or lobed, branches may be much subdivided. Polyps small, prominent, not retractile, usually incurved, often with few spicules on the inner or shorter side. Outer convex side forms an anthocodia strengthened with numerous small rough spicules, largely clubs, with the larger end more or less lobed and spinose, the smaller end acute and warted; with these are warted spindles and other slender forms. They are arranged in chevrons; spicules also occur in the aboral side of the tentacles and a wreath of more or less transverse spicules at the base of the anthocodia. Cœnenchyma nearly or quite lacking between the calicles. Cortex of stalk and branches filled with small short roughly warted spindles, ellipsoids, with some clubs and various other forms.

Danielssen gives the meaning of *Drifa* as a snow-nymph or snowstorm.

Drifa glomerata Verrill.

Eunephthya glomerata Verrill, Amer. Jour. Sci. Vol. 47, p. 284, 1869: Proc. Essex Inst. Vol. 6, p. 97, 1869.

Ammothea arctica Norman, Proc. Roy. Soc. London, Vol. 25, p. 208, 1876. Lutken, Medd. om Grônland, Vol. 6, p. 29, 1883.

Ammothea lütkeni Marenzeller, Akad. Wiss. Wien. Vol. 35, p. 372, pl. III, fig. 1, 1898.

Alcyonium lütkeni Verrill, Proc. U.S. Nat. Mus., Vol. 2, p. 200, 1879.

Ammothea glomerata Carter, Zoology Barents Sea, Ann. Mag. Nat. Hist., Ser. 5, Vol. 6, p. 253, 1883.

Eunephthya lütkeni Verrill, Bull. Mus. Comp. Zool., Vol. XI, p. 43, pl. IV, figs. 7, 7a, 1883.

Nephthya polaris+N. flavescens+N. rosea+Drifa islandica+D. hyalina+Gersemiopsis arctica (*teste* Jungersen) Danielssen, N. Nordhavs Exped. Vol. 5, Alcyonaria, pp. 59, 65, 83, 87,92, 99, plates VI, VII, X–XV, 1887. Excellent figures.

Eunephthya glomerata+E. hyalina Kükenthal, Alcyonacea, Wiss. Erg. deutsch. Tiefsee–Exped. Vol. 13, pp. 78, 79, 1906. (*t.* Jungersen).

Eunephthya glomerata Jungersen, F. E. Alcyonaria of E. Greenland, p. 493, 1916; Alcyonarian and Madr. Corals, Bergens Mus. Aarbok, for 1915, 1916, p. 14, 1916.

Paraspongodes lütkeni+P. polaris May, Jen. Zeitschr. Nat. Vol. 33, pp. 148, 154, 1899 (*t.* Jungersen).

Eunephthya flavescens Molander, op. cit., pp. 72–78, pl. ii, figs. 15, 17, 19 (good figures), 1915.

Plate V; Figs. 2, 2a (from type). Plate XVIIa; Figs. 2, 3. Plate XIV; Figs. 2-2b. Plate XV; Figs. 1-5. Text Figure 5, Type.

The type of this species was from Greenland, and was sent to me by Professor Chr. Lütken under the MS. name *glomerata*, which he never published. The original description by me in 1869, under the name *Eunephthya glomerata*, was as follows:—It "forms an upright corallum, with a stout trunk, from all sides and to near the base of which arise short subconical branches, naked at their bases, like the trunk, but mostly covered with close clusters of 3 to 12, roundish, verruciform polyp-cells, which are rough exteriorly, and covered with numerous very rough thorny club-shaped spicula, 0·20 to 0·35 mm. long, by ·075 to 0·125 mm. thick."

Fig. 5. *Drifa glomerata* Verrill. Type. One of the branches. From Greenland. x about 3

In my report on the "Blake" Anthozoa, 1883, p. 43, the name was changed to *E. lütkeni*, following Marenzeller, because of the prior use of the name *Alcyonium glomeratum* by Johnson; but that change was not valid, for the present species was not originally described as an *Alcyonium*.

In the latter work it was more fully described and figured, together with a few of the spicules. In that place the spicules were described as follows:—"The larger spicula are rather large, long, stout, mostly club-shaped, with the smaller end thickly covered with small warts, and the large end covered with large, roughly lacerate warts, sometimes taking the form of ragged spinules; in other cases having the form of lacerate flattened lobes; with these are some roughly warted fusiform spicula, of similar size, and numerous smaller rough spicula, some of which are fusiform, others club-shaped, and some of them slender while others are stout.

Height, in alcohol, 60 to 80 mm., or about three inches; breadth 35 to 50 mm.; diameter of contracted calicles (polyps) 1 to 1·25 mm. It sometimes becomes larger, up to 5 inches high."

Several examples were dredged off Halifax, Nova Scotia, in 52 fathoms (U.S.F. Comm. steamer *Speedwell*) in 1877. One small one was dredged by the *Blake* off Delaware bay, in 1,186 fathoms, and several good specimens, obtained on the Fishing Banks, off Nova Scotia, by cod and halibut fishermen have been presented to the U.S. Fish Commission.

In life the colour is usually pink or pale red, brownish on the stalk, and when fully expanded it is translucent, sometimes yellow or orange. The mode of branching and form of the polypidom are quite variable, and the states of contraction cause notable changes in the appearance. This species, as shown above, has been referred to as least nine genera and has received at least eleven specific names, according to Jungersen. If it be considered generically distinct from the type of *Eunephthya* the next available generic name will be either *Drifa* or *Gersemiopsis* of Danielssen, 1887, and I would suggest the former. It is nearly allied to *Duva* and *Gersemia*, but differs from both in having rough, clavate spicules, with the acute processes projecting slightly from the polyp walls, giving them a rough appearance. The polyps are not capable of entire retraction, and are often incurved, with few or no spicules on the inner side. The anthocodial spicules do not form a wreath proximally.

In the type (Pl. V, figs. 2, 2a) most of the larger spicules of the anthocodia have numerous rough, flattish, lacerated or foliated processes, varying much in form and size, on the larger end of the spicule, decreasing in size towards the small end, where they are reduced to small spinules or warts. These spicules stand in chevron with the larger end outward, and the tips of the lacerate prominences often project more or less from the surface, especially in dried or much contracted specimens, making them rough.

According to Molander his *E. grœnlandica* differs in having the rough processes of the clubs much more slender and more numerous. Some of our specimens agree fairly with *Drifa islandica* Dan., others with his *flavescens* and *rosea*. These last two are united under the former name as a distinct species by Molander, but its distinctness seems very doubtful, at least to Jungersen, who also unites into our species all the nominal species well illustrated by Danielssen. All are ovoviviparous.

Several of Danielssen's forms seem to me to be either distinct, or at least notable varieties, for they differ very much from the typical *glomerata* in the forms and ornamentation of the spicules as well as in other characters, as figured by Danielssen, but his *D. hyalina* and *N. flavescens* agree best with my types.

The various specimens from the Fishing Banks, in the Yale Museum, are not now available for study, for they were boxed up and put in storage before the demolition of the museum building, several years ago. Those examples undoubtedly include several of the forms named as distinct by Danielssen.

The type of *E. glomerata* is in my private collection, and is now before me. It agrees closely with the form named *Nephthya flavescens* by Danielssen (op. cit., Pl. XI, figs. 1–58) where it is very fully illustrated, with many of its spicules, which are practically identical with corresponding spicules of the type. The tentacles are figured as heavily loaded with small warted spindles, etc. A much enlarged contracted polyp is represented as incurved, with the inner side smaller and without spicules. It is viviparous, and the figured planulæ are already filled with small spicules. (See Pl. XIV, figs. 4, 5, and text-cut).

My type specimen also contains eggs and planulæ, as do all other specimens that I have examined.

The *Nephthya rosea* Dan. (op. cit., Pl. XI, figs. 1–72), is united to *flavescens* by Molander, and both are placed under *glomerata* by Jungersen. As figured the branches are longer, less crowded, and the polyps are more slender and longer, which might be due to less contraction. But the larger club-shaped spicules figured have the lacerate processes of the larger end elongated and slender, without foliations, and most of the larger warted spicules are stouter and thicker than in the type of *glomerata*. Its planulæ are also spiculose. *N. polaris* Dan. (op. cit., Pl. XIII, figs. 2–45) seems to be a younger and more strongly contracted form of Molander's *glomerata*, with the same kinds of short thick clubs. It may be a distinct species.

Gersemiopsis arctica Dan. (op. cit., Pl. XIV, figs. 1–49: and Pl. XV) seems to differ some from our type as to its spicules, but the general figures show specimens less contracted than usual, and consequently with more elongated polyps, some of them expanded. Clubs have short slender branched foliations.

Drifa hyalina Dan. (op. cit., Pl. VII, figs. 1–44). The general figure shows a large example more openly branched than usual, and with elongated polyps, some incurved. Its club-shaped spicules are, in general, smaller and more slender, with the lacerate processes somewhat smaller than in the type of *glomerata* but otherwise similar. Spindles are more slender.

D. islandica Dan. (Pl. VI, figs. 30–71) is openly branched, with polyps elongated as in the last, but the larger club-shaped spicules figured are larger and coarser, stout, and often more rudely foliated, than in typical *glomerata*.

Of all these forms *E. rosea* and *E. islandica* seem to me to differ the most from the type. Kükenthal has already recognized the latter as a distinct form. Molander separated *flavescens* Dan. as a species, but that is apparently identical with the type. He united *hyalina* and *flavescens*, but *rosea* is most distinct in spiculation, and might be considered a variety worth recognizing at least. Molander proposed (1915) a new species *E. grœnlandica*, distinguished mainly on account of the presence in the polyps of elongated, slender, warted spindles, longer than the clubs, and the latter having narrow elevated processes at the enlarged end, without foliations. It seems to be a fairly distinct form, but might be considered a variety.

The form called *E. glomerata* by Molander does not agree with the type. He says of the larger polyp-spicules that they are "short clumsy clubs and spindles, 0·2–0·38 mm. long, generally clubs, their thorns broad and low." A glance at the figures that I have given (Pl. V, figs. 2, 2a) will show that this is not true of the type, for the major clubs are elongated with the smaller end much tapered. In fact they are more like his figures of *E. flavescens* (p. 71) than like those that he gives as of *E. glomerata*. His species agrees better as to spicules with *Drifa islandica*, as figured by Danielssen (Pl. VI, op. cit.) but the latter also has more tapered clubs. *N. polaris* is similar.

My impression is that Jungersen has gone too far in uniting all the known northern forms of this group (*Drifa*) under one species. Probably two or three species should be recognized, each with subordinate varieties, all based mainly on the spiculation. Many of these forms occur on the Banks, off Newfoundland; but I am not in a position to express very decided opinions on any of them, except my own types, because others are not now accessible, without too much trouble and delay.

Drifa racemosa Studer

Eunephthya racemosa Studer, Note prelim., 2nd part, 1891; op. cit., 1901, Camp. Hirondelle, p. 33, Pl. IV, figs. 1, 1a, 2.

Plate XIV; Fig. 3.

This appears to be a species distinct from *D. glomerata*. It is openly branched, with larger and more elongated polyps. The clubs of the anthocodia are much more slender. They have a more abruptly enlarged distal end, while the proximal part is slender. The enlarged part is covered with smaller spinules and more slender and shorter thorns; the slender part is closely covered with small acute warts and spinules. The spindles are more slender and have smaller more regular, and much more numerous spinules. Polyps are 4 mm. long, 2 mm. wide. It seems to be much like *D. gronlandica* Molander,—perhaps the same. It was from off Newfoundland, in 1,267 meters. Molander considers it a form of *D. flavescens*.

Duva Kören and Danielssen. Type *D. rosea* Kör. and Dan.

Duva Koren and Danielssen, Bergens Mus., pp. 1–7, pl. i–iii, 1883. Danielssen, op. cit., 1887, pp. 36–57, pl. iii–vi.

Paraspongodes (pars) May, op. cit., 1900, pp. 391–394.

Eunephthya (pars) Kükenthal, op. cit., 1906, pp. 79–81 (*non* Verrill). Jungersen, op. cit., 1915, p. 1969; op. cit., 1916, p. 495; Bergens Mus. Aarbok, 2, 1916, p. 16; Molander (*pars*), op. cit., 1915, p. 79.

As stated above *Eunephthya* cannot be used legitimately for this group. Therefore *Duva*, the earliest available name, must be used. The genus and the several species referred to it by Danielssen were very fully described and finely

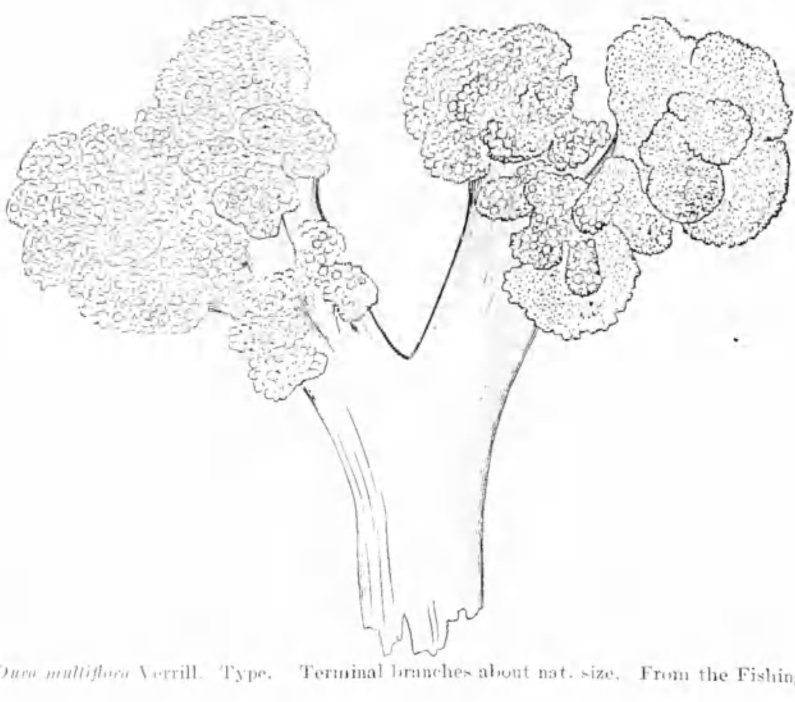

Fig. 6. *Duva multiflora* Verrill. Type. Terminal branches about nat. size. From the Fishing Banks.

illustrated by him with abundant anatomical and histological observations, though he doubtless erred in making too many species, and by giving too much importance to variations in the forms of branching.

When well-grown the polypidom has a stout stalk and numerous branches and branchlets, which bear a multitude of small crowded polyps at their tips, usually three to five in a cluster, with a little or no intervening cœnenchyma.

The branching is usually arborescent and often symmetrical, but variable. The stalk is usually smooth and naked for some distance, and the proximal part of the branches is usually naked. The terminal branches are often clustered into umbel-like groups, and in other cases into cyme-like or thyrsoid groups, usually of three to seven branchlets.

The polyps are not wholly retractile, and are often partly expanded in alcoholic specimens. The anthocodia is usually pretty well-developed and contains eight double rows of slender spindles and subclavates in chevrons, but the basal wreath of transverse spicules is nearly or quite lacking, so that its limits proximally are not well-defined. The polyps are often unequally developed in the inner and outer sides, and spicules may be few or none on the smaller inner side; in such cases the polyps curve inward in contraction.

The spicules of the anthocodia and the tentacles are mostly slender warted spindles and imperfect clubs. Those of the cortex of the branches and stalk are mostly small warted spindles, sub-clavate forms, double-heads, with more or less compound crosses, double stars, and various small irregular forms. Sometimes the lower part of the stalk is nearly destitute of spicules; the upper part and branches are often without spicules or with few. One of the most salient characteristics is the absence of any well developed wreath of transverse spicules defining the proximal zone of the anthocodia. The rows of spicules run continuously, or nearly so, from the anthocodia to the base of the polyp-body with little change, though sometimes the spicules are small, few, or lacking proximally. The tentacles are spiculose usually nearly to the tips, and sometimes in the pinnules also. This genus is in many respects intermediate between *Gersemia* and *Drifa*. From the former it differs in having less cœnenchyma, or none at all, between the polyps, and especially in not having a well-developed wreath of spicules defining the anthocodia. The spicules are mostly smaller and simpler, and those of the cortex are fewer and more generally small spindles and clubs. Also the polyps are not retractile. From *Drifa* it differs especially in not having the anthocodial area covered with lacerately lobed or spinose clubs. The latter also has larger and more clavate spicules in the cortex of the branches. It agrees in lacking an anthocodial wreath of transverse spicules. The cymiform or subumbellate mode of branching is also generally distinctive for well-grown specimens of this genus.

Duva multiflora Verrill. Sea-Cauliflower.

Alcyonium multiflorum VERRILL, Proc. U.S. Nat. Mus., Vol. 11, p. 200, 1879; Ann. Rep. U.S. Fish Comm. for 1883, p. 533, 1885.

Duva arborescens DANIELSSEN, op. cit., pp. 37–41, pl. ii, figs. 42–54: pl. iii, figs. 1–17, 1887; probably also including *D. spitsbergensis* DAN., op. cit., pl. iii, figs. 18–29, and *D. rosea* KÖREN and DAN., op. cit., 1883, pl. i.

Eunephthya rosea MOLANDER, op. cit., 1915, p. 74, pl. ii, figs. 10, 20, 21.

Plate IV; Fig. 7. Plate XIV; Fig. 6. Text Figs. 6, 7.

This, when well-grown, is a large arborescent species often 100 to 150 mm. high, and 75 mm. broad. The stalk is large and smooth; basal part of branches naked; branches very numerous, subumbellate, bearing clusters of small crowded polyps at their tips, and thus in contraction resembling a cauliflower, giving reason for the name "sea-cauliflower" used by fishermen.

Colour in life is often light red or pink, fading in alcohol.

This species has been brought in from the fishing banks, off Nova Scotia and Newfoundland, by various vessels, and presented to the U.S. Fish Commission. It occurs in 130 to 300 fathoms, and is evidently common at those depths. It is also widely distributed in the Arctic regions, and off the northern coasts of Europe.

Fig. 7. *Duva arborescens* Dan. Type. One of the polyps, and part of another with eggs. After Danielssen, enlarged.

Jungersen united all the twelve nominal species of *Duva*, described and figured by Danielssen, under the common name *Eunephthya florida* (Rathke). Molander retained three as distinct. Our species seems to agree best with *D. rosea*, and to differ distinctly from *D. florida*, judging by the figures of the latter. Some of the other species described by Danielssen seem to me worthy of recognition, judging from his numerous figures of the spicules, etc., especially those that have in the polyps much larger and more numerous spicules, like *D. glacialis*, to which *D. cinerea* might be united; and *D. flava*, Pl. V, figs. 1–33, which has unusually large and stout spicules in the anthocodia.

Family **CLAVULARIDÆ**. New family.

Stoloniferous Actinaria having calicles more or less prominent and filled with spicules, mostly rough warted spindles. Polyps also spiculose with a spiculose anthocodia.

Trachythela Verrill. New genus.

Plate VII; Figs. 1–7.

Polypidom consists of rather large, low, verruciform or short truncate-conic calicles united by narrow creeping stolons, or by a thin continuous basal expansion, usually attached to the dead axis of a Gorgonian coral, and stiffened by closely packed fusiform spicules of unusually large size.

The walls of the calicles and the cœnenchyma are filled with large elongated acute spicules, mostly in the form of warted spindles (Pl. VII, figs. 4 and 5), which project from the surface, especially in the summits of the calicles, as sharp spinules (figs. 1 and 2). Those of the outer cœnenchyma (fig. 5) are mostly very roughly warted spindles, often bent or irregular; those of the inner layer are smaller, more regularly spinulose or warted.

The polyps are large, capable of partial retraction, but usually leave a large anthocodia exposed (fig. 2). This has an opercular armature, consisting of eight convergent groups of large acute warted spindles, arranged in chevrons, in quadruple series, on the basal part of the tentacles; and of a wide collar, made up of about four to six or more transverse rows of long, stout, acute spindles, mostly more or less curved (fig. 4). The inner layer of the cœnenchyma contains smaller spindles, often unequally ended, and many small thorny clubs and double clubs with prominent warts and other small forms (fig. 7).

The polyp-cavity connects directly with the large canals in the basal structure. The calicles may stand singly or they may be united in pairs, or in small groups of abour three, with small buds around them.

Trachythela rudis Verrill. New species

Plate VII; Figs. 1–7.

Most of the characters of this, the only known species, are included in the generic description above. The larger calicles are large, swollen or mammiform at the base, with stiff spinulose cortex. The polyps are most frequently united by a membranous but spiculose basal crust, but not uncommonly by narrow creeping stolons; both methods may occur in one colony. The calicles may stand singly but are often grouped in twos or threes, or may form close nodose clusters, 8 to 10 mm. high, composed of two or three larger and several young ones. They are usually, when contracted in alcohol, about 3·5 mm. to 4 mm. in diameter, the anthocodia about 3·5 mm. broad by about 2 to 2·3 mm. high; stolons may be 3 to 4 mm. wide. Most of the calicles are surmounted by a stout strongly spiculose anthocodia (fig. 2). The calicles are echinate or rough at the margin with the sharp projecting points of numerous spicules. Some of these large warted spindles are forked or branched. The larger spicules of the anthocodia are 1·25 mm. long by 0·11 thick; 1·15 mm. long by 0·10 thick; 1·00 mm. long by 0·10 thick. Some of the larger spicules of the cœnenchyma are 1·00 mm. long and 0·16 mm. thick; 0·70 long by 0·13 thick. Some from the inner layer of the calicles are irregular and some are branched or forked at one end; length of large ones (fig. 6), may be 1·00 mm. long by 0·16 thick; 0·80 long by 0·17 mm. thick.

Numerous smaller spicules are present in the tentacles, to near the tips, and in the pinnæ.

The type specimens were from the deep water fishing banks attached to dead stalks of *Keratoisis ornata* V. Types are in my collection. One large group was on *Paragorgia arborea*.

This peculiar new species does not appear to be very nearly allied to any species previously known. It is remarkable for its strong armature of large acute projecting spicules, on and around the margins of the calicles, and for the abundant large spicules of the anthocodia and the tentacular operculum. The polyps are often entirely retracted.

The rather large spindles of the base and calicles are so thickly packed, side by side, that these parts change their sizes and forms but little in drying.

Cornulariella modesta Verrill.

Cornulariella modesta VERRILL, Amer. Journ. Sci., Ser. 3, Vol. VII, p. 40, pl. 8, figs. 1, 2, 1874; Proc. Amer. Assoc. Adv. Sci., Vol. for 1873, p. 390, pl. 6, figs. 1, 2, 1875. J. F. WHITEAVES, Amer. Journ. Sci. Vol. VII, p. 2; Catal. Mar. Invert. E. Canada, p. 30, 1901. VERRILL, Ann. Rep. U.S. Comm. Fish and Fisheries for 1883, p. 533, 1885.

Plate VI; Figs. 5, 6. Text Figs. 8, 9.

This is a small inconspicuous species, usually found growing on stones and dead shells; height 6 to 18 mm.; diameter of calicles, 3 mm.

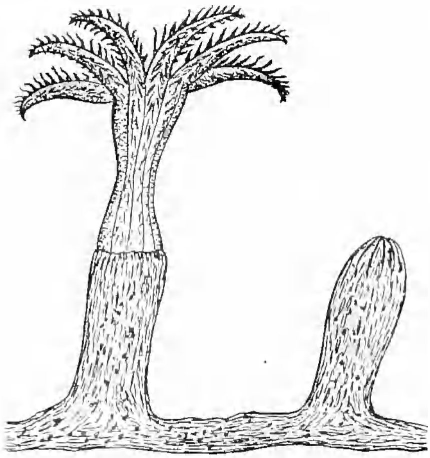

Fig. 8. *Cornulariella modesta* Verrill. Type. Enlarged about four times.

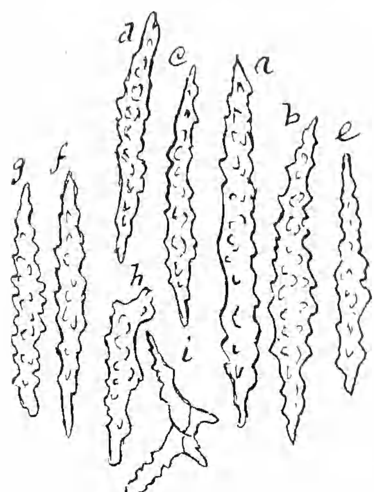

Fig. 9. *Cornulariella modesta* Verrill. Type. Some of the spicules of the basal stolon and calicles. X 116

The cylindric calicles arise either from narrow creeping stolons or from thin membranous expansions, which are filled with slender fusiform spicules. The polyps are elongated, in contraction the soft upper portion can be entirely retracted into the firmer lower part or calicle, which then has a rounded top, with eight convergent grooves. The full-grown calicles are usually at least twice higher than broad, often more. The basal stolons and calicle walls are stiffened by an abundance of rather large and long, acute, strongly spinulose spindles, closely packed together in two or more layers; in the stolons they lie parallel, but near the bases of the calicles they lie crossing each other in various directions. In addition to these there are relatively few very small roundish or granule-like, rough spicules scattered over and among the large spindles, and occasionally small compound crosses also occur sparingly. The retractile region and tentacles have eight double rows of small spicules.

The soft part of the polyps when expanded is elongated, whitish, and translucent, with spicules placed in chevrons. It is often constricted in the middle. The tentacles are white, long and graceful, swollen at base.

The type specimens were taken by us in Casco bay, 35 fathoms, and bay of Fundy in 80 to 100 fathoms, 1870-1873. Dr. Whiteaves, dredged it south of Anticosti island in 220 fathoms. It has subsequently been taken in a number of places, at similar depths, off Maine and New Brunswick, and off Cape Sable, Nova Scotia, in 80 fathoms, 1883 ("Albatross").

Several additions have been made to the Canadian Alcyonaria by T. Studer in Resultats des Campagnes Sci., Albert 1, (Camp. Hirondelle, 1886–1887) Fasc. XX, Alcyonaria, published in 1901. These were as follows:—

From off Newfoundland, in 1,267 meters.

Clavularia concreta Studer, p. 15, Pl. 1, figs. 1, 2.

Anthomastus agaricus Studer, p. 27, Pl. 1, figs. 6–9.

Eunephthya racemosa Studer, p. 33, Pl. IV, figs. 1, 2. See above, p. 34G.

Acanthogorgia verrilli Studer, p. 44, Pl. IV, figs. 4–6.

From 155 meters depth:—

Paraspongodes danielsseni Studer, p. 31, Pl. III, figs. 8, 9; pl. X, figs. 1, 3, 7. See below, p. 48G.

The *Anthomastus agaricus* seems to me to be only the young stages of *A. grandiflorus* Ver. *Eunephthya racemosa* was placed under *E. flavescens* (Dan.) by Molander; *Paraspongodes danielsseni* was united to *Gersemia clavata* (Dan.) by Molander.

Some additions have also been made to the fauna of the Newfoundland Banks by A. R. Molander in "Northern and Arctic Invertebrates in the Collection of the Swedish State Museum."[1] He records *Gersemia uvæformis* (May) from 66 meters, 1871, p. 54, pl. 1, fig. 1; pl. III, fig. 28; *G. mirabilis* (Dan.), p. 69, pl. 1, fig. 10, from 290 meters; *G. clavata* Danielssen, from 164 meters, 1871, with which he united *G. danielsseni* (Studer), pp. 56–60, pl. 1, figs. 2, 5, 8, pl. 111, fig. 29; *G. fruticosa*, pp. 60–69, pl. 1, figs. 6, 9, 11, 13, pl. 111, figs. 30, 32; *Eunephthya flavescens* (Dan. 1887), pp. 74–78, pl. 11, figs. 15, 17; 290 meters, 1871, and in this last species he includes *E. racemosa* Studer, and *E. hyalina* (Dan.), *E. sarsii* May, and *E. candida* (K. and D.).

Professor C. C. Nutting, has recorded *Stachyptilum quadridentatum* Nutting, from Juneau, Alaska, in the collection of the University of California. Proc. U.S., Nat. Museum, Vol. XXXV, p. 709, 1909.

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[1] Kungl. Svenska, Vetens.-Akad. Handlingar, Bd. 51, No. 11, VII, Alcyonacea. Stockholm, 1915.

Family **ANTHOMASTIDÆ.** New family.

I now propose to establish a new family of Alcyonacea to include *Anthomastus* Ver., and *Sarcophytum* Less., hitherto included in the family Alcyonidæ. Its principal diagnostic characters are the presence of an expanded polypiferous upper body supported on a barren stalk, with the two regions well differentiated, and the presence of numerous fertile siphonozooids between the polyps, on the upper surface. The form may be *Agaricus*-like (mushroom-shaped), or the upper portion may be lobed or divided into frondose forms.

The genus *Sarcophytum* Less. is abundant in most tropical seas, except in the West Indies and on West American coasts. It is characteristic of shallow water on coral reefs. Its polyps are small, but it often grows in large frondose masses, as well as in mushroom-shapes. It is abundant in the Red Sea, East Indies, Australian reefs, etc.

Anthomastus (Verrill, 1878,) is a deep water genus, confined to cold waters. It was first found on the Newfoundland Banks in 1878, but several species are now known coming from nearly all parts of the world where deep sea dredging has been done, both in the colder seas and in the tropics.

The polyps are always relatively large and retractile, while the fertile siphonozooids are small and destitute of tentacles. All the species appear to be of some shade of red or purple, and when mature are usually mushroom-shaped or biscuit-shaped. Some species become large. They are often found on muddy bottoms where they anchor themselves by lobulated root-like processes. But our species, and probably also all the others, can also attach itself to stones, etc., and it then has a broad encrusting base, either simple or lobed. These notable differences are not to be regarded as specific, for all intermediate states are found in the same species. So, likewise, the forms of the individuals of a species vary greatly, according to their ages and environment. They may be tall with a long stem, or low and broad with a short stalk, etc.

Anthomastus grandiflorus Verrill.

Anthomastus grandiflorus Verrill, American Journal Science, ser. 3, vol. XVI, p. 376; Brief Cont. to Zoology, No. 39, 1878; Bull. Mus. Comp. Zool., vol. XI, p. 41, pl. I, figs. 7–10b; Annual Report, U.S. Comm. Fish and Fisheries for 1883, pp. 513, 533, pl. ii, fig 12, 1885. Also a figure in Webster's International Dictionary, pp. 63, 1975, ed. of 1890 and in ed. of 1904. Whiteaves, List. Invert., op cit., p. 31, 1901.

Anthomastus purpureus (as *Sarcophyton*) Kören and Danielssen, Fauna Litt. Norv., 1883. Molander, op cit., p. 43, 1901 (details).

Anthomastus agaricus Studer, op. cit., p. 27, pl. i, figs. 1–9, 1901 (Young).

Plate XIV; Figs. 5–7. Plate XVII; Figs. 1–1d.

When well grown this is a large species, with numerous very large polyps, perhaps the largest known in any Alcyonarian genus, except that those of some species of *Umbellula* may be as large or larger.

The form is usually somewhat mushroom-like (*Agaricus*-shape). The upper part is thick and often considerably larger than the stalk, and may become 3 to 5 inches or more in diameter (75 to 120 mm.). The summit is more or less convex and when large bears a large number of large exsert polyps, becoming in partial expansion 20 to 25 mm. high and sometimes over an inch (25 to 30 mm.) across, the tentacles, even in alcohol. They are entirely retractile into calicles that are only slightly elevated and eight-lobed. Young specimens often occur with only two or three large polyps and with a thick convex top.

Large numbers of slightly raised fertile siphonozooids are scattered over all the top, between the polyps. The stalk bears neither polyps nor siphonozooids. The base may be either expanded and simple, or else lobed, when adherent to stones; but on muddy bottoms it usually has more or less numerous thick root-like or bulbous nodules and lobes extending downward into the mud for anchorage (figs. 6, 7). The cœnenchyma is abundant and contains numerous channels connecting the polyps and siphonozooids. The cœlenterons of the large polyps extend to the base. The siphonozooids contain ova, but have no tentacles.

The tentacles and their pinnæ contain numerous slender fusiform and rod-like spicules. The cortex of the top contains abundant rod-like, fusiform, and some club-shaped and double stellate spicules with a few crosses, etc. (see pl. XVII, fig. 1). The spicules of the interior are mostly slender spindles and rods. Colour is usually deep red, varying to purple and light red. It does not fade much in alcohol.

The *Anthomastus purpureus* (K. and D.) as *Sarcophyton*, of the Norwegian coast, is much like our species, but the described specimens are much smaller and probably young. Its polyps, as described, are only about half as large as those of our full grown examples.

Studer described *A. agaricus* from 1267 meters, off Newfoundland, (op. cit., p. 27, pl. i, figs. 6–9, 1901). His largest examples were badly contracted, small, and probably very young, having only about 10 polyps. One had but three polyps. It is probably the young state of *A. grandiflorus*. Colour was red. Spicules are much like those of our species. I have seen similar young ones of our form, associated with large ones. See pl. XIV, figs. 6, 7.

A. grandiflorus was taken in large numbers on or between the deeper banks off Nova Scotia and Newfoundland, in 150 to 300 fathoms, They were presented to the U.S. Fish Commission by the Gloucester, Mass., fishermen, from 1878 to 1881. It was also taken by the "Albatross" and "Fish Hawk" in 410 to 1395 fathoms off our northern coasts. A similar species (*A. agassizii* Ver.) occurs in the West Indies in deep water. It is light red and has somewhat smaller polyps and different spicules. The rod-like spicules of the cœnenchyma and calicles are longer, larger, and more spinulose and the short ellipsoidal and double stellate forms from the exterior of the cœnenchyma are more strongly warted or spiunlose. (See Plate XVII, figs. 2–2c.)

Suborder GORGONACEA.

Family **CHRYSOGORGIDÆ** Ver. or **DASYGORGIDÆ**. Some authors.

Radicipes Stearns.

Radicipes STEARNS, Proc. U.S. Nat. Mus., vol. VI, p. 97, pl. vii, figs. 1, 2, July, 1883. Type *R. pleurocristatus*, Japan. KINOSHITA, Journ. College Sci. Tokio Imp. Univ., vol. XXXIII, art. 2, pp. 1, 5, 1913.

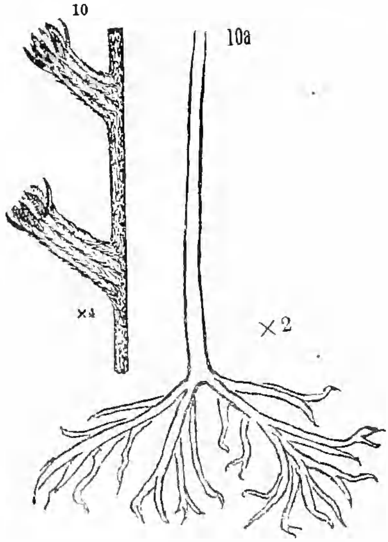
Lepidogorgia VERRILL, Amer. Journ. Science, vol. XXVIII, p. 220, 1884, Brief Cont. to Zoology, No. 55; Annual Report U.S. Comm. of Fish and Fisheries for 1883, p. 512, 1885.

Strophogorgia WRIGHT and STUDER, Voy. Challenger, vol. VI, Alcyonaria, p. 2, 1889. In part.

Chrysogorgidæ usually growing in the form of long, simple rods, with the base divided into calcareous, branched, root-like processes. Cœnenchyma thin; its spicules in the form of thin oblong scales. Polyp-calicles elongated, well separated, oblique, usually arranged in a secund manner; their spicules are spindles.

Radicipes gracilis Verrill.

Lepidogorgia gracilis VERRILL, op. cit., 1884, p. 220; op. cit., 1885, pp. 512, 533, pl. II, figs. 10, 10a.



Figs. 10 and 10a. *Radicipes gracilis* Verrill. Fig. 10. Portion from the middle of the stalk bearing two polyps; 10a. base of stalk and basal root-like processes, x 2.

The axis is simple, tall, slender, tapered to the tip, terete, iridescent. Polyp calicles are large, elongated, often wider than the axis, seated obliquely, well apart, and secund. Colour when living is orange or salmon-color. Calicles are filled with elongated spindles. Cœnenchyma is very thin; its spicules are thin, scale-like, oblong, with rounded ends and often constricted in the middle. Root processes are much branched, round, hard, calcareous, and taper to small slender tips. Height up to 3 feet or more (900 mm.). It was taken by the "Albatross" in 1883, off Georges Bank, in 858 fathoms, and farther south in 1731 and 1735 fathoms in large numbers. A comparison with the types of Stearns shows the generic identity of *Lepidogorgia*.

Family **KERATOISIDÆ** Gray, 1870 (emended).

Keratoisidæ + *Acanelladæ* + *Mopseadæ* (*pars*) GRAY, Cat. Lithophytes Brit. Mus., pp. 13, 16, 18, 1870.

Ceratoisidæ VERRILL, Bulletin Mus. Comp. Zool., Vol. XI, p. 11, 1883.

Axis simple or variously branched, with long calcareous joints, which are often hollow, alternating with shorter horny joints. Branches, when present, sometimes arise from the calcareous joints, but more frequently from the horny ones. Base calcareous, usually divided into long, flat, irregular lobes, serving as anchors in the mud of the sea bottom. Cœnenchyma thin, commonly with long fusiform conspicuous spicules, sometimes with other small scale-like ones at the surface. Calicles large and prominent, filled with large fusiform spicules, of which eight or more are larger than the rest and commonly project as sharp marginal spines between the bases of the tentacles, forming an armature for the protection of the incurved and imperfectly retracted tentacles.

Keratoisis Wright.

Keratoisis WRIGHT, Ann. and Mag. Nat. Hist., II, 1869, p. 427; III, p. 24. GRAY, Cat. Lith. Brit. Mus., 1870, p. 18. *Ceratoisis* VERRILL, op. cit., 1883, p. 11.

In this genus the branches are usually few and distant and arise from the calcareous joints. Otherwise it agrees very closely with some of the sparingly branched species of *Acanella*. The calcareous joints are tubular. The calicles are strongly armed with large spiniform spicules, and the cœnenchyma also contains large fusiform spicules.

In this genus are included the largest known species of the family. Some specimens of *K. ornata* are about four feet high. These are found at considerable depths, in cold water, on the Banks off Newfoundland and Nova Scotia.

Keratoisis ornata Verrill. Gold-banded Coral.

Keratoisis ornata VERRILL, Amer. Jour. Sci., vol. XVI, 1878, pp. 212, 376; op. cit., 1883, p. 11, pl. I, figs. 4–4b (as *Ceratoisis*); op. cit., 1885, p. 533.

Plate XVI; Figs. 1–1b. Plate XVII; Figs. 4–4b.

Coral tall; sometimes over four feet high; distantly and irregularly branched, the branches spreading, often nearly at right angles, elongated, rather slender, gradually tapering, giving off, in the same manner, elongated branchlets. The branches and branchlets mostly arise from near the proximal end of the calcareous joints, but sometimes from the middle. The calcareous joints are ivory-white, elongated, round, slightly enlarged at the ends, usually faintly and often indistinctly striated longitudinally, appearing smooth to the naked eye, but finely granulous under a lens; they are tubular, having a central tube equal to about a third or a fourth of their total diameter. The chitinous joints are usually lustrous golden yellow or bronze-color, sometimes plain brown, short, scarcely longer than thick in the larger branches, about twice as long as thick in the smaller ones, where they become translucent and brownish or amber-color, without the metallic lustre seen in those of the larger branches. The basal part is deeply divided into irregular, palmate, flattened lobes, or root-like expansions, by means of which it anchors itself in the mud.

One specimen, preserved in alcohol, shows remarkable variations in the length and form of the calicles. Over most of the branches they are very long and prominent, constricted in the middle, with an expanded base and enlarged summit, crowned by eight prominent spines, surrounding the incurved and nearly retracted tentacles (Pl. XVII, fig. 4a). In this form of calicle the length is two to three times the average diameter. But on other branches the calicles are only prominent, sub-conical verrucæ, broadest at base, with the summit narrow, and the spines but little prominent (Fig. 4a); these are often about as broad as high. Intermediate forms also occur on this specimen. The calicles are irregularly but rather uniformly scattered over the whole surface, and are mostly separated by spaces two or three times as great as their breadth, though some are in contact at their bases. The surface of the cœnenchyma and calicles is covered with a soft integument, which nearly conceals the spicules, except at the border of the calicles; but they become conspicuous when dried.

The calicles in dried specimens are usually prominent, elongated, somewhat expanding toward the end, and are crowded nearly equally over the whole surface; they are covered with large, conspicuous, acute spicules which form, at the summit, eight sharp spinous points. (See Pl. XVI, fig. 1a). The cœnenchyma is thin, translucent, yellowish, filled with long and large fusiform, spicules.

The large projecting spicules of the calicles are fusiform, usually more or less bent, and either acute at both ends or acute at the distal end and obtuse at the other. The larger of these measure 4·40 by 0·35, 4·10 by 0·30, 3·80 by 0·30, 3·70 by 0·22 mm. With these, below the margin and in the polyps, there are many smaller and more slender, partly fusiform, partly oblong or rod-like spicules, with both ends similar, and either acute or obtuse.

The spicules of the cœnenchyma are large, fusiform, and striated, mostly acute at both ends, and bear small conical spinules in rows. The larger ones measure about 4·2 mm. long by ·025 thick, but most are smaller, about 2·5 to 3·5 mm. long by ·015 to ·020 mm. thick.

One specimen, lacking the base, was about 40 inches high (1020 mm.) and one of its branches was 27 inches, or 675 mm., long before dividing. One of the type specimens was 660 mm. high. (See Pl. XVI, figs. 1–1b.)

Most of the known specimens came up entangled by the lines used in deep water fishing, in about 200 to 300 fathoms, around the Banks off Nova Scotia, and were presented to the U.S. Fish Commission, 1878 to 1881, by the Gloucester, Mass., halibut fishermen.

Acanella Gray.

Acanella normani Verrill. Bush Coral.

Acanella arbuscula Norman, Proc. Royal Soc. London, 1876, p. 210, (*non* Johnson, 1862).

Acanella normani Verrill, Amer. Jour. Sci., XVI, 1878, p. 212 (descr.); XXIII, 1882, p. 315; Bulletin Mus. Comp. Zool., vol. XI, p. 14, pl. IV, figs. 2–2b, 1883; Ann. Report U.S. Fish Comm. for 1883, pp. 512, 533, pl. XLIV, fig. 198, a–f, 1885.

Plate XVI; Figs. 2, 3, 4. Plate XVII; Figs. 3, 3a. Text Fig. 11.

This abundant species grows in much branched bush-like forms about eight inches to a foot high and often nearly as broad. The colour, when living, is usually light chestnut-brown, varying to orange-brown and dark brown; polyps when expanded are paler and transluscent.

Axis white with orange-brown nodes. Base much branched with flat divisions. Stems rather stout; branches arise at nearly right angles to the stalk, mostly in whorls of four, from the horn-like nodes; distal ones slender, more upright.

11

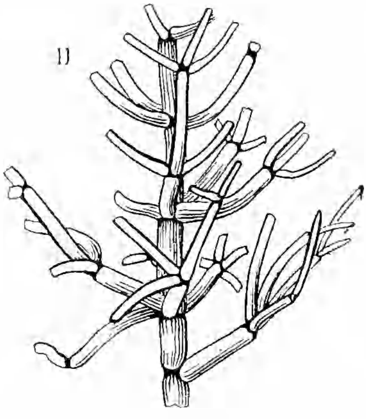


Fig. 11. *Acanella normani* Verrill. Naked axis of a branch and branchlets to show mode of branching; natural size.

Internodes of the stem are short, mostly 6 to 12 mm. long; in the branches often 18 to 20 mm. Calicles large, elongated, swollen near the base, or at both ends, with eight conspicuous, distal, marginal spines.

It was obtained in considerable numbers by the fishermen, in deep water, about 150 to 250 fathoms, on or near the Banks off Nova Scotia and Newfoundland. It was also dredged in many places by the "Albatross" off the New England coast in large numbers. Sometimes a hundred or more came up in a single haul of the trawl. Its range in depth here was mostly from 219 to 1735 fathoms. It was most abundant in 300 to 400 fathoms.

Suborder Pennatulacea Verrill, 1865.

Family **PENNATULIDÆ** Dana.

Pennatula aculeata (Sars) Danielssen, 1858, Red Sea-pen.

Pennatula phosphorea, var. *aculeata* Sars, 1870. Kölliker, op. cit., 1869, p. 154, pl. IX, fig. 73.

Pennatula aculeata Verrill, Amer. Journ. Sci., vol. V, pp. 5, 100, 1875; vol. XXXIII, pp. 310, 315, 1882; Bulletin Mus. Comp. Zool., vol. XI, p. 2, pl. 1, figs. 2, 2a, 1883; Verrill, op cit. 1885, p. 532, pl. III, figs. 7, a, b. Whiteaves, List Invert., p. 55, 1901.

Plate XVIII; Figures 1, 2.

This elegant "sea-pen" occurs very commonly in moderately deep water off the coasts of Nova Scotia and the eastern United States, in 60 to 300 fathoms, and also abundantly in deep water, down to 1255 fathoms. Mr. Whiteaves dredged it in 160 to 200 fathoms, between Anticosti island and Gaspé in 1871–73. The Gloucester, Mass., fishermen also brought in numerous specimens from the various fishing banks off Nova Scotia, taken entangled on their lines in 60 to 300 fathoms. Large numbers were dredged by the steamers "Fishhawk," "Albatross" and "Blake," south of Martha's Vineyard, etc., in 200 to 1,000 fathoms, 1880 to 1887. In one instance 494 specimens were taken by the "Albatross" in one haul, in other cases over 200.

It is very phosphorescent and is usually bright red or purplish red with a yellow or pale orange stalk. Occasionally a white or albino specimen was taken, more frequently a pink or rose-coloured variety (var. *rosea* Kor. and Dan.). This was taken by the "Albatross" in 157 to 410 fathoms.

In the deeper waters we took many specimens with the pinnæ longer, more slender and more loosely arranged than usual (var. *laxa*, new name). Two of these are figured on Plate XVIII, Figures 1, 2. In other respects they agree nearly with the ordinary kind.

Supplement to the Report on the Alcyonaria of the Canadian Arctic Expedition.

By A. E. Verrill.

After the preceding report was written another small collection of Alcyonaria and Actinaria was received. These were collected by Mr. F. Johansen on an expedition to Hudson bay in 1920.

Some of the specimens are of special zoological interest. Others belong to species not hitherto recorded from that region.

Family **NEPHTHYIDÆ** Verrill, 1869.

Drifa glomerata Verrill. (See above, Page 31 G). 'Sea Cauliflower.'

Plate V; Figs. 2–2a. Plate XIV; Figs. 2–2b. Plate XV; Figs. 1–5. Plate XVIIa; Figs. 2, 3. Text Figures 5, 12.

Three good specimens of this species were obtained. These confirm the identification of *Væringia flavescens* Danielssen with this species and show that *Eunephthya glomerata* Molander is not the true *glomerata* Verrill.

These later and larger specimens agree well with the original general figures of Danielssen and the spicules (Pl. XV, figs. 1, 2) correspond well with his figures, (same Plate, Figs. 3, 4) and also with those of my type specimen (Pl. V, fig. 2a).

The largest specimen, well preserved in alcohol, but strongly contracted, is 85 mm. high and 75 mm. broad; diameter of stem, 14 mm. Pl. XVIIa, figs. 2. 3.

Mr. Johansen states that its colour has kept fairly well in alcohol. It is now rather dark yellowish brown, the color being in the soft tissues. The spicules are white. The trunk-stem is relatively small and is strongly grooved, due to vigorous contraction. It is but slightly translucent, rather firm, but flexible, and its somewhat thick cortex contains numerous small thorny spicules of various forms, beneath the surface.

The main trunk and the stems of the branches and branchlets are concealed almost completely by the abundance of the crowded polyps, but can be seen in places by pushing the groups apart. The trunk gives rise to numerous short branches from the base to the summit. The branches, as now contracted, have short stalks, or may be nearly sessile. Most arise from one side of the trunk. The branches, as covered by the crowded branchlets and polyps, are mostly ovate-conical or pine-cone shaped. The branches are covered with numerous small, short branchlets, shaped like the branches and bearing numerous crowded and unequal polyps, often up to twelve or fourteen on each. Some occur, however, with few polyps and small branchlets are also found arising directly from the main stalk.

The polyps are so closely crowded by contraction that they overlap or appear imbricated and many of the mature ones are incurved more or less. The larger ones are from 1 to 2 mm. long and 0·75 to 1·00 mm. broad. Between these are many young ones not more than half as large, but of the same form. All have the tentacles closely incurved, so that they show only the convex outer basal portions, which form eight acute convergent lobes, containing an abundance of small, white, rough, irregular spicules arranged chevronwise with their spinules directly outwardly. (See Pl. XIV, fig. 2a).)

The polyp bodies are more or less clavate or clove-shaped. The anthocodial part is the larger and has eight narrow raised ribs, each containing two crowded rows of white clavate spicules arranged chevronwise; the proximal or mesenterial portion is usually somewhat narrower, and contains similar spicules, but smaller and not so many. The two regions are not separated by a constriction nor by a transverse wreath of spicules such as occurs in species of the genus *Gersemia*.

In transverse sections of the branch stems there are relatively few longitudinal ducts, usually 8 to 12, some much larger than the others. They often contain yellow ova and planulæ (Text Fig. 12), as do the polyp bodies. The membrane between them is rather thick and soft. Direct connections occur between them and also indirect connections by fine channels, as in most species of this family.

The spicules of the anthocodiæ are mainly very thorny clubs of various forms, essentially like those from the type (see Plate XV, figures 2a–2g), but there are also various other forms; usually the clubs are three or four times as long as broad, with the wide outer end covered with many longer and shorter, mostly blunt lobes and thorns, which are more or less flattened; some are wide at the base; others are slender. Thick "clumsy" clubs and spindles, such as Molander figured and described as characteristic of his *glomerata*, do not occur. The clubs usually taper gradually to the narrow acute tip and are covered proximally with shorter thorns and small lobes or spinules. With the clubs are much fewer spindles of about the same length, acute at one or both ends, and covered with more or less acute thorny processes (2 h). Some have larger lobes or thorns on one side, which is then convex. Some are intermediate between clubs and spindles.

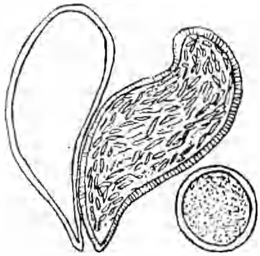


Fig. 12. *Drifa glomerate* Verrill. Ovum and two planulæ taken from one of the polyp bodies; one is only in outline. Much enlarged.

The spicules of the cortex of the branches are of various forms and sizes, and are mostly covered with very prominent, mostly obtuse lobes and irregular prominences (Pl. XV, figs. 1, a–t), so that they are apt to interlock and cling together in clusters when cleaned. Some of the larger forms are stout, regular spindles, but the more abundant ones, of the larger sizes, are short, irregular, blunt forms (a, b, d, g), many of them being subclavate, like (c, f, h, i); others have a median smooth zone, (j, k); but much greater numbers are much smaller, irregular spindles (m, o), double heads and double stellate forms and other forms with a median narrow naked zone and few relatively high prominences, appearing stellate when seen endwise (q, r, t); many forms occur that are not figured.

The largest specimen and a small one were taken in Richmond gulf, about three miles from the entrance, east side of Hudson bay, on a bottom of stones and sand, in 25 fathoms, Aug. 27, 1920. The other specimen was taken near the same place, four miles from the entrance, in 10 to 20 fathoms, stones and algæ, Aug. 24, 1920, by F. Johansen.

These specimens agree in form and mode of branching with the *Eunephthya flavescens* of Molander (his Pl. 2, figs. 15, 17). The spicules of the latter, as shown by my figures of those from the type of *E. flavescens*, agree much better with my type specimens than do those that he refers to in his *E. glomerata*. Those that he figured and described from the latter (his text-fig. 13, op. cit.) are much stouter and thicker, both the clubs and spindles, and the clubs are less evidently club-shaped. His figures of the anthocodial spicules (figures 13, a, b) agree much better with those from the cortex of the branches of my type, not tapering rapidly to an acute end, as they do in his *flavescens* and in my type. He states that he had examined also the type of Danielssens' *flavescens*. Danielssens' figures of the entire organism and of numerous forms of spicules are excellent and agree with those of my type. (See my Pl. XV, figs. 3a–f, after Danielssen.)

These specimens, like the type, contained eggs and planulæ in various stages of development. (See figure 12.)

Therefore I am convinced that *D. flavescens* is a synonym of the true *glomerata*. The *glomerata* of Molander is either a strongly marked variety or a distinct species, if the spicules are correctly figured and described. The mode of branching and arrangement of the polyps is essentially alike in both forms, allowing for the unequal effects of strong contraction seen in alcoholic specimens of this and all other species of this family.

The character of the spicules of Molander's species is much like those of *D. islandica* Danielssen in most respects, and it may be referable to that species or variety.

Gersemia studeri, Verrill New name.

Paraspongodes danielsseni STUDER, op. cit., 1901, p. 31, pl. III, figs. 8, 9; pl. X, figs. 1, 3, 7 (*non* Marenzeller, species, 1877).

Since this species also belongs to *Gersemia,* it should have a new name. In mode of branching and form of the colony it is like *G. rubiformis,* and like that species it has an abundance of cœnenchyma between the entirely retractile polyps, but the polyps are more crowded with spicules in the anthocodia and tentacles, while in the proximal part there are transverse rows of stouter and rougher spicules. The thick spindles of the stalk are covered with sharp spinules; those of the anthocodia and its wreath are slender spindles. Color in alcohol was grayish brown. Off Newfoundland, in 1267 m.

Gersemia rubiformis Pallas. (Ehr.)

See above, page 4G, and Plate I; Figs. 1–1f. Plate II; Figs. 1–4a. Plate XVIIa; Fig. 1.

Additional specimens of this species were collected by Mr. Johansen in 1920. One is from near the entrance of Richmond gulf, in 25 fathoms, sand and stones, Aug. 23. Two other specimens are from near the same place in 15 to 20 fathoms, stones and algæ, Aug. 24, 1920.

With this was a very interesting young specimen in hemispherical shape, about 2mm. broad. It has a central polyp, surrounded by seven slightly smaller unequal ones, and there are about eight to ten still smaller younger outer ones irregularly alternating. The base has a thin transparent outer edge. All the polyps are entirely contracted. The tissues are translucent and show the usual bright red spicules. The outer polyps are quite young and imperfectly developed.

Another specimen was taken between Great Whale river and Richmond gulf, L. 56° N., August, 1920 (Johansen coll.).

Gersemia longiflora Verrill.

Gersemia longiflora VERRILL, Bull. Mus. Comp. Zoology, vol. XI, p. 44, pl. III, figs. 6–6b, 1883; Annual Report U.S. Comm. of Fish and Fisheries for 1883, pp. 513, 533, pl. II, fig. 13, 1885.

Plate IV; Fig. 8. Plate XIV; Figs. 3, 3a, variety. Text Fig. 13. Type.

This species has a naked stalk, sometimes bulbous at the base and enclosing mud, though it evidently starts adhering to some solid object; most frequently a dead gorgonian axis. It branches openly and the polyps lie along the elongated branches, rather loosely. They are longer than in most species and nearly cylindric, with little or no cœnenchyma between them. The spicules of the type are notably slender (Pl. IV, fig. 8). Most of them are slender warted spindles and slender oblong forms; some are almost rod like. They are more slender than in any other described species of this genus, and quite unlike those of *G. fruticosa,* which has a similar mode of branching. Jungersen's supposition that it was the same as *G. fruticosa* is incorrect. The type was taken by the "Blake" in 1186 fathoms, off Deleware, only one specimen was then found. It was taken by the "Albatross" and the "Blake" off New Jersey and Delaware, in 1186 to 1917 fathoms, and off Georges Bank in 858 fathoms, in 1883. Common in the deeper stations.

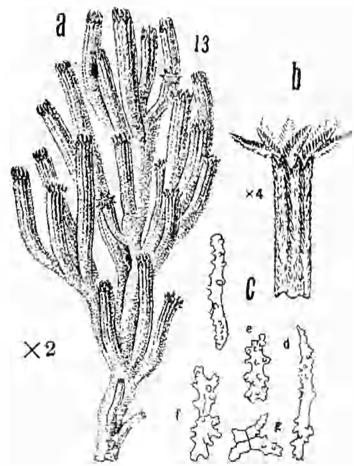


Fig. 13. *Gersemia longiflora* Verrill. Type, *a*, one of the branches, enlarged about twice; *b*, one of the polyps, more enlarged; *c*, some of the spicules.

It is possible that the later specimens, such as the one figured on my Pl, XIV, fig. 3, are not identical with the type. The latter, as originally figured. has elongated cylindrical calicles, resembling those of a *Telesto*, with no cœnenchyma between them and the spicules are more slender than usual in *Gersemia*, while the later specimens are more like *Gersemia fruticosa* in form. Unfortunately these types are not at present available for reexamination. It is possible that the type does not belong to the genus *Gersemia*.

EXPLANATION OF PLATES.

Plate I.

Fig. 1. *Gersemia rubiformis* (Pallas.) One of the polyps nearly expanded, somewhat flattened by pressure. x about 20.

From Station 20g, Port Clarence bay.

Fig. 1a. The same. Another polyp, less compressed, showing the small spicules of the anthocodial portion. x about 20.

$1a^1$. One of the smaller immature polyps.

Fig. 1b. The same: two of the tentacles. x about 45.

s, s^1, s^{11}, spicules from the anthocodia. x 45.

Fig. 1c. The same: tip of a branchlet with retracted polyps showing the character of the calicles.

Figs. 1d, $1d^1$. The same: sections of branches showing the arrangement of the longitudinal tubes: 1d is from a large branch. x about 10.

Fig. 1e. The same: disk of a polyp with the tentacles removed. x 20.

Fig. 1f. The same: group of the eggs from the tubes, some are immature. x 20.

Figs. 2, 2a. *Gersemia canadensis*, new sp. Type. Two of the exsert polyps, somewhat contracted. x 20.

Figs. 2b, 2c. The same: two nearly retracted polyps, exposing the anthocodia above the calicle; 2c has some young polyp calicles around the mature one. x 20.

Fig. 2d. The same: end of a branch showing a group of stellate calicles and one anthocodia. x 20.

Fig. 3. *Gersemia rubiformis:* a pale variety from Orphan Bank. A large calicle and anthocodia from the tip of a branchlet, surrounded by immature calicles. x 20.

PLATE I.

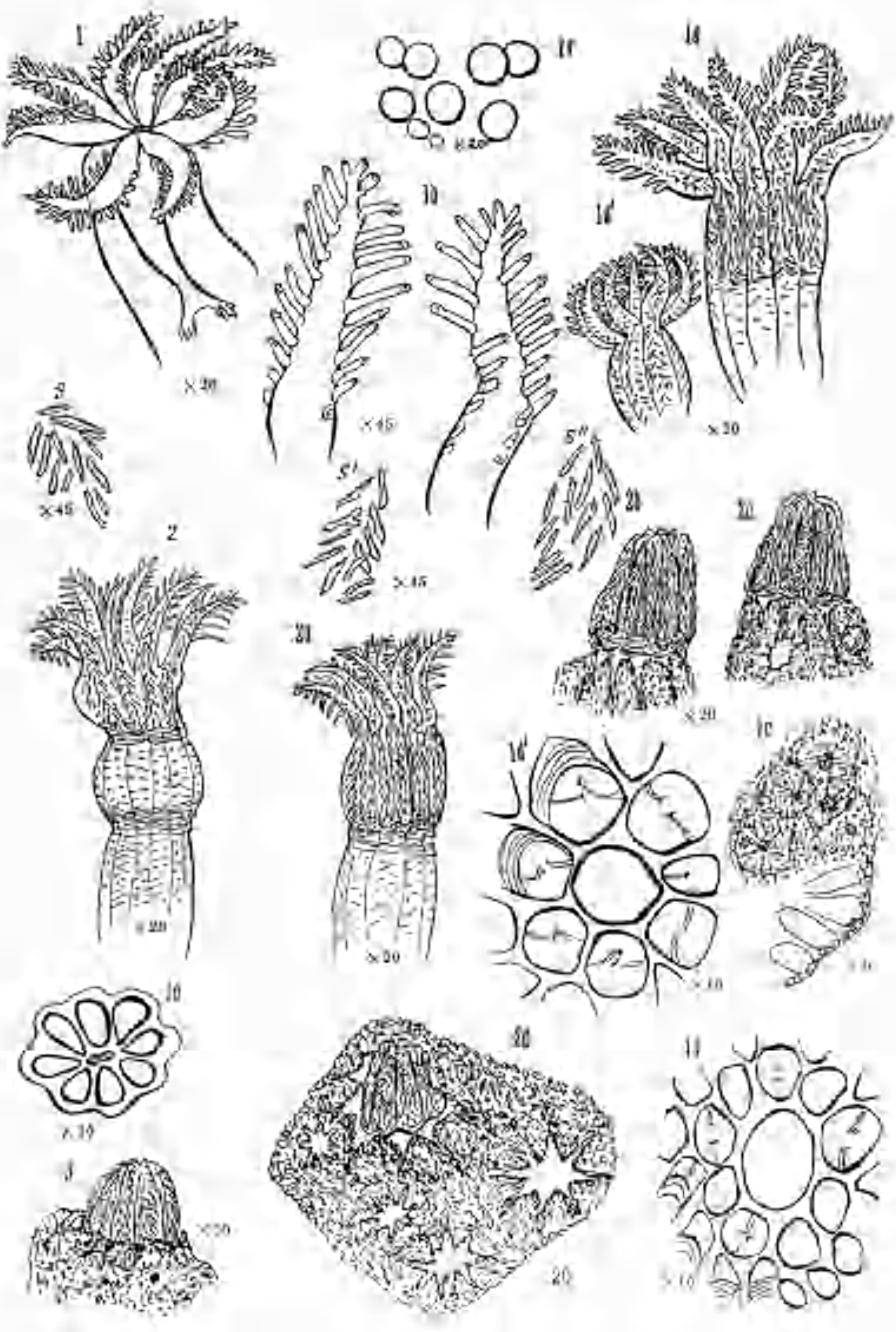


PLATE II.

Fig. 1. *Gersemia rubiformis* (Ehren.) Red spicules from a Port Clarence bay specimen. Station 20G. x about 165.

Fig. 2. The same: group of red spicules from a specimen from Station 24; a—g are from the superficial layer of the calicles: e, f are endwise views; h—k are from the stalk. x about 165.

Fig. 3. The same. Red spicules of specimen from point Barrow—mostly from the superficial layer of a branch. x 165.

Figs. 4, 4a[1]. The same. A pale variety with nearly white spicules, from Orphan Bank; Figs. 4, a—c are from the stalk; 4a, a—m are mostly from the external layer of the calicle, and surrounding surface layer; j is a compound cross; i, j, k, are end views. x 165.

Fig. 5. *Gersemia canadensis*, new species, type. Group of spicules from an entire branchlet and the basal expansion; a—g are the larger spicules from the thin attached base; a, b, c, are classed as warted double-spindles; e, f, are irregular double spindles; h,–o, are mostly white double-spindles from the surface layer of the calicles; n, n, are end views of the same kind; p is an irregular compound cross; q, r, r, s, are simple warted spindles; t[1], t[11], are slender spindles from the anthocodial portion of the calicles. x 165.

Fig. 6. *G. rubiformis* (Ehrenberg). Red spicules of the larger kinds from a specimen from Point Locker, c is seen endwise, e is a compound cross-shaped form frequent in this species. x 165.

PLATE II.

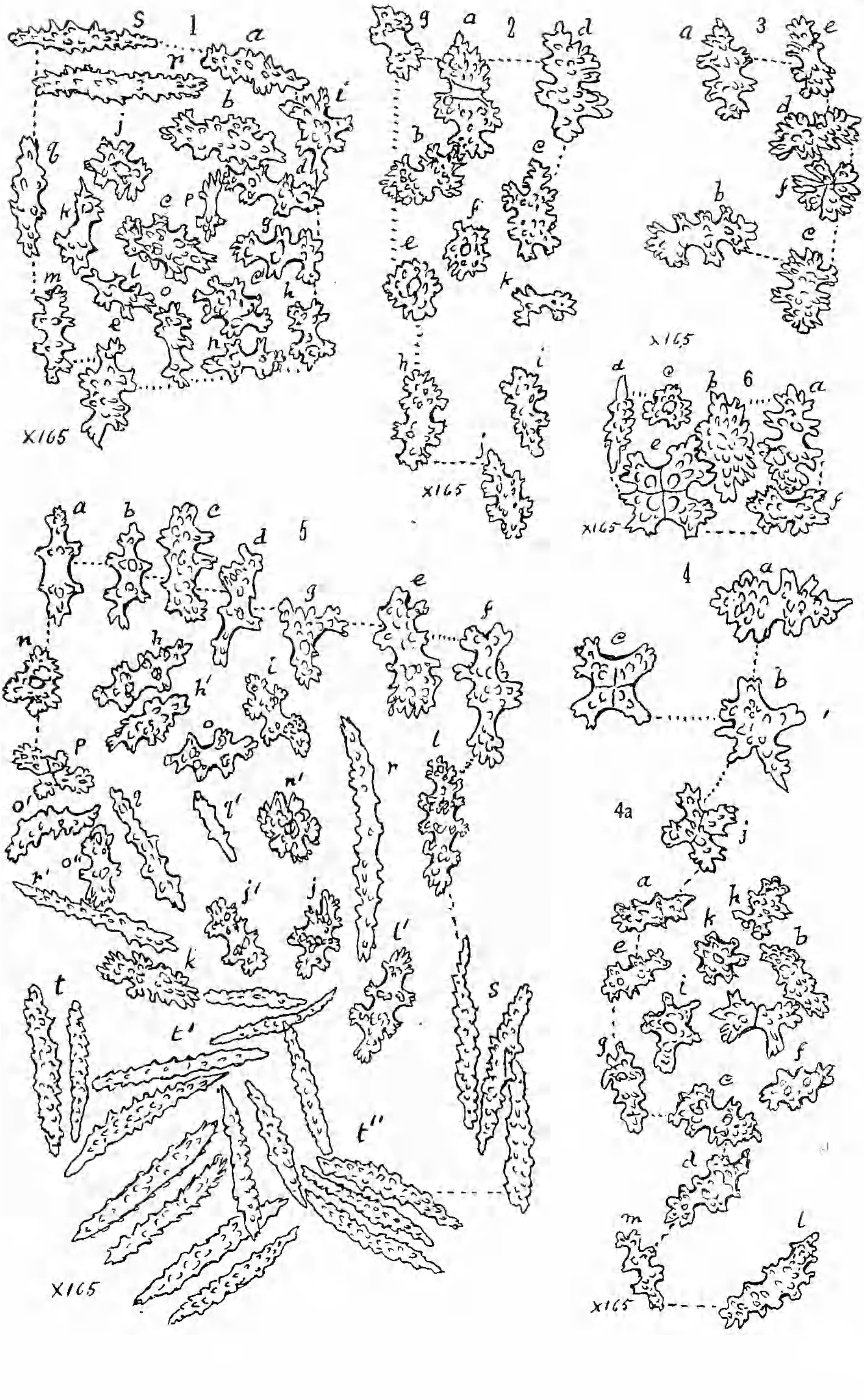


PLATE III.

Fig. 1. *Stylatula columbiana* Verrill. New species. Type. One of the wings or pinnæ from near the distal end, with a reduced number of polyps, some of which are nearly expanded. x about 10
Fig. 2. The same. Basal part of wing, more enlarged to show arrangement of the spicules on stalk and base of wing. x 20.
Fig. 3. The same. One of the larger wings from the central part with the polyps partly contracted, some of the crowded polyps are omitted. x 10.
Fig. 4. The same. Four of the mature polyps from one of the larger wings, nearly expanded. x 20.
Fig. 4a. Some of the supporting spicules of the same. e, Transverse sections of some of these spicules. x 45.
Fig. 5. *Gersemia fruticosa* (Sars.) Tip of a small branchlet, with a cluster of polyps partially expanded, in alcohol. From Richmond gulf, Hudson bay. x 10
Fig. 6. The same. Another polyp as compressed under the cover glass to show the arrangement of the spicules. x 20
Fig. 7. The same. a–o, A group of spicules from polyp-walls and tentacles; b–g, are slender spicules from the larger or anthocodial portion; a, one of the largest spindles, probably from the collar-like transverse rows; h–j, from the narrower proximal portion; k–o, mostly from the tentacles; p–t, from the cortex of a branch. x 165
Fig. 8. *Gersemia canadensis* Verrill. Type. One of the nearly expanded tentacles. x about 45

All by the author.

PLATE III.

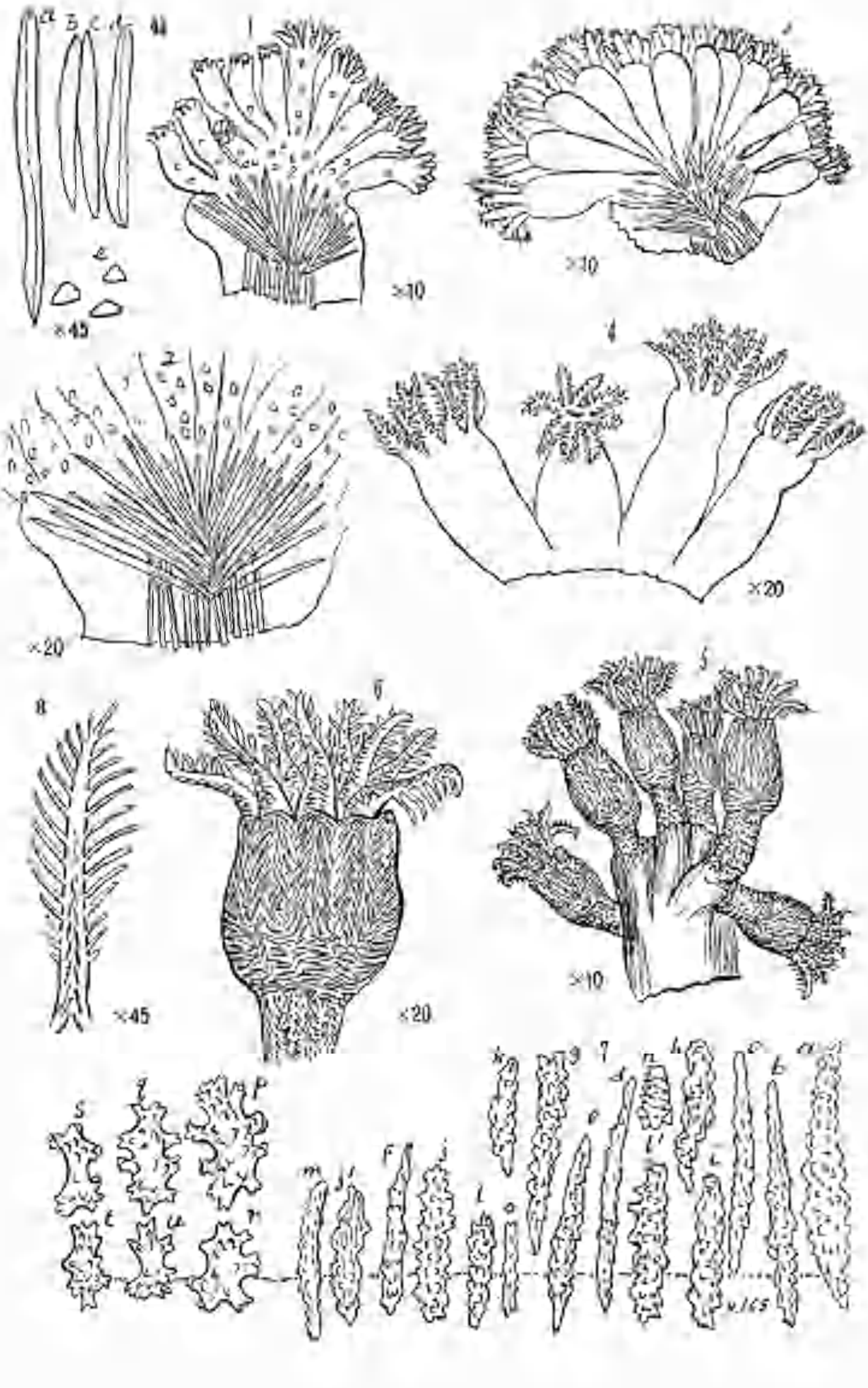


PLATE IV.

Fig. 1. *Gersemia carnea* (Ag.) Ver. A young specimen nearly fully expanded, copied from a photograph of a living specimen in aquarium. o—o, eggs. x about 2.

Fig. 2. The same. Spicules from a specimen taken at Eastport, Me. a–e, from the anthocodiæ and tentacles; f, a group from the anthocodia; g–h, double stars; i, j, k, double heads from the cœnenchyma of the cortex; l, l^1, spindles; m, n, popped-corn-shaped from the cortex; t, u, small double heads. x 140.

Fig. 3. The same: variety *microstella* Verrill. a, b, c, from the anthocodia and tentacles; d—n, from the cortex; d, e, f, double heads; g, h, l^1, double stars; i–l, stellate forms seen endwise; m, n, very irregular branched spicules. x 140.

Figs. 4 and 5. *Primnoa reseda* (Pallas). Ver. Larger and smaller branches (from the Banks); a, b, young calicles; c, a mature calicle of the larger kind; d, one of the shorter kind. x 2.

Fig. 6. The same: side view of one of the shorter mature calicles showing the forms and arrangement of the scales. Much enlarged.

Fig. 7. *Duva arborescens* Dan. Spicules, after Danielssen: a—d, from the polyp-bodies; e—j, spicules from the branchlets; k, spicules from upper part of a branch; l, m, spicules from a branch; n, spicules from the base.

Fig. 8. *Gersemia longiflora* Verrill. Variety? Spicules mostly from the anthocodiæ and tentacles of a specimen from the gulf of St. Lawrence. a, b, c, Slender rod-like bodies, sparingly warted or spinulose, from the anthocodiæ; d—h, Stouter rods, or oblong forms from the anthocodiæ; i, an irregular rough spindle; j—n, imperfect double spindles blunt at ends; 1—q, small forms mostly from the tentacles. Forms like a–f predominate and many are more slender than those figured. x 110.

PLATE IV.

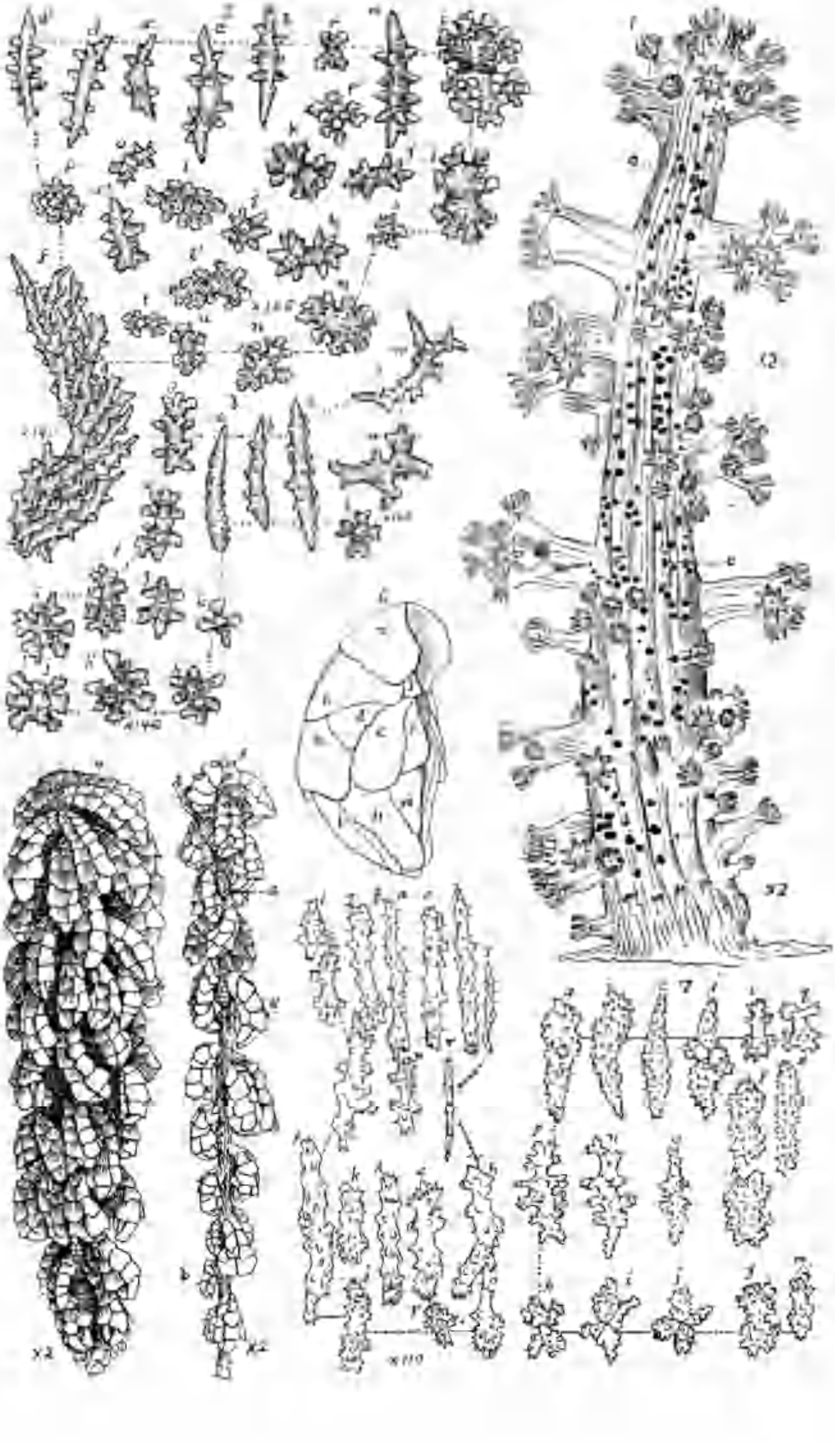


PLATE V.

Fig. 1. *Eunephthya thrysoidea* Verrill. Type from cape of Good Hope. Side view of one of the polyps to show the arrangement and forms of the spicules, and the spinose convex surface of the anthocodial region. The tentacles are strongly incurved. x 36.

Fig. 1a. The same. Spicules. a, a foliated and spinose club from the outer rows of the anthocodia, one of the more common forms; b, a one-sided club from lower part of the same area; c, a more slender form of club from the anthocodia; d, an irregular trilobed form; e, a small spindle from a tentacle. x 70.

Fig. 2. *Drifa glomerata* Verrill. Spicules from the type of *Eunephthya glomerata* V. a–f, clubs and a rough spindle from the anthocodia for comparison with those of fig. 1 a. x 132.

Fig. 2a. The same: a—e, various forms of clubs from the anthocodia; f—g, one-sided clubs; h, a compound cross; j—l, smaller clubs; m, a spindle spinose on one side; n, a normal spindle· o—r, small spicules from the tentacles. x 132.

Fig. 3. *Gersemia clavata* Dan. A polyp partly expanded, from an alcoholic specimen, from the gulf of St. Lawrence. The anthocodial region is somewhat flattened by pressure, and therefore appears relatively too wide. x 36.

Fig. 3a. The same specimen: spicules. a—h, from the anthocodia; i—m, from the cœnenchyma of a branchlet; n—p, from a tentacle. x 132.

Fig. 4. *Gersemia clavata* Dan: Spicules of the type, after Danielssen. a—e, spicules from the anthocodia; i, j, l, from the cortex of the stem; k—m, from the cortex of a branch.

Fig. 5. *Gersemia mirabilis* Dan: Spicules from the type, after Danielssen. a, b, c, spindles from the anthocodia; d—g, from the tentacles; h—l, from the cortex of stem and base.

Plate V.

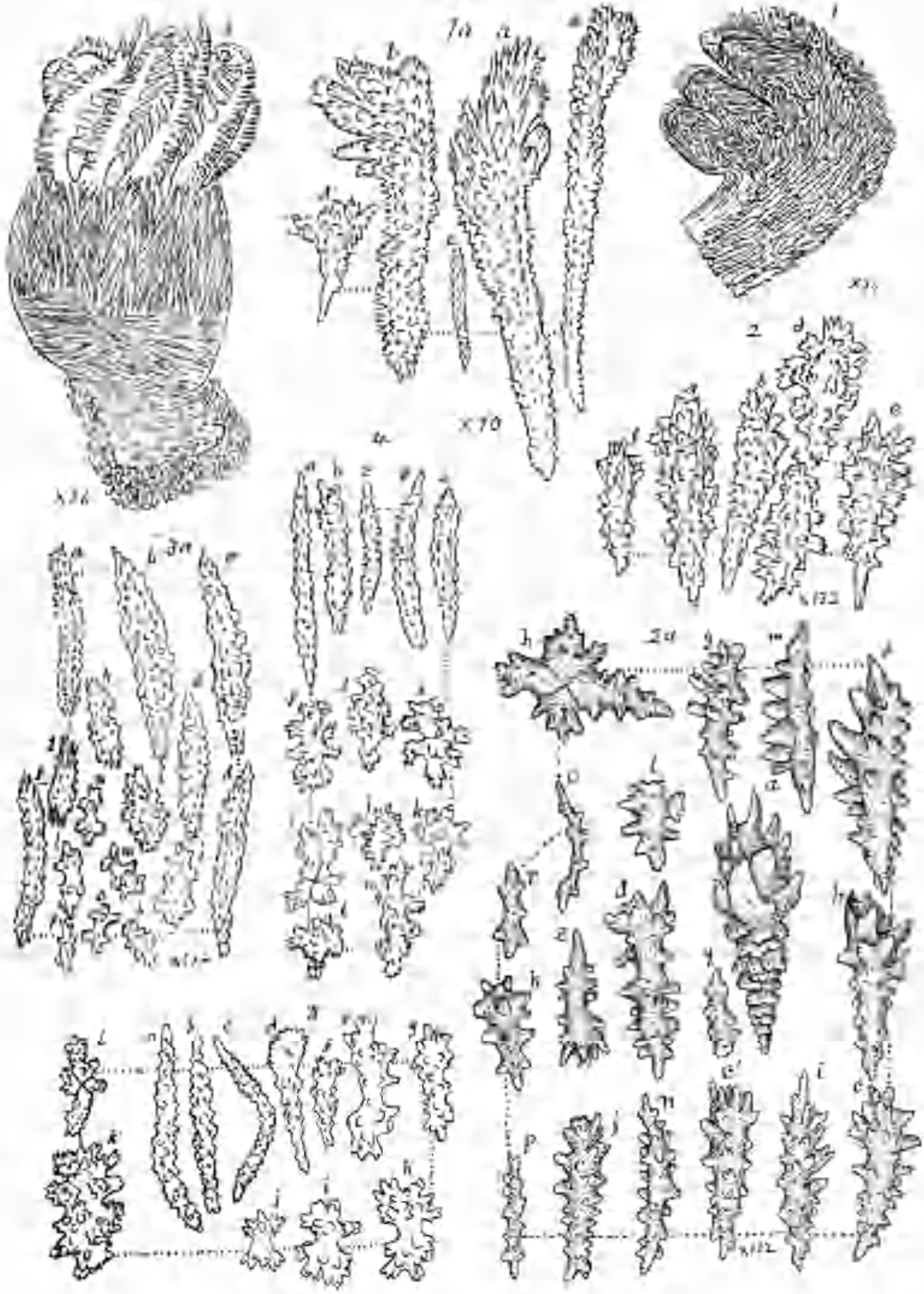


PLATE VI.

Fig. 1.	*Anthothela grandiflora* (Sars) Verrill. Calicles from the type described in 1869.	x 8.
Fig. 2.	The same;	x 66.
	a–h, spicules from the anthocodia and tentacles.	
	a, c, spindles.	
	b, curved or bow-form from wreath at base of anthocodia.	
	d, h, smaller forms from the tentacles.	
Fig. 3.	The same;	x 66.
	a—f, spicules from the cœnenchyma.	
Fig. 4.	The same;	x 66.
	a—g, spicules from the axis.	
Fig. 5.	*Cornulariella modesta* Verrill. Spicules from the type.	
	a, b, spindles from the cortex of the base.	x 132.
Fig. 6.	The same; a, b, c, spicules from the calicles.	x 132.
Fig. 7.	The same. Spicule from the polyp.	x 132.
Fig. 8.	*Paramuricea placomus* (L.) Köll.	
	a—p, Spicules from the anthocodia and tentacles of a large Norwegian specimen.	
	a, b, c, h, bent spicules from the anthocodia.	
	d, e, e^1, straight spindles.	
	f, g, h, j, j^1, irregular forms.	
	l–p, small spicules from the tentacles.	
	i, irregular small clubs from the calicle.	
Fig. 8a;	The same;	
	a—e, spicules from the calicles and cœnenchyma.	

PLATE VI.

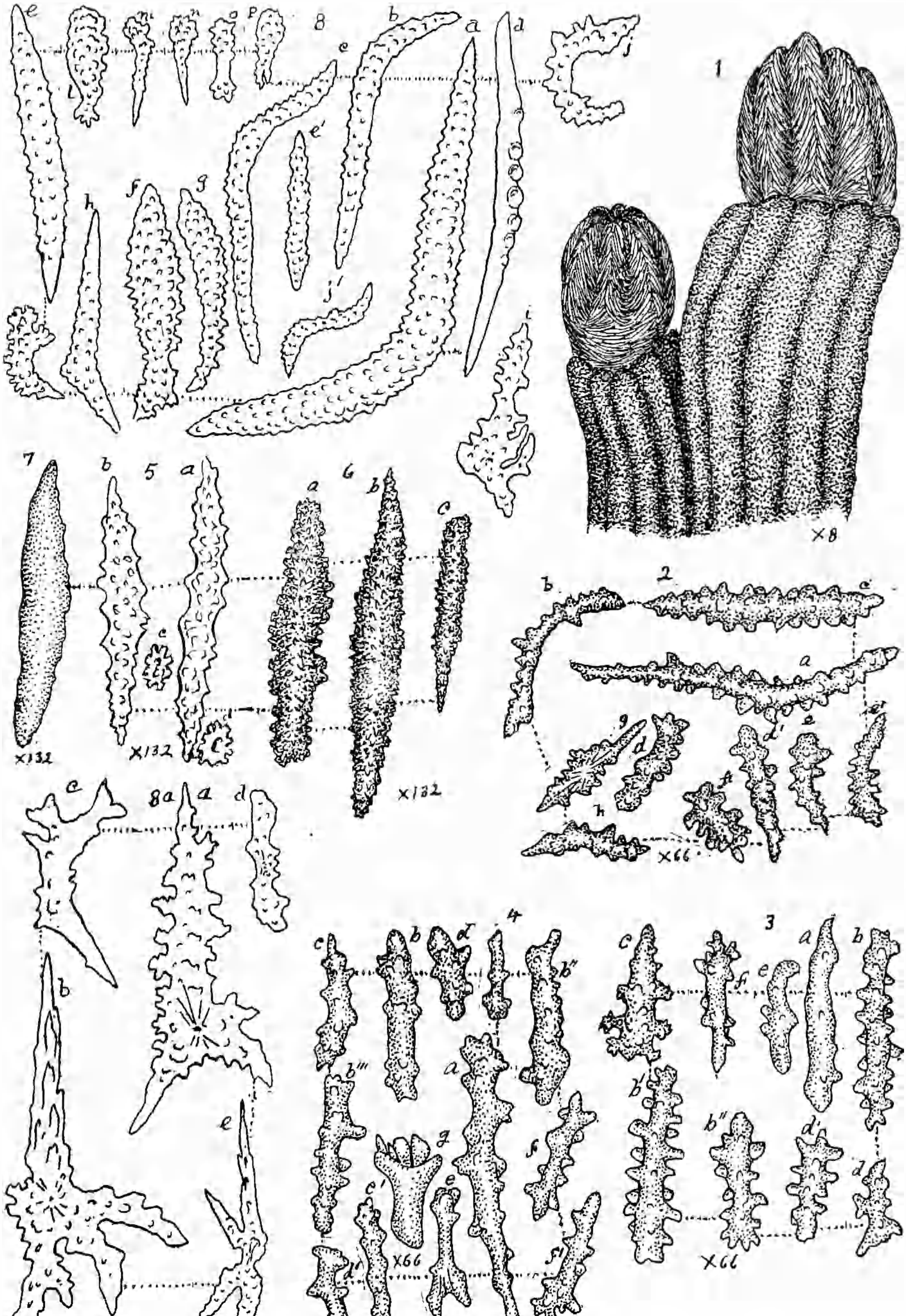


PLATE VII.

Figs. 1—7. *Trachythela rudis* Verrill, new sp. Type.

Fig. 1.	Anthocodia and top of calicle, end view.	x 7.
Fig. 2.	The same: side view of anthocodia and spicules in the base of the tentacles.	x 7.
Fig. 3.	View of a part of a stolon with calicle removed.	x 7.
Fig. 4.	The same.	x 56.
	a—s, spicules from the anthocodia and tentacles.	
Fig. 5.	The same.	x 56.
	a—o, spicules mostly from the cœnenchyma.	
Fig. 6.	The same.	x 56.
	a—g, spicules from the inner part of polyp, mostly irregular forms.	
Fig. 7.	The same: spicules from the inner layers of the cœnenchyma.	x 90.
	a, one of the larger clubs.	
	b—d, larger forms of spindles.	
	e—k, smaller forms of clubs.	
	l—o, irregular small forms.	

Plate VII.

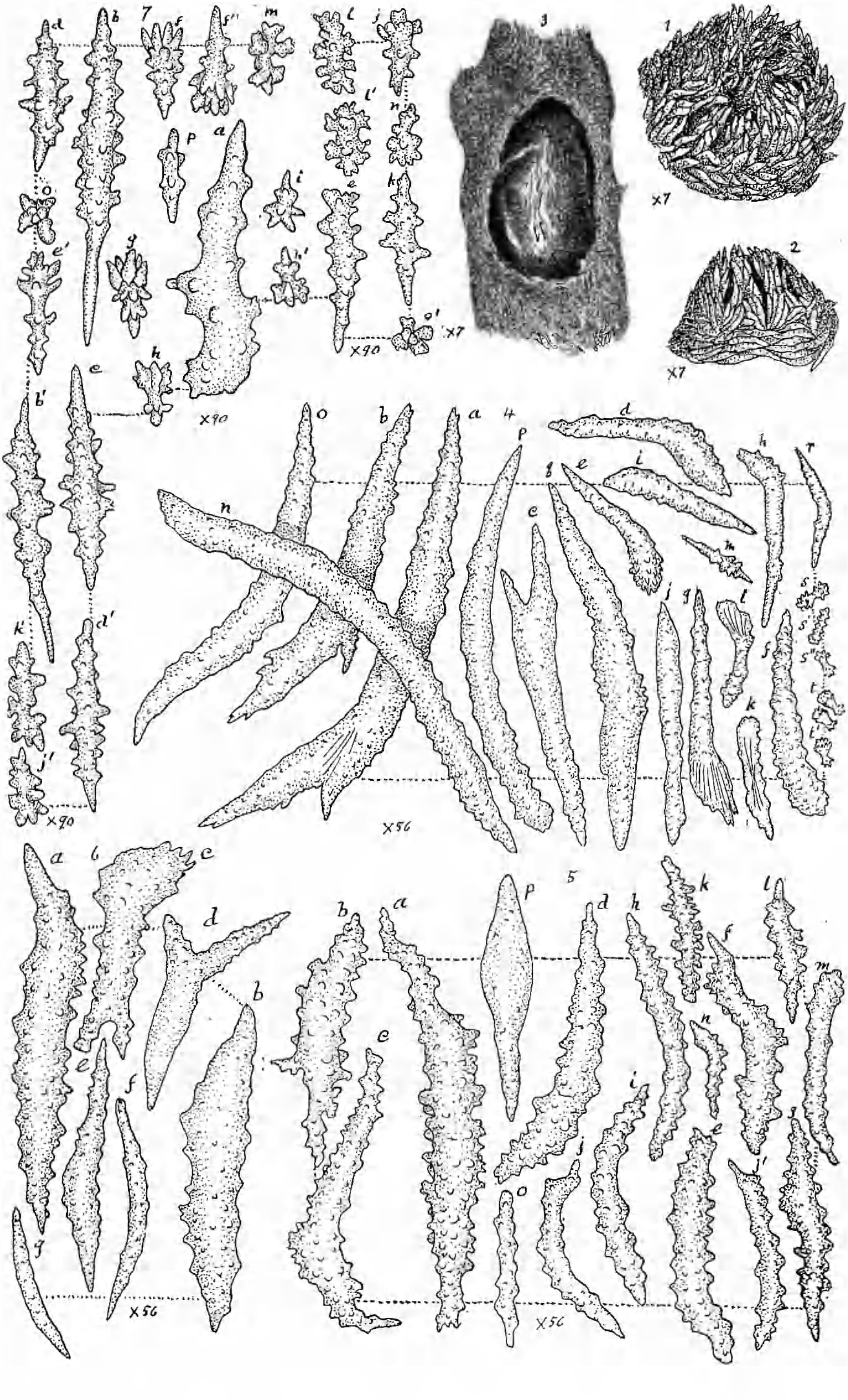


PLATE VIII.

Fig. 1. *Lepidomuricea grandis* Verrill. Type.
Group of spicules from the cœnenchyma. x about 48.
a—f, flat rough, irregular, scale-like forms.
g—h, elongated irregular spindles.
j, acutely warted or thorny irregular club with the point projecting from the surface.
y, a simple slender spindle.

Fig. 2. The same specimen. Group of spicules from the calicles. x 50. By A.H.V.
a—e, flattened somewhat scale-like imbricated spicules.
f—g, similar flat forms with short acute outer tips.
h, a more acute spicule with an acute distal projecting tip and a branched root-like inserted base belonging to one of the proximal series of the spiniform calicinal armature.
i, a more spiniform spicule from near the margin of the calicle.
j, a simple spindle with a spiniform tip.
l–p, bent spindles from the basal collar of the anthocodia.

Fig. 3. *Paragorgia pacifica* Verrill. Type. Part of a section across a branch. x 15, original by A.H.V.
a—a—a, larger longitudinal canals and *f* smaller canal in the cœnenchyma or outer layer.
d—d, g—g, smaller canals in the middle layer.
h, h, canals in the inner or axial layer.
i, central canal.
c, cœnenchyma.
s, s, s, polyp cavities.

Fig. 4. The same specimen: spicules from the outer part of the cœnenchyma. x 130.

Fig. 4a. The same: spicules from the middle layer. x 130.

Fig. 4b. The same: spicules from the inner or axial layer; i, h, are seen endwise. x 130.

PLATE VIII

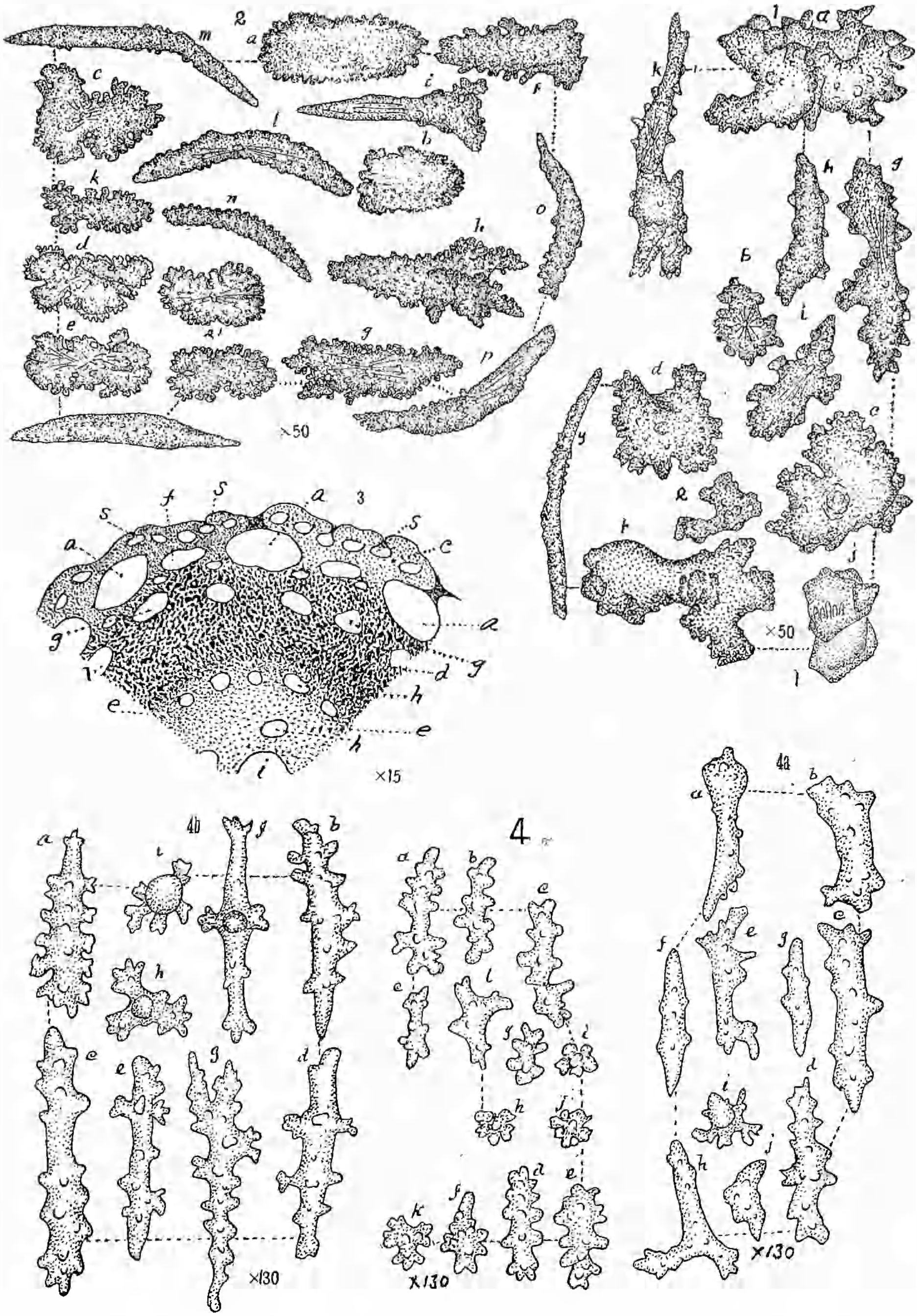


PLATE IX.

Primnoa reseda (Pallas). Photograph of a rather large specimen from Queen Charlotte islands, British Columbia. About $\frac{1}{3}$ nat. size.

PLATE IX

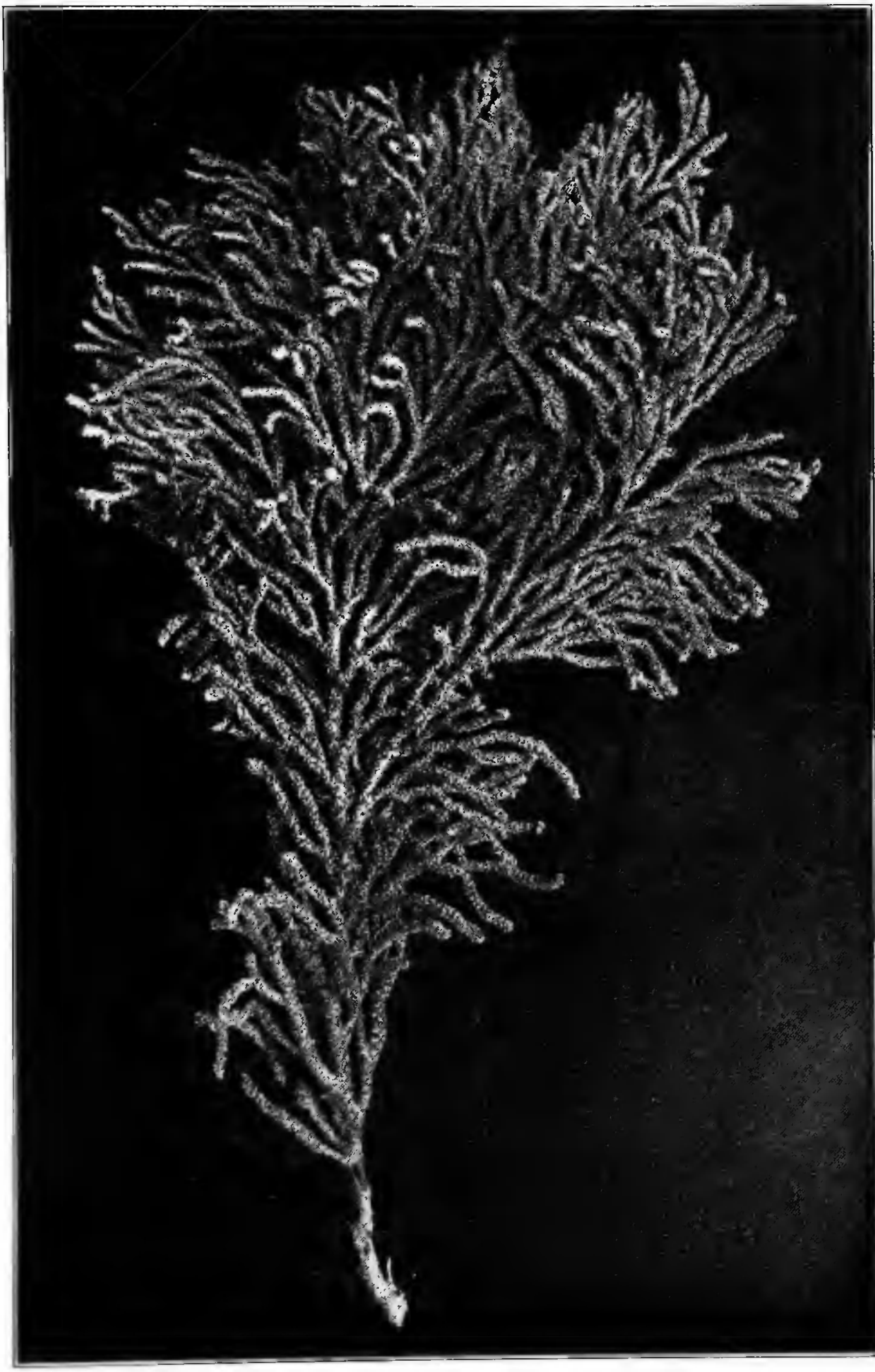


PLATE X.

Lepidomuricea grandis Verrill. Type. Photograph of a large specimen about ½ nat. size.

PLATE X.

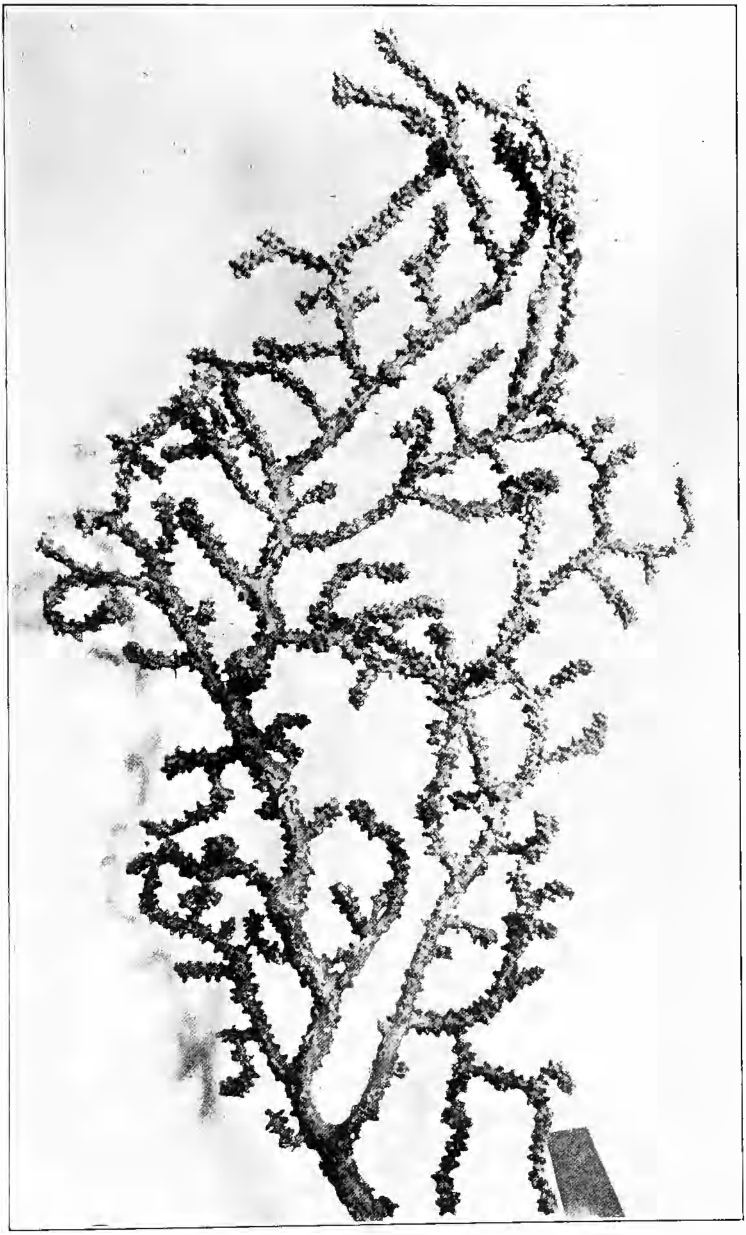


PLATE XI.

Gersemia carnea (Ag.) Verrill. Photograph of a large specimen contracted in alcohol. About nat. size.

PLATE XI.

PLATE XII.

Ptilosarcus gurneyi Gray. Photographs of a large specimen from Orca, Alaska.
Fig. 1. Back side, to show large areas of siphonozooids.
Fig. 2. The same specimen, front view of polypiferous side.
Both figures about ⅔ natural size.

PLATE XII.

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PLATE XIII.

Fig. 1. *Paragorgia arborea* (L.). A branch, about ½ natural size, of a rather slender specimen.

PLATE XIII.

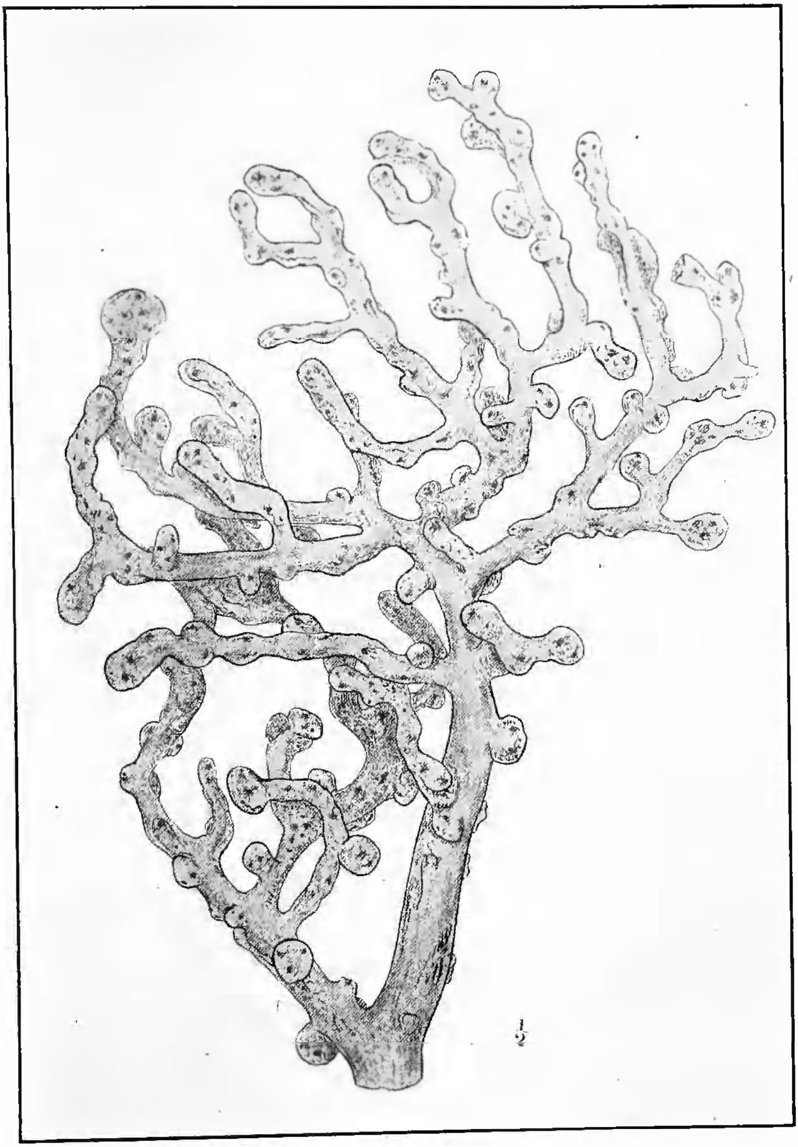

PLATE XIV.

Fig. 1. *Paragorgia arborea* (L.). Swollen end of a branch, enlarged about $1\frac{1}{2}$.

Fig. 2. *Drifa glomerata* Ver. Three polyps from a large Hudson bay specimen; p, a planula-form larva being discharged. Two of these polyps are immature. Much enlarged.

Fig. 2a. The same. Surface spicules of the anthocodia as seen more or less endwise in natural positions; much enlarged.

Fig. 2b. The same. Surface spicules of the cœnenclyma, with the same enlargement.

Fig. 3. *Gersemia longiflora* var. (?). Ver. A specimen surrounding a fragment of a gorgonian axis and then extending its base so as to include a lump of mud for anchorage. Enlarged $1\frac{1}{2}$. This is not the typical form.

Fig. 3a. The same. One of the branches, enlarged about 3.

Fig. 4. *Drifa ramosa* Studer. Spicules of the type from off Newfoundland, after Studer; a, one of the spindles; b, c, two clubs from the anthocodia; enlarged 270.

Fig. 5. *Anthomastus grandiflorus* Ver. A small specimen with only seven large polpys in nearly full expansion, from a fresh specimen. The tentacles are not of their full length. About natural size.

Fig. 5a. The same. Three of the spicules; (a) club; (b) double star; (c) spindle. Much enlarged.

Fig. 6. The same. A very young specimen with three or four contracted polyps. About natural size.

Fig. 7. The same. A younger one with three expanded polyps. This and the last have clavate lobes at the base for anchorage in soft mud. About $\frac{2}{3}$ natural size.

Figs. 1, 5, 6, 7 by J. H. Emerton; the others by the author.

PLATE XIV.

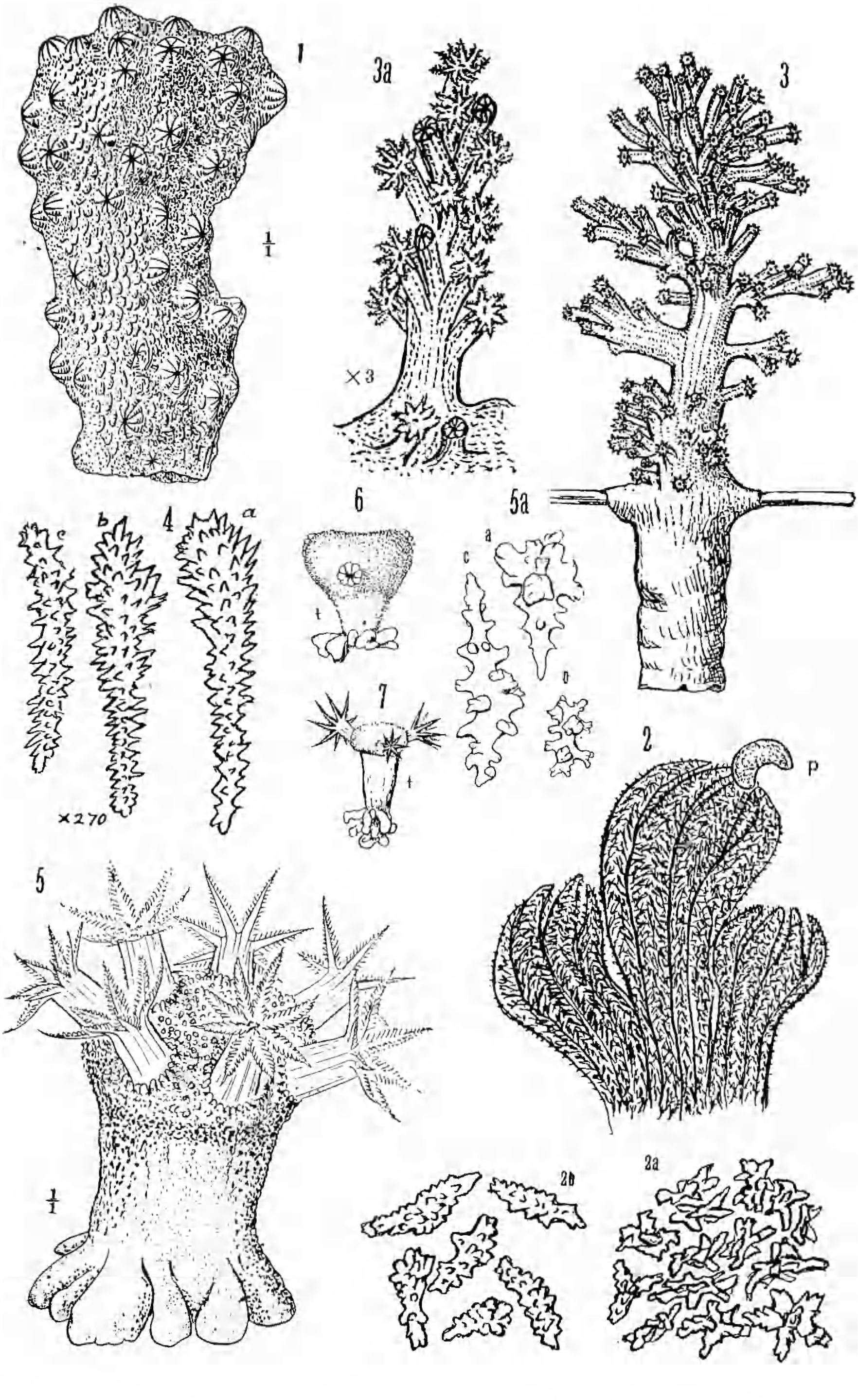

PLATE XV.

Fig. 1. *Drifa glomerata* Ver. A group of spicules (a-u) from the cœnenchyma of a branch from a large Hudson bay specimen, much enlarged. Leitz No. 6.
Fig. 2. The same. A group of spicules from the anthocodia; a-g, some of the larger and rougher forms of clubs; h, a spinulose spindle; much enlarged.
Fig. 3. *Drifa flavescens* Dan. = *D. glomerata* Ver. Spicules from the type, after Danielssen; a, b, club and spindle from the anthocodia; c, d, club and spindle from the lower part of a polyp; e, f, double star and double spindle or girdled spindle from the cœnenchyma of the stalk; much enlarged.
Fig. 4. The same. Transverse section of a polyp containing eggs and planulæ, after Danielssen. Enlarged.
Fig. 5. The same. One of the planulæ much enlarged, after Danielssen. The planulæ even in this early stage are filled with small fusiform spicules.
Fig. 6. *Duva rosea* Dan. Type. A terminal branch, after Danielssen. Enlarged about 2.
Fig. 6a. The same. Spicules from the anthocodia; (a) slender; (b) stouter warted spindles. After Danielssen; (6b) the same. Spicules from the branches much enlarged.
Fig. 7. *Duva multiflora* Ver. One of the calicles much enlarged. By the author.

PLATE XV.

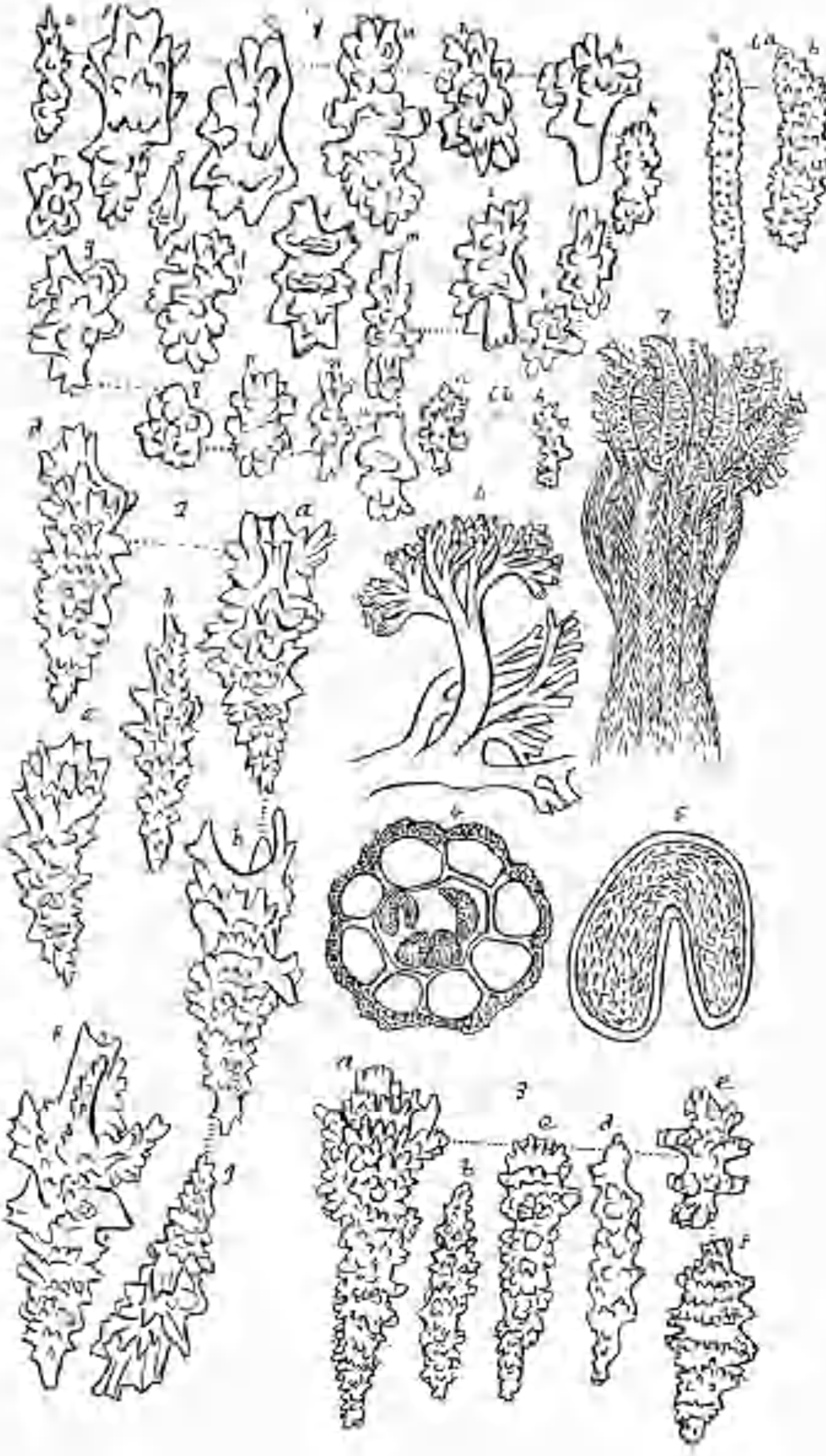

PLATE XVI.

Fig. 1. *Keratoisis ornata* Ver. Photograph of the type specimen about ¼ natural size. The axis is exposed in some places. Specimen was dry; from the Banks.

Fig. 1a. The same specimen. A portion having the dried calicles more or less disturbed. About natural size.

Fig. 1b. The same specimen. A calcareous segment, with two of the short horny ones (c, e,) partly detached. About natural size.

Figs. 2, 3. *Acanella normani* Ver. Two branches, each with the remarkable egg (e, e,) of *Myxine gelatinosa* attached. About natural size. From the Banks.

Fig. 4. The same. A group of polyps in expansion. Enlarged about 6 times.

PLATE XVI.

4

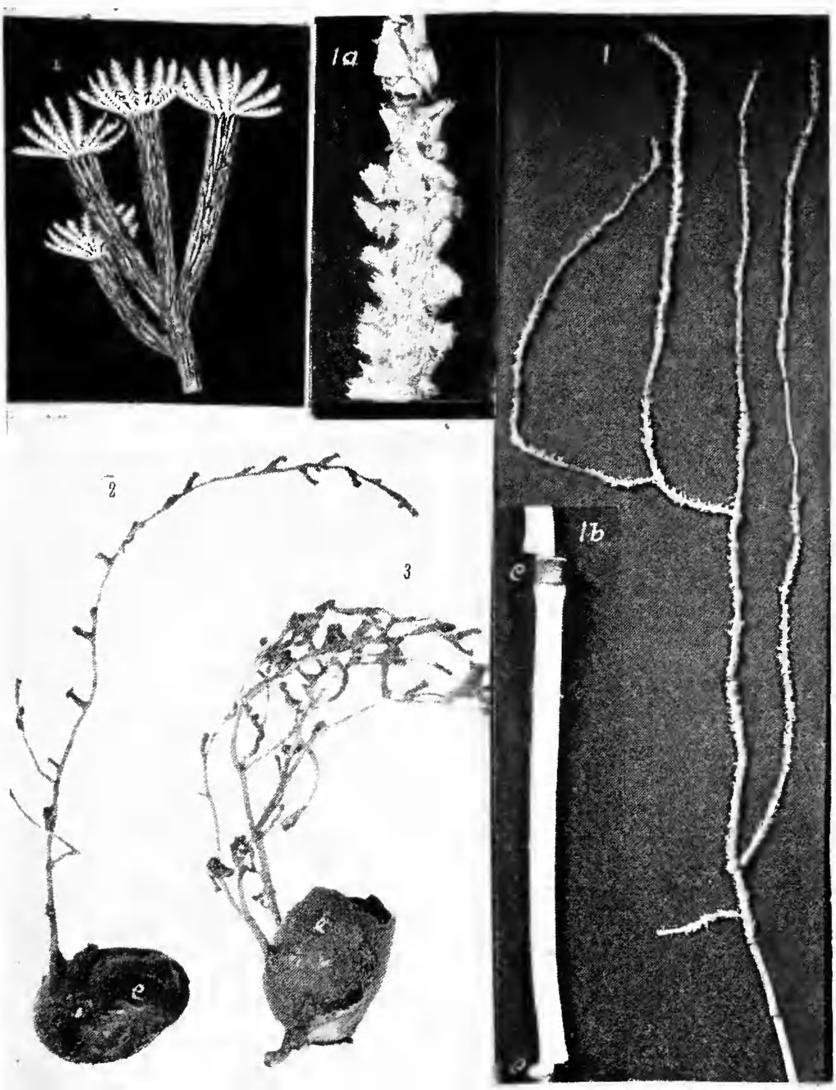

PLATE XVII.

Fig. 1. *Anthomastus grandiflorus* Ver. Spicules from the cœnenchyma: a–d, elongated rod-like forms and slender spindles, these are the dominant forms; e–g, club-like forms; h–m, short irregular spicules; n–o, small crosses; p, an unusual large branched form.
Fig. 1a. The same. Slender internal spindles from the cœlenteron walls.
Fig. 1c. The same. Spicules from the tentacles of No. 6436.
Fig. 1d. The same. Spicules from the outer layer of the tentacles of a specimen from the Banks (lot 404)
Fig. 2. *Anthomastus agassizii* Ver., new sp. Spicules from the cœnenchyma, outer layer; a–d, shorter spindles strongly spinulose; e–g, short stellate and irregular forms.
Fig. 2a. The same. Spicules of the interior, from the cœlenteron walls; h–k, slender rod-like forms; these are the dominant kinds; l, a club; m, a small cross—few of these occur.
Fig. 2b. The same. Spicules from the tentacles; n–o, rod-like forms; p, a short irregular kind.
Fig. 2c. The same. Spicules from the outer layer of the polyps; r–v, short, thick ellipsoids and ovate forms, strongly spinulose; x, stellate form; y, a double star; z, a small cross seen in profile.
Fig. 3. *Acanella normani* Verrill. A cluster of four contracted polyps from tip of a branch; enlarged about 7 times.
Fig. 3a. The same. Spicules: not the largest.
Figs. 4, 4a. *Keratoisis ornata* Verrill. Two calicles; a longer and a shorter one from the same stalk.
Fig. 4b. The same. One of the larger spicules from the calicles; b, three of the small spicules from the cœnenchyma.

PLATE XVII.

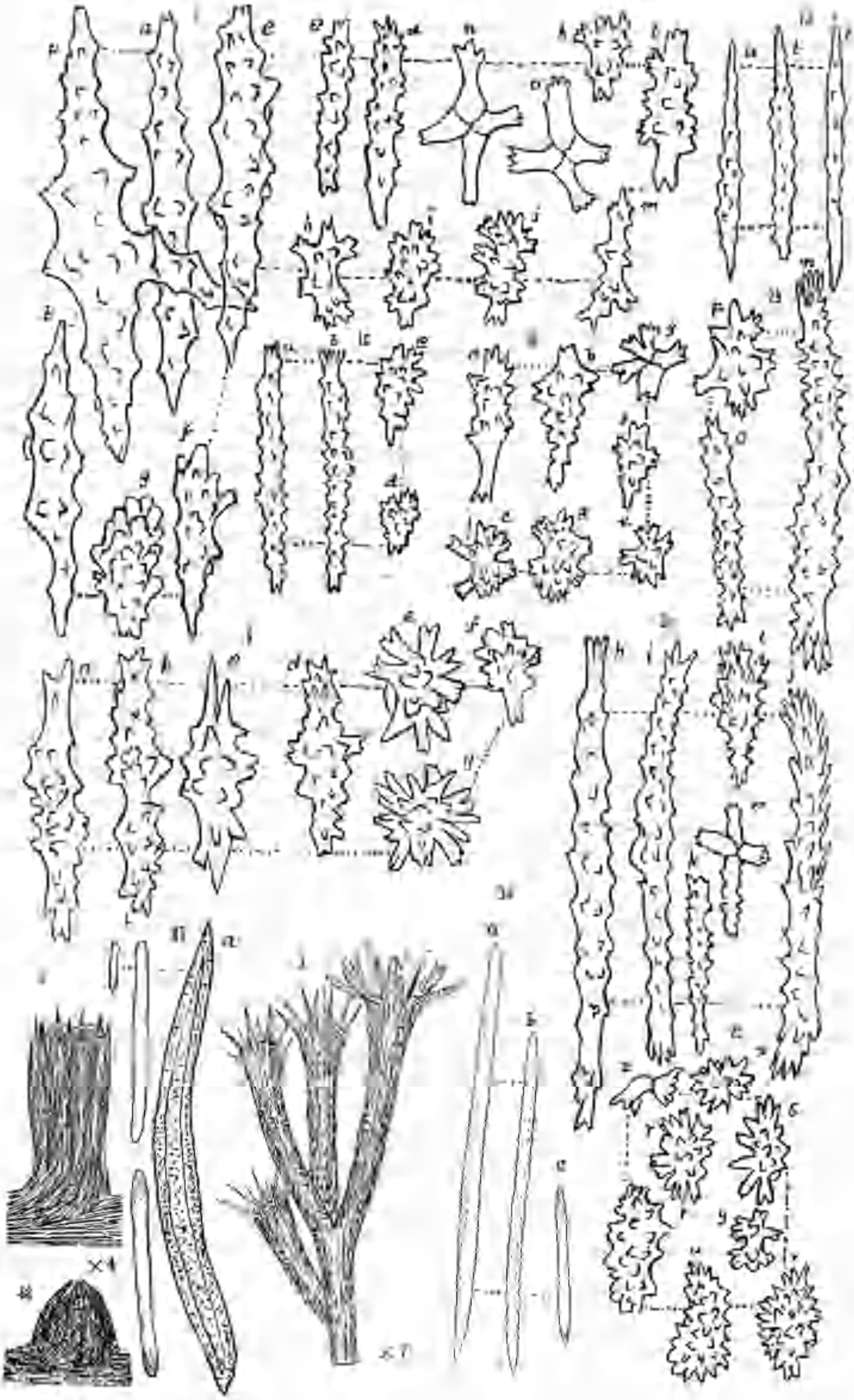

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PLATE XVIIA.

Fig. 1. *Gersemia rubiformis* (Ehr.). From a photograph under water, of a large alcoholic specimen, only partly contracted, from Grantley harbour, Port Clarence, Alaska, station 20d, in 2-3 fathoms. About natural size. See page 6 G.

Figs. 2 and 3. *Drifa glomerata* Verrill. Front and back views, photographed under water, from the largest Hudson bay alcoholic specimen described. See page 46 G. All photographed by Professor Alexander Petrunkevitch.

PLATE XVIIA.

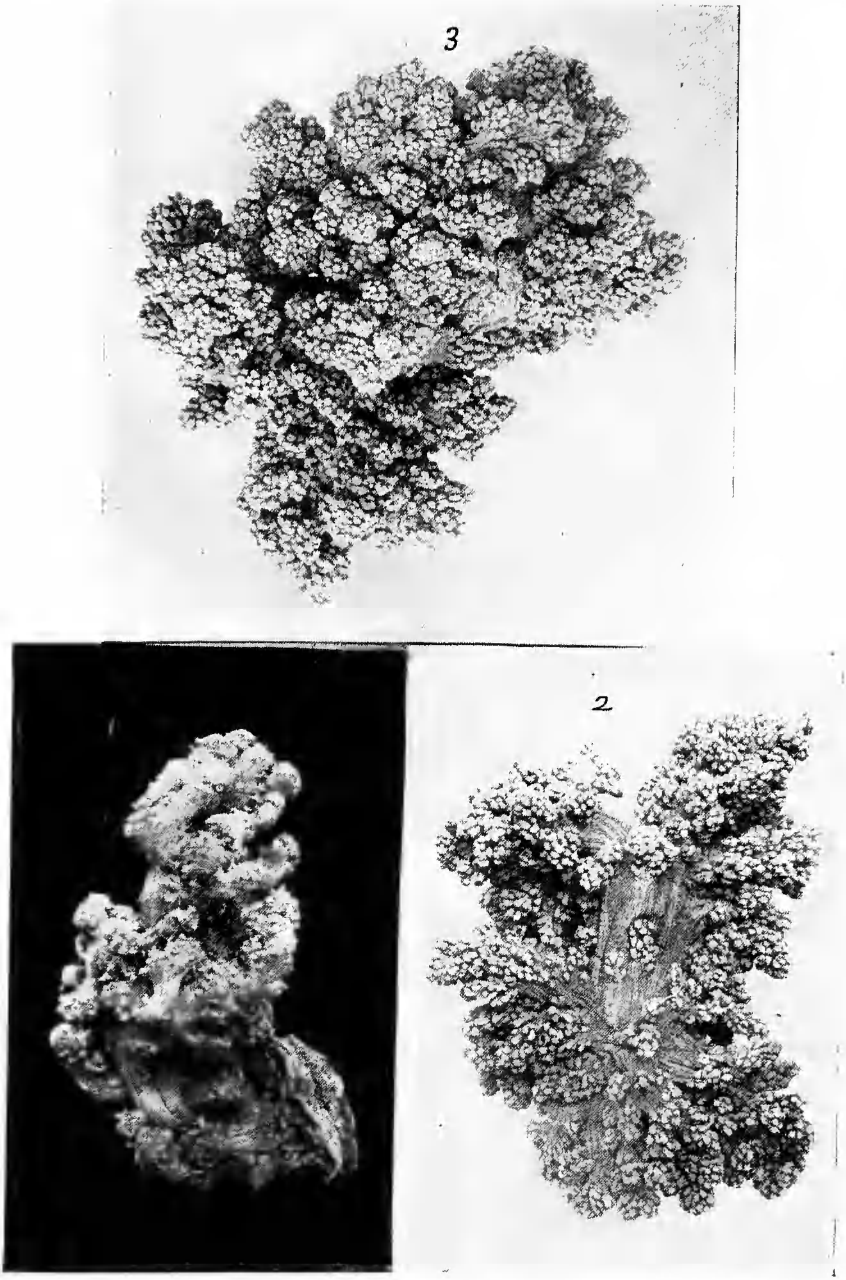
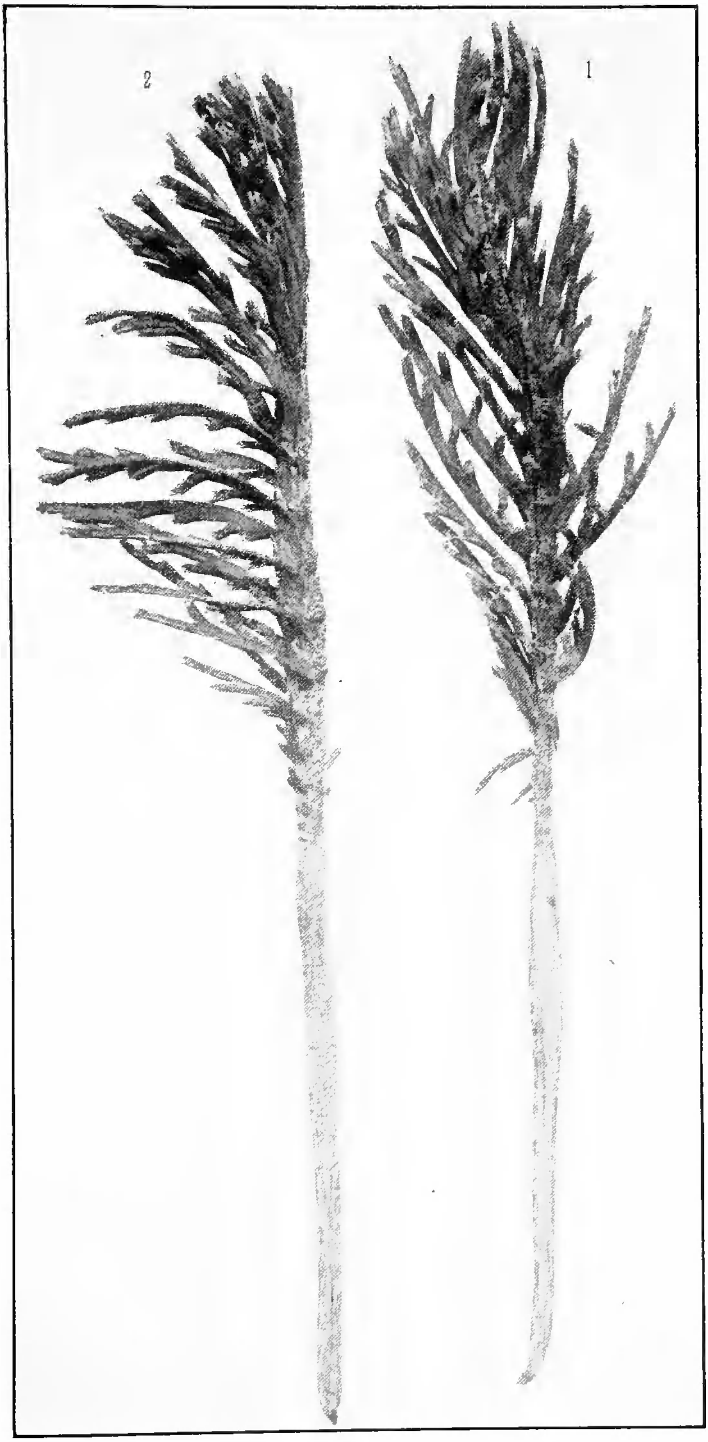


PLATE XVIII.

Figs. 1, 2. *Pennatula aculeata* (Sars) Dan. A deep-sea variety (var. *laxa*, new) having the pinnæ unusually long and far apart, and with fewer and more separated calicles than in the ordinary kind; natural size, from photographs.

PLATE XVIII.



III.

The Actinaria of the Canadian Arctic Expeditions, with Notes on Interesting Species from Hudson Bay and other Canadian Localities.

By A. E. VERRILL
Professor Emeritus, Yale University
(With thirteen plates and nine text figures).

Only a few specimens of Actinians were received by me from the Canadian Arctic Expedition, 1913-18, besides a few larval forms, belonging to a *Cerianthus*. One specimen is of interest because it is in process of dividing by fissiparity. Three species of Actinians of considerable interest and not previously known from Hudson bay were obtained by Mr. F. Johansen in 1920. Others were collected there by Dr. A. P. Low. Three species from Hudson bay are now described as new species.

In addition, I have thought it best to include a number of little known species, from both coasts of Canada, that need revision, and especially those from the rich fauna of the fishing Banks off Nova Scotia and Newfoundland. But this article is not intended to include a complete list of the Banks species, though it includes most of those commonly found there.

The drawings from living specimens were mostly made by Mr. J. H. Emerton. I am much indebted to Professor Alexander Petrunkevitch of Yale University for the pains he has taken in making for me photographs from several difficult subjects figured in this part and the preceding part of this report. Several of the anatomical drawings in each article were made by Mr. A. H. Verrill.

Order ACTINARIA

Family **SAGARTIADÆ** Gosse.

Actinians usually with numerous retractile tentacles, and always having acontia and normally cinclidæ. Acontia may be emitted from the mouth as well as from cinclidæ. Column variable, either without suckers or with suckers or verrucæ. Sphincter muscle is usually mesogloeal and more or less diffuse, or it may be in two parts; rarely it is more or less endodermal. Mesenteries are usually hexamerous, but they may be pentamerous, decamerous or irregular. Often only 6 to 12 pairs, including directives are perfect down to the bottom of the stomodæum, and the six primary pairs are nearly always sterile; more pairs may be adherent to the stomodæum near the oral disk, and sometimes for its whole length. Variations from this normal arrangement are frequent. There may be two siphonoglyphs and two pairs of directives in the more normal species, but some species of *Sagartia, Metridium,* etc, may have only one siphonoglyph and one pair of directives, as often as two pairs, or there may be three or more pairs and corresponding siphonoglyphs. Such variations are believed to be due to their asexual modes of reproduction. See below under *Metridium.*

Among the eastern American species that have such notable variations are *Sagartia* (*Thoe*) *luciæ* Verrill, and *S. spongicola* Verrill, and *Metridium dianthus.* (See McMurrich, Zool. Bulletin, Vol. 1, No. 3, 1897). Among English species remarkable variations of this kind occur in *Sagartia venusta*, *S. miniata*, and other allied species. (See Dixon, Proc. Royal Dublin Soc., Vol. VI, pp. 136-142, 1888).

Sub-family **SAGARTINÆ** Verrill, 1868.

Sagartian actinians having a flexible column wall, without a closely adherent epidermal coating, with cinclidæ, with or without adhesive suckers, without thickened tubercles or verrucæ.

Metridium dianthus (Ellis) Oken.

Actinia dianthus Ellis, Phil. Trans., Vol. 47, p. 428, Pl. XIX, fig. 67, 1767. Ellis and Solander, Hist. Zoophytes, p. 7, 1786; also many later writers.

Metridium dianthus Oken, Lehrb., Vol. III, p. 450, 1815; H. M.-Edward and Haime, Corrall., Vol. 1, p. 253, 1857; McMurrich, Annals New York Acad. of Science, Vol. XIV, No. 1, p. 3, pl. 1, figs. 1-5, 1901. (Sections).

Actinoloba dianthus (Blainville) Gosse, Actinologia Brit., p. 12, pl. I, fig. 1, 1860. Andres, Attinie, p. 133, fig. 15 (after Gosse).

Metridium marginatum (Les.) H. M.-Edward, op. cit., p. 234, 1857; Verrill, Revision Polyps E. Coast, pp. 22-24, 1864, and most other American writers formerly.

Metridium fimbriatum Verrill, Proc. Essex Inst., Vol. IV, p. 150, 1865, described from Californian speciemns.

Metridium senile McMurrich, Trans. Royal Soc., Canada, Vol. IV, section 4, p. 60, 1910, (not *Actinia senilis* Linn., 1767, nor *Priapus sinilis* Linn., 1761).

Plate XXVI; Fig. 2. Plate XXXI; Fig. 6.

This species is readily distinguished by its smooth column, well defined parapet, widely expanded oral disk, which in well grown specimens when expanded is thrown into a number of marginal frills or wavy lobes covered with large numbers of small and rather slender tentacles. The outer ones much smaller than the inner ones.

When very large it may have about a thousand tentacles, and a corresponding number of mesenterial pairs, and abundant white acontia, which are readily emitted from scattered cinclidæ when the creature is roughly handled, and also from the mouth.

It is very changeable in form while living. In full expansion it may be much higher than broad, or its height may be less than its diameter. The disk is usually much wider than the column. Its disk and tentacles can be completely inverted together with the upper part of the column, and then it may have a hemispherical form or become even more depressed in form.

Its colours on the New England coast are very variable, rarely white or blotched with white. Most frequently its colour is dull yellowish brown, dark olive-colour, or chestnut brown to umber brown and often blotched or streaked with lighter colours; sometimes it is pale buff, salmon-colour or flesh-colour, rarely brick-red. The tentacles are usually paler or even white.

Professor W. R. Coe, who was one of the naturalists on the Harriman Alaska Expedition, tells me that at Victoria, British Columbia, he found the piles of the wharves, at low tide, entirely covered with large examples of this species, which were, when in expansion, white or nearly so.

It is capable of reproduction asexually in several ways: by longitudinal fission; by budding from near the base or rarely elsewhere; and by breaking off fragments from the edge of the expanded basal disk, each of these pieces developing into a young one in a short time. This last is a common mode of increase.

It may have either one, two, three or more siphonoglyphs and directive pairs of mesenteries according to the positions whence fragments are taken or a basal bud arises. It rarely buds from the stomodeal region. Longitudinal fission is not infrequent.

The mesenteries also show considerable variations in their arrangements largely, no doubt, in consequence of these asexual reproductions.[1]

Its distribution is circumpolar. It is essentially a shallow water species, seldom found in more than 25 fathoms. It frequently occurs above low-water mark amongst stones, on piles of wharves, and especially in cavernous places in shore cliffs. It likes the shade.

On the Eastern American coast it extends southward to Long Island sound and northern New Jersey. It is much more abundant north of Cape Cod, on the coasts of Massachusetts and Maine and in the Bay of Fundy, etc., where it becomes very large; also in the Gulf of St. Lawrence, etc.

On the northern European coasts it is abundant and extends southwards to England, etc., and varies in colours much as it does on the American coast. It sometimes becomes large there.

The Canadian Arctic Expedition specimens were from Port Clarence bay, Alaska, Station 20y, in 2 to 3 fathoms, mud and thread algæ, August 4-13. Two medium-sized specimens, collected by F. Johansen; several young ones were on a sponge, from the same place.

Its range extends southward on the Pacific coast to San Francisco, where it was found by Dr. Wm. Stimpson and described by me as a new species (*M. fimbriatum*) many years ago (1865). His specimens were very large, pale orange or salmon-colour, dotted with brown; lips orange.

On the North Pacific coast it has been recorded from only a few places between Bering strait and San Francisco. It was recorded by me, in 1869, from Puget sound. Prof. Coe, as mentioned above, gives Victoria as a locality. McMurrich described it from Puget sound, and recorded it from Sitka (observed by Calkins).

Possibly it has been carried to San Francisco from more northern localities on the bottoms of vessels. It is well adapted for such transportation, like *Sagartia luciæ*, which has now been found on the English coast, at Naples, and at San Francisco, although only known from southern New England a few years ago. Being a very hardy shallow water species and very prolific it may well be carried across the oceans on vessel bottoms.

Metridium dianthus is also very hardy, as indicated by its northern and arctic distribution. Like *S. luciæ*, it can withstand freezing. I have kept specimens in dishes of water until frozen within a solid mass of ice. When slowly thawed out they completely revived.

When deprived of food for a long time a large one will gradually decrease in size and numbers of tentacles. Some that I have tried became less than half their original sizes and looked like young ones.

After an experience of over fifty years, I have not been able to find any reliable differences between the North Pacific and Atlantic forms. McMurrich also failed to find any tangible anatomical differences (1921). At present there seems to be no doubt of the identity of the American and European forms, though Andres kept them distinct.

Prof. McMurrich has endeavoured to restore for this species a name (*senilis*) used by Linnæus, for a small indeterminable species very imperfectly described in 1761. (Fauna Suecica). The description does not in the least apply to this

[1] For descriptions and discussions of the numerous variations of the mesenteries and siphonoglyphs of *Metridium*, and also its sexual modes of reproduction, see G. H. Parker:—The mesenteries and siphonoglyphs in *Metridium marginatum*, in Bull. Mus. Comp. Zool., Vol. XXX, No. 5, pp. 259–273. with plate; also in the same work, Vol. XXV, pp. 43–53, 1899. H. B. Torrey, Observations on Monogenesis in Metridium, in Proc. Calif. Acad. Science, ser. 3, vol. i, No. 10, pp. 345–360, pl. XXI, 1898; also in Proc. Washington Acad. Sci., Vol. IV, pp. 395–406, 1902. C. W. Hahn, Dimorphism and Regeneration in Metridium, in Journ. Exper. Zool., Vol. ii, No. 2, pp. 225–235, 1905.

species. He described his thing as the size of the last joint of a finger, sordid, rough, with a subcoriaceous tunic. Such a description could not possibly apply to this soft and smooth species, which is not in the least subcoriaceous. It would apply better to a *Phellia* or to *Actinia digitata*, and other local species available for him, but it would be mere guesswork to say what species he had in view.

European writers, who have had the best opportunities, have not been able to agree as to this question. Moreover, aside from this uncertainty, most modern writers have rejected most of the Linnæan names of actinians on account of their obscenity or indecency. Prof. McMurrich (1910) tried to identify this species by means of the earlier works loosely quoted by Linnæus, but that is not conclusive. The figures referred to usually represent rudely more than one species, and none agree with his descriptions.

European writers have given the name *senilis* to at least four very diverse species. Many have applied it to *Urticina crassicornis*, e.g. Cuvier, Brugiere, Fabricius, Blainville, Lamarck, etc. Martens, 1838, used it for *Cereus bellis* or *pedunculatus*. Macri (1778) identified it with *Anemonia sulcata*. Adams applied it to *dianthus;* Ehrenberg to *coriacea*, etc.

All this confusion shows the impossibility of fixing the name, even if it were not otherwise objectionable. It should be forgotten or ignored, like the generic name used by Linnæus in 1761, and by some others of that period, for species of *Actinia*. Their indecent names were usually the Latinized forms of vulgar names used by fishermen, some of which are still in use among the fishermen of our own coasts, for similar things.

Metridium dianthus? (See above p. 89 G).

The specimen mentioned above as undergoing fission is placed under this species with some doubt, partly on account of its apparently larger tentacles and the peculiar areolation of its body-wall. It is very strongly contracted, about an inch in diameter, and half as high, and subconical in form. It does not show the tentacles externally. Its outer integument is irregularly roughened or vermiculated by minute broken transverse and longitudinal wrinkles. In life, according to the note accompanying the example, it was red. It has scattered cinclidæ, from which a few broken acontia protruded. It has a distinct parapet and ribbed capitulum. It has two well separated disks and mouths, and two complete sets of tentacles. Not wishing to destroy the single specimen I have made only a superficial examination of its internal structure by partial sections. Its state of preservation is not suitable for a positive identification of the genus or species, but it seems to be *Metridium dianthus*.

The wall of the body is thin, but tough and not lubricous. No suckers are visible. The tentacles are rather larger than usual in preserved *Metridium*, in a similar state of contraction. They are entirely retracted and much compressed in flattened forms. No acontia were observed inside, except those lodged in the cinclidæ.

The sphincter muscle is strong, mesodermal, nearly round in transverse sections. Mesenteries toward the base are in about 96 pairs. There are about twelve pairs of wider and mostly perfect mesenteries; those of the third cycle are well developed; those of the fifth cycle very small. All or nearly all of the mesenteries bear gonads. The longitudinal muscle is definite and well-developed in the larger mesenteries, and placed near the middle. There is considerable irregularity in the mesenteries above the middle of the stomodæum, due to the fission. It was taken by F. Johansen at Station 41, in Bernard harbour, Dolphin and Union strait, Northwest Territories, in 10 meters, on a bottom of sandy mud, July 20, 1915.

Sub-family **CHONDRACTININÆ** Haddon.

Chondractininæ HADDON, Sci. Trans. Royal. Dublin Soc., vol. IV, part V, pp. 304, 305, 1889, (Revision British Actiniæ, Part I). McMURRICH, Proc. U. S. Nat. Museum, vol. XVI, p. 183, 1895.

Lower part or most of the column is usually more or less firm and often verrucose; upper part is differentiated. It is softer or more flexible, often with crests or flutings, or defined by a transverse row of verrucæ, and is capable of being strongly infolded; outside of the lower part of the column may have a more or less adherent epidermal coating; cinclidæ few, not to be easily detected unless in use while living. Acontiæ are present but not numerous. Tentacles contractile, large, numerous, in several hexamerous cycles. Two siphonoglyphs and two pairs of directive mesenteries are normally present. Usually there are six or twelve pairs of wide perfect mesenteries, which may be sterile, but many other pairs may be attached to the upper part of the stomodæum, near the oral disk. Sphincter muscle is mesoglœal and usually strong. Base may enclose a ball of mud for anchorage, or it may be attached to stones, etc., or it may clasp and surround slender supports, such as the axes of alcyonarians.

Actinauge Verrill.

Actinauge VERRILL, Bull. Mus. Comp. Zool., Vol. XI, p. 50, 1883. Type *A. verrillii*, formerly *Urticina nodosa* Verrill (*non* Müller).

Actinauge HADDON, op. cit., 1, p. 317, 1889. McMURRICH, op. cit., p. 183, 1893.

Large actinians of the subfamily Chondractininæ, having the tentacles and upper part of the body or capitulum capable of involution. Integument of the body formed of two kinds; that of the lower part is firm and often thick, with persistent, solid verrucæ or tubercles, usually in vertical rows, and often more or less covered with a thin, tough, epidermal coating; that of the upper part of the body forms a marginal, brighter coloured capitulum below the tentacles, where it is softer and lubricous, secreting mucous abundantly, and usually rising into longitudinal ridges, crests, or oblong tubercles, which run to and unite with the bases of all or nearly all of the tentacles. Cinclidæ are few, scattered, and inconspicuous among the verrucæ, Acontia are present. The basal disk may be broad and flat, adherent, or it may be bulbous, clasping mud, or it may ensheath the branches of Gorgonidæ, etc. Tentacles long and large with a basal aboral lobe, contractile and retractile. The basal lobe may be inconspicuous in strongly contracted specimens, or the distal part may be partly invaginated into the basal lobe in some cases. Lips with large folds and two gonidial grooves.

The soft submarginal band or capitulum is usually phosphorescent, due to the mucous. In contracted specimens it is usually entirely invected and concealed.

This genus, like *Actinernus*, has marginal elevations of the wall, running to and uniting with the outer bases of the tentacles, but in *Actinernus*, there is no specialized submarginal zone or capitulum, and the body is not verrucose.

The sphincter muscle is large and mesoglœal. Six or twelve pairs of mesenteries are perfect and usually sterile in the middle part of the body, but many more may be perfect near the disk; usually only the six large primary pairs reach the base of the stomodæum. Mesenteries may form four to six hexamerous cycles, or even more in large examples. Mesoglœa is very thick, especially in the upper part of the column at the parapet.

Actinauge verrillii McMurrich.

Actinauge verrillii McMurrich, op. cit., p. 1-4, pl. XXX; Figs. 86-89; Pl. XXXI; Figs. 90-92; Pl. XXXV; Fig. 121, 1893, (Structure).

Actinauge nodosa (*pars*) Verrill, Bulletin Mus. Comp. Zool., Vol XI, p. 50, Pl. VI, figs. 7, 8, 8a, 1883; Ann. Report U.S. Comm. Fish and Fisheries for 1883, pp. 514 (12); 534 (32); Pl. V, fig. 20, 1885.

Actinauge verrillii Whiteaves, op. cit., p. 38, 1901. Hargitt, Anthozoa of Woods Hole Region, p. 249, 1914.

Plate XIX; Fig. 1. Plate XXVII; Fig. 2, (anatomy). Plate XXX; Fig. 2.

The most common adult form in expansion has the body more or less cylindrical, varying to hour-glass shape. The base may be broad and flat often much broader than the body, and adherent to stones and shells; it may closely clasp cylindrical worm-tubes, branches of gorgonidæ, etc., or more often it may be deeply concave and bulbous, and enclose a mass of sand and mud. (Pl. XIX, Fig. 1). Specimens with these different styles of base may all occur in the same locality, without other corresponding differences.

The column is usually nearly covered with hard, prominent, and persistent verrucæ, arranged in pretty regular vertical rows, the upper ones becoming larger and more prominent, often with a hard sharp tip, the lower ones gradually diminishing and disappearing close to the base. Usually there are 12 larger rounded ones in a transverse row, below the capitulum. In very large examples the lower part of the body is usually nearly smooth and naked, with a firm, cartilaginous texture, due to the thick mesoglœa, but higher up there will usually be some conical or rounded verrucæ or small tubercles, on some of which the brownish epidermal coating is still retained.

The tentacles are not very large, moderately long and rather stout, changeable, with the tips either acute or obtuse; and with a distinct swollen basal lobe; in large examples they are numerous, up to 120 or more, forming several rows. In smaller specimens often 72 or 96. Plate XXX, Fig. 2.

When preserved, the upper part of the column is generally strongly involuted and the tentacles and part of the capitulum are concealed. In this condition the capitulum is covered with convergent, strongly raised folds, or crest-like ridges, larger and smaller ones irregularly alternating. These crests correspond in number to the tentacles, and run up to their outer bases; the larger ones, which correspond to the inner or primary tentacles, can be traced inward between the outer tentacles until they run to and coalesce with the external basal portion of the inner ones. (Plate XXX, Fig. 2). The upper portion of the column, covered by these ridges and crests, is differentiated from the part below it, for its integument is soft and lubricous, and usually decidedly red or pink in colour during life; and this portion, like the tentacles, secretes an abundant mucous, which is strongly phosphorescent. A row of rounded warts or larger tubercles, or a more or less marked, transverse, verrucose ridge or "parapet" separates this upper or submarginal capitulum from the general surface of the column, which is firmer, more or less verrucose, and generally wholly or partly covered with a dirty, brownish, tough, and firmly adherent coating, which is strongly wrinkled in contracted specimens, and sometimes has hydroids, bryozoa, and even such shells as *Anomia* adhering to its surface. This covering is often partially, and sometimes wholly wanting, especially in very large examples. It often persists on the larger upper verrucæ, even when absent elsewhere, and in some rather exceptional specimens it is much thickened on these warts, or even forms for them hard conical tips, sometimes affecting thus only the uppermost row, but at other times several series of them.

The colour of the body, in life, is usually dull pale red, flesh colour or salmon, where it is not concealed by the dirty, dark brown epidermis; the verrucæ are often whitish or pink, while the wrinkles and grooves between them are dark brown or mud-colour; the submarginal zone, which is 15 to 20 mm. or more broad in the larger examples, is bright red, orange-brown, or chocolate-brown; the colour is often in stripes of darker and lighter tints. The tentacles are usually dark pink, salmon, orange or orange-brown, varying to dull red and chocolate-brown. Disk usually orange or reddish brown, or chocolate, with lighter and darker radii.

Specimens from stony bottoms have the base broad and firmly adherent to pebbles, shells, etc. On fine sandy and muddy bottoms in deep water the base usually becomes bulbous and swollen, enclosing and nearly surrounding a large mass of sand or mud; in these situations the basal part of the column is evidently buried in the materials of the bottom and as the base has only a small opening to its large cavity it is unable to withdraw itself from the enclosed mass of dirt, of which there is often several ounces in each of the large actinians, and there may be a hundred or more of these in a single haul of the trawl.[1] The haul gave excellent samples of the bottom deposits unaltered by washing out.

This species, like several others, also has the habit of attaching itself to the dead stems of gorgonians, to stems of large hydroids, to sponges (*Cladorhiza grandis*), and especially to the large quill-like tubes of the large annelid, *Hyalinœcia artifex* Ver., which is often very abundant on the same muddy bottoms where this actinian abounds. Such examples, as they grow larger, fold the basal disk around the supporting stem or tube until the two edges meet and then firmly unite together, by a suture, so that the stem seems to go through the base itself.

These three forms of the base occur in specimens that are otherwise similar, and also in several varieties based on the tuberculation of the surface. Specimens having flat and others with bulbous bases often occur in the same haul and some have been taken that are intermediate, having one edge of the base attached to a small shell or pebble, while the rest of it enclosed mud.

This species grows to a large size. Examples were often taken that were 80 to 100 mm. (4 inches) in diameter, and 100 to 150 mm. (6 inches) high. Ordinary adult specimens are 50 to 75 mm. broad, and 80 to 100 mm. high, with the larger tentacles about 15 to 20 mm. long.

It has been taken by the U.S. Fish Commission at a large number of stations on the Gulf Stream slope, off Martha's Vineyard, Nantucket, and Long Island, and off Chesapeake bay, during 1880, to 1886, in 86 to 1,098 fathoms. In this region it is often very abundant and of large size. The smaller ones here mostly occur clasping the large tubes of *Hyalinœcia*; the large ones in the deeper localities generally enclose a ball of fine sand or mud in the bulbous base.

Actinauge rugosa. New species.

Urticina nodosa (Fabr.) Verrill, Amer. Journ. Science, Vol. VI, p. 440; vol. VII, p. 413, pl. VII, fig. 7, 1874 (*non* Fabricius sp.), Proc. Amer. Assoc. Adv. Science, Vol. for 1873, p. 349, 1874, (Exploration of Casco Bay). Not *Actinauge nodosa* Verrill, of 1882-3. Smith and Harger, Trans. Conn. Acad. Science, Vol. III, pp. 11, 54, 1874.

Plate XIX; Figs. 2 & 3. Plate XXIV; Fig. 2. Plate XXVII; Fig. 1.
Text Fig. 14.

Column mostly rather rigid with a thick and firm cortex, with some adherent epidermis; generally nearly cylindrical with a somewhat expanded base; upper part or capitulum defined by a transverse row of about twelve larger or more

[1] At some localities in deep water, off the northeastern United States coast, at least a barrel full or hundreds of large actinians were brought up in a single haul of the trawl. This species made up the greater part of such lots.

prominent usually compressed and irregular, obtuse or subconical tubercles; below these the surface, except near the base, is covered with rather scattered and unevenly placed firm tubercles, varying in size, and mostly transversely elongated in contraction; between these the surface is strongly transversely and longitudinally wrinkled in contraction. The tubercles in large specimens do not show any notable arrangement in vertical rows, in most cases, because of their fewness, but they are actually in rows, more evidently so in the young. The upper part, or capitulum, has a softer integument and is closely covered with numerous prominent folds or crests, having the thicker aboral lower edge lobed or verrucose, or irregularly scalloped or crenulated; less so in the young; each of these extends to and joins a tentacle, becoming thin and smooth near the margin. This capitulum can be completely contracted and infolded, together with the reversed tentacles.

The tentacles are numerous, 96 or more in the larger specimens, arranged in about five cycles. They are rather stout not very long, usually blunt in expansion; the inner 12 or 24 are much the larger; those in the outer rows are not very small in the type. Two siphonoglyphs and the lip-lobes are large. The colour of the column, when cleaned of its dark coating, below the capitulum or collor, in life was usually dull pale red or flesh-colour, with the exposed summits of the tubercles whitish. The capitulum was brighter red and lubricous; tentacles were either dull salmon-colour or brown, sometimes chocolate-colour.

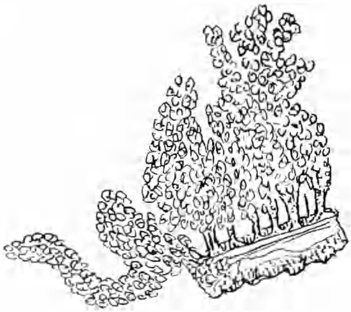


Fig. 14. *Actinauge rugosa* Verrill. Imperfect mesenteries of the 4th and 5th cycles with the gonads partly removed, much enlarged.

It was first taken by the "Bache," in 1873, in 430 fathoms, off Georges bank. It also occurred off Casco bay in 1873, in 95 fathoms. Also in the Gulf of St. Lawrence (Coll. Whiteaves). A number of specimens taken on the Grand Banks and other fishing banks were brought in by the Gloucester, Mass., fishermen and presented to the U.S. Fish Commission in 1878 to 1881. They were all listed then as *U. nodosa*. It was not nearly so abundant in our collections as *A. verrillii*. It has also been taken by the U. S. Fish Commission off Cape Cod, in 50 to 90 fathoms; Gulf of Maine, Massachusetts bay, Bay of Fundy, in 50 to 150 fathoms; off Nova Scotia, in 50 to 110 fathoms, 1877.

A few specimens of relatively small size are in the collections from Hudson bay in 1920. These are strongly contracted and some are still partially covered on their sides and bases with a dark brown adherent epidermal coating, as in most other localities. The bases were adherent to stones. The verrucae of the walls are not very conspicuous, but form imperfect longitudinal rows. The surface between them is strongly wrinkled both ways. The cinclidæ are inconspicuous among the wrinkles and appear to be few.

One lot (of 2) was from Richmond gulf, about three miles from the entrance east side of Hudson bay, in 12-13 fathoms, stones, sand and red algæ, about N. lat. 56°, Aug. 23, 1920. Collection of F. Johansen.

The other was from Richmond gulf in 25 fathoms, Aug. 24, 1920, obtained from Eskimos by F. Johansen. Another specimen came from Richmond gulf in 15-25 fathoms. Collected by A. P. Low, June, 1899. In collection of Victoria Memorial Museum, Cat. No. 55, Cœlenterates.

It was not previously known to occur in Hudson bay, nor in such shallow water.

It has also been taken by the U.S. Fish Commission off Cape Cod, in 50 to 90 fathoms; Gulf of Maine; Massachusetts Bay; Bay of Fundy, in 50 to 150 fathoms; off Nova Scotia, in 50 to 110 fathoms, 1877.

In longitudinal sections (Pl. XXVII, fig. 1) the column wall is seen to be very thick, especially in the upper part, or parapet, next the capitulum, owing to the thick mesoglœa, especially if the section cuts one of the larger verrucæ. The sphincter muscle is very large and thick, with a simple pinnate arrangement of the muscle fibres. The stomodæum is large with strong longitudinal folds. Only a few acontia were found.

In a transverse section of a small specimen from Hudson bay, about 30 mm. in diameter, about the middle of the stomodæum, there are four complete hexamerous cycles of mesenteries. The six primary pairs are alone perfect and sterile; their longitudinal muscles are rather thin and extend nearly across them. All the other mesenteries are covered with gonads, which completely fill all the areas between the primary pairs. The secondary pairs nearly reach the stomodeal wall; the tertiaries are small but well developed; those of the fourth cycle are quite narrow and thin, but all bear gonads.

In a transverse section made across the upper part of the stomodæum, near the oral disk, most of the tentacles, or their basal lobes, are cut across, for they are infolded within the stomodæum; here there are 12 pairs of nearly equal perfect pairs of mesenteries, and it is not easy to distinguish those of the first and second cycles except by their positions, for all are much alike. Their muscles are thickened. In this section the mesenteries of the third and some of the fourth cycles bear gonads; those of the fourth cycle are very small and some are lacking.

This was formerly believed by me to be the true *Actinia nodosa* of O. Fabricius (1780), from deep water off Greenland, very briefly and poorly described.

Haddon (op. cit., 1890, p. 308, Pl. XXXIII, fig. 13, Pl. XXXV, fig. 4) described and figured a very different looking specimen, taken off Greenland, as the true *nodosa,* and referred it to the genus *Chondractinia,* after Lütken, 1860.

Haddon's specimen looks more like my *C. tuberculosa* than like the present species, which is a true *Actinauge,* having the capitulum covered with high crests. His specimen had a smooth capitulum and the column tubercles are conical and in regular vertical rows, while the tentacles lack the basal lobe. Its column wall was unusually rigid.

However, among the many hundreds of specimens of this group, dredged by the "Albatross" in deep water there were some that had verrucæ arranged as in Haddon's *C. nodosa* and probably were the same species. They were at that time classed as one of the varieties of the present species. They are not now accessible for examination.

The *Actinauge nodosa* of Danielssen is also unlike Haddon's *C. nodosa,* and may be identical with my *Chondractinia tuberculosa.* It is covered with large, irregular tubercles and has a smooth capitulum. Tentacles rather long and stout, round tipped.

Actinauge borealis. New species.

Plate XXIV; Figures 1–1h.

Among the Hudson bay actinians were two specimens that seem to belong to an undescribed species resembling *Actinauge rugosa* externally, but having much longer tentacles which lack the large basal lobe usually seen in that genus, and differ in other ways.

Both specimens are very strongly contracted, so that the internal organs form a compact mass. The longer invected tentacles reach to and below the base of the long stomodæum, or quite to the basal disk in some cases.

The column-wall is firm, strongly wrinkled both longitudinally and transversely; it also has vertical rows of low, but persistent, verrucæ. The whole surface below the capitulum is covered with a firmly adherent, thin, dark coloured eipdermal coating, much as *Phellia*. The capitulum is strongly invected, but sections show that it is covered by numerous raised ridges, with a plain edge toward the margin, but thickened and crenulated toward the parapet.

The verrucæ on the parapet are not much more prominent than those below, and have the same structure.

The tentacles are numerous, up to 84 to 96, slender, the inner ones nearly as long as the column; they are so crowded by contraction that they are angular in sections.

The stomodæum is elongated with the walls strongly plicated. Two siphonoglyps are present.

The sphincter muscle (Plate XXIV, figs. 1, 1a) is mesoglœal and very well developed. In transverse sections, made near the oral disk (figs. 1b-1c) and including some of it, there are about 24 to 40 perfect mesenteries, which are all very much alike, with strong retractor muscles extending nearly across their whole breadth.

Between these perfect mesenteries there are pairs of small, narrow ones, which bear gonads. A little lower down there are twelve pairs of perfect mesenteries; and below the middle of the stomodæum there are only six pairs. They are sterile (fig. 1f). All the other mesenteries bear dense clusters of gonads and filaments, squeezed compactly together by the severe contractions of the walls.

Between every pair of mesenteries there is a narrow, angular, raised endodermal ridge (r, r,) which appears triangular in the transverse sections. These occur of larger size and less acute between the primaries, and are very small between those of the fourth and fifth cycles (fig. 1f).

The ectoderm (figs. 1e, 1f, h, h) is moderately thick and firm, with deep grooves caused by wrinkles, and containing more or less of the dark epidermal coating, and with thickened places caused by the verrucæ (figs. 1d, 1g, v, v).

The mesoglœa is much thicker than the ectoderm and endoderm combined (1e, 1g, h, h). It is crossed by numerous very fine, nearly straight, muscular lines, running out from the endoderm at nearly right angles, often more than half way across. In some sections they are bent a little in zigzag forms.

None of the original colour remains except a tinge of light red on the retracted oral part of the disk and upper part of the mesenteries (fig. 1, m).

The contracted specimens are nearly cylindric and higher than broad. The larger one is 25 mm. high; 13 mm. in diameter; length of the longer retracted tentacles 22 mm.; outer shorter ones, about 10 to 12 mm.

These two specimens came from Richmond gulf, east side of Hudson bay, in 25 fathoms, August 24, 1920, obtained from Eskimos by F. Johansen.

The generic position of this species seemed a little doubtful. It looks much like some species of *Phellia*, but differs in having a verrucose wall and a ribbed capitulum. From typical *Actinauge* it differs chiefly in lacking notable basal tentacular lobes and in having very long slender tentacles. However, a careful examination shows the basal lobe on some of the less powerfully compressed tentacles. Their apparent absence on others is probably due to the violent pressure put on them during contraction.

The dark epidermal coating is thicker, rougher, and more firmly adherent than in the allied species. It covers the basal disk and all the column-wall up to the capitulum, and penetrates deeply into the wrinkles of the surface, as seen in sections.

Stephanauge Verrill.

Stephanauge VERRILL, Amer. Journ. Sci., Vol. VII, p. 145, note, Feb., 1899 Type, *S. nexilis* Ver.

Stephanactis HERTWIG, Voy. Challenger, Zool. Vol. VI, p. 87, 1882. Type was *S. tuberculata*, pl. iii, figs. 7-7a, (*non* Verrill, 1869).

? *Hormathia* Gosse, Ann. and Mag. Nat. Hist., ser. 3, vol. III., p. 47, 1859. ? HADDON, op. cit., 1889, p. 309 (in part?).

Chitonactininæ with the greater pert of the column-wall thin, flexible, smooth or nearly so below the thickened parapet, with or without an imperfect epidermal coating, and with few small and usually obscure cinclidæ; and bearing toward the top, in typical species, a transverse row of verrucæ on the parapet, defining the capitulum, which is more flexible and covered with folds or small ridges running to the bases of the tentacles. Tentacles are numerous, swollen at the aboral base, and with the capitulum, they can be entirely retracted. Sphincter muscle mesoglœal and rather large. Usually 12 or more pairs of mesenteries may be perfect near the oral disk; lower down 12 pairs may be perfect; near the base of the stomodæum only 6 pairs are perfect; all mesenteries may bear gonads, except perhaps the six primary pairs. Acontia few. The base may be either amplexicaul or flat. The typical species seems to differ from *Hormathia* mainly in having lobed tentacles and the capitulum covered with ridges, and not having so notable a row of submarginal tubercles or verrucæ. The amplexicaul habit is not a generic character.

Stephanauge nexilis Verrill.

Actinauge nexilis VERRILL, op. cit., 1883, p. 55, pl. VI, figs, 4, 5; op. cit., 1885, pp. 511, 534, pl. VII, figs. 22, 22a.

Stephanauge abyssicola VERRILL, Amer. Jour. Sci., Vol. VII, pp. 145, 217, note, fig. 31, 1899; (*non* MOSELEY sp.).

Plate XXII; Figs. 5, 6. Plate XXVIII; Figs. 1-4. Plate XXX; Fig. 3.

The column wall is rather thin, but strong, and it is nearly smooth, except for wrinkles, with no notable verrucæ; folds of the capitulum are notable. The sphincter muscle is mesoglœal and somewhat thick. Tentacles are moderately stout, numerous, about 96 to 108 in the larger specimens, arranged in four or five hexamerous cycles. Their bases are somewhat swollen, opposite the capitular folds. In a transverse section, near the disk, the mesenteries of many pairs join the stomodæun and disk; between most of these pairs there is a smaller pair of the fourth or fifth cycle, mostly bearing gonads and not attached to the stomodæum. Lower down only about 12 pairs are perfect, and near the lower end of the stomodæum there are only 6 perfect pairs. Many of these, especially those of the second and third cycles, bear gonads (Plate XXX; Fig. 3.)

Acontia are apparently few; solitary ones are occasionally seen emitted from the small scattered cinclidæ, which are seldom noticeable when not in use.

One specimen (Pl. XXII, fig. 7) had several very distinct cinclidæ, and some outer integument. It may be a very distinct species. No sections of it were made.

This species is very closely related to *Actinauge*, to which I formerly referred it. The only notable distinctions seem to be the lack of tubercles below the parapet and the thinness of the walls with a corresponding decrease in the thickness of the sphincter muscle. The character of the capitular ridges, the swollen bases of the tentacles, and the arrangement of the mesenteries are nearly the same if specimens of equal age be compared.

It has been suggested that it might be related to *Korenia margaritæ* of Danielssen, 1887, but that appears to be quite different, although it has the same amplexicaul habit, as do many other unrelated species. *Korenia* has a nearly smooth column with a few perforated papillæ, probably raised cinclidæ, and with some similar papillæ on the disk. The margin is crenulated and there are no capitular folds. Its tentacles seem not to be retractile. It has 12 pairs of perfect mesenteries. It probably belongs to the same subfamily.

It may be nearer *Actinia abyssicola* Moseley.

Our species has been taken on the fishing Banks off Nova Scotia many times by the Gloucester, Mass., fishermen. It was dredged by the "Blake" and by the "Albatross" at several stations in 168 to 245 fathoms, nearly always attached to bare portions of the axis of living *Balticina*, sometimes singly, but more often in clusters of three or more, united together by sutures and so large and heavy that the *Balticina* bends over. The *Challenger* specimens of *S. abyssicola* had the same habit and were from the same region.

Hertwig included two species in his genus *Stephanactis*, viz.: first, *S. tuberculata* H.; and second, *S. abyssicola* Moseley, sp. He very fully described the former externally and internally, but owing to the state of the two specimens of the second he did not give much new information, but found that it agreed in most structural characters with the former. But he noted the relative smoothness of the capitulum and the presence of a few cinclidæ.

His *S. tuberculata* had strong capitular ridges or folds, some of them lobate, and a verrucose parapet; the tentacles had swollen bases, and he found a few papilliform cinclidæ. It is, therefore, very like my *S. nexilis* in appearance and structure.

The generic name, *Stephanactis*[1] was, however, used by me many years previously for a very different genus. Therefore, I proposed in 1899 to use *Stephanauge* for the generic name, but I erred in thinking that *S. abyssicola* was the same as *nexilis*, and figured the latter under the name, *S. abyssicola*. The real *abyssicola* may be generically distinct, if the character of the parapet and capitulum are to be considered important in this group.

Stephanauge tuberculata (Hert. sp., op. cit., p. 87, pl. III, figs. 7-7b) was taken in 345 fathoms, Lat. 35° 11′ N.; Long. 139° 28′ East: attached to dead parts of the axis of a *Virgularia*.

Raphactis Verrill.

Raphactis Verrill, Amer. Journ. Science, Vol. VII, p. 144, 1899. Type, *R nitida* Verrill.

Stephanactis (*pars*) Hertwig, op. cit., 1882, (*non* Verrill, 1869).

My genus *Raphactis* (op. cit., 1899, p. 144) is much like *Stephanauge* externally and internally, except that no acontia were found, so that it was formerly

[1] *Stephanactis* Verrill, (Proc. Essex Inst., Vol. VI, p. 89 (38), 1869), was the name given to *S. indica* Ver., of the family Discostomidæ. It was from Gaspar Strait. The type has 12 very muscular perfect mesenteries. The sphincter muscle is endodermal, circumscribed, large, oval in section; column is without verrucæ or suckers noticeable in alcoholic specimens; cortex is strongly wrinkled in both directions.

referred to Paractidæ. Probably its acontia had been lost by strong contraction. In that case it would belong to this subfamily and would come near *Hormathia*, on account of its smooth capitulum and scapus, but it differs from that genus, as at present understood, in lacking a circular row of coronal verrucæ on the parapet.

In these characters it is like the *Actinia abyssicola* Moseley, referred to *Stephanactis* by Hertwig. Both he and Moseley described the parapet as thickened but not verrucose. Hertwig found a few cinclidæ, but no acontia.

Raphactis abyssicola (Moseley) Verrill.

Actinia abyssicola MOSELEY, Trans. Linn. Soc., Ser. 2, Vol. 1, p. 297, Pl. 45, fig. 5, 1877. Andres, op. cit., p. 364.

Stephanactis abyssicola HERTWIG, op. cit., 1882.

Plate XXII; Fig. 7(?)

According to Moseley, in life its colour on the column was reddish yellow, paler on the parapet; capitulum rose-red, with darker radial lines; disk rose-red, tentacles paler red. Height was 5 mm.; greatest breadth, 35 mm. It was taken in lat. 40° 17′ N., south of Nova Soctia, in 1,350 fathoms, in 1873.

It probably should be called *Raphactis abyssicola*, for it agrees well with the type of that genus, in most respects. Perhaps my fig. 7, of pl. XXII, is the same species, from near the same region.

Synanthus mirabilis Verrill.

Synanthus mirabilis VERRILL, Amer. Journ. Science, Vol. XVIII, p. 474, 1879; vol. VII, p. 211, fig. 23, 1899 (*pars*); Bull. Mus. Comp. Zool., vol. xi, p. 48 1883. (Probably not fig. 9, pl. VI).

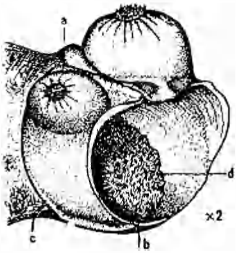


Fig. 15. *Synanthus mirabilis* Verrill. Two individuals surrounding and girdling a branch of *Paragorgia* (c, d,), and united by a suture above and below (a, b,); x about $1\frac{1}{2}$.

This small species has not yet been obtained in a sufficiently good state of preservation for complete anatomical studies by sections; it has about 48 pairs of mesenteries; only six pairs are perfect; sphincter muscle mesoglœal, thick.

It has the amplexicaul habit, common to many other deep sea species. This particular species seems to prefer to attach itself to the smaller branches of *Paragorgia arborea*. It then spreads its base around the branch, the two opposite lobes meeting and uniting by a suture, thus girdling the branch and sometimes causing a deep constriction, at which the branch may easily break off. Frequently two or more unite together, to form the girdle, as in the figure.

The column and basal expanse are smooth, with no epidermal coating; tentacles are numerous, about 96, small and not very slender. Acontia were not observed, but its general habit and internal structure are so much like some of the Sagartiadæ that it probably belongs to that family. It is possibly related to *Raphactis nitida* Verrill or to *R. abyssicola* (Moseley).

This has been found chiefly on large specimens of *Paragorgia* from the Bank fisheries, Such specimens are generally dried, and so the Actinian is spoiled. Specimens on the stalks of dead gorgonians in alcohol, formerly described and figured by me as this species (op. cit., 1883, p. 48, pl. VI, fig. 9) may be a distinct species. Its internal structure was not studied.

Chondractinia Lütken.

Chondractinia Lütken, Vidensk. Meddel. Naturhist. Foren. Kjöbenhavn, p. 184, 1860. (Type *C. digitata* Müll.). Haddon, op. cit. p. 305, 1889. McMurrich, op. cit. p. 187, 1893.

Actinauge (*pars*) Verrill, op. cit., 1883.

Column stout, firm, bearing on the greater part large, permanent, thick verrucæ or tubercles in more or less evident longitudinal rows, and usually more or less covered with an imperfect epidermal coating. Cinclidæ indistinct; submarginal zone softer, flexible, not bearing crests or ribs. Sphincter muscle large, thick, mesoglœal; mesoglœa unusually thick and firm. Six primary pairs of mesenteries strong, sterile. Two large siphonoglyphs. Tentacles stout, without basal lobes.

Chondractinia tuberculosa (Verrill).

Actinauge nodosa var. *tuberculosa* Verrill, Bull. Mus. Comp. Zoology, vol. XI, p. 53, pl. VI, fig. 7, 1883; Annual Report of Comm. of Fish and Fisheries for 1883, p. 612, pl. V, fig. 20a, 1885.

Chondractinia tuberculosa McMurrich, op. cit., 1893, p. 187. Whiteaves, op. cit., p. 38, 1901.

Plate XIX; Fig. 5.

The body in this species is covered with remarkably large (5 to 10 mm. broad), prominent, often hemispherical, firm tubercles, arranged irregularly and not very numerous. The integument is very thick and firm, except on the pink or red capitulum, below the tentacles, where it is softer, slightly longitudinally ridged, or nearly smooth, and probably capable of secreting a phosphorescent mucous, as in *A. verrillii*.

The lower tubercular part is usually covered with an adherent dirty brown or mud-coloured epidermal secretion. When this coating is removed the colour is usually light brown, flesh-colour, or pale red; the tubercles whitish.

The tentacles are numerous, dull red or reddish brown, rather long, usually not bulbous at the base nor much tapered. The sphincter muscle is large and thick.

The mesenteries are regularly hexamerous in the specimens dissected, and very unequal. Six pairs are wide and perfect, and some may bear small gonads near the base. Their longitudinal muscles are not very strongly developed, being scarcely thicker than the plicated transverse ones. Those of the second cycle are nearly as wide as the primaries in the lateral systems. All are muscular and bear large gonads. Much narrower mesenteries of the third and fourth cycles occur in all the systems and bear gonads.

The stomodæum is large and long. It has five deep lateral sulci, and four large intervening wrinkled lobes on each side. Siphonoglyphs are large and deep. No cinclidæ were found.

The description above was made mostly from a medium sized specimen from the Gulf of St. Lawrence, in 112 fathoms (Coll. J. F. Whiteaves). It grows to much larger sizes. Some specimens are about 100 mm. (4 inches) high and 45 to 50 mm. in diameter. In contraction, tubercles are often 5 to 8 mm. in diameter, or more. None of the specimens taken alive would expand.

It is only known from rather deep water. Many specimens have been taken on the fishing Banks off Newfoundland and Nova Scotia by the Gloucester, Mass., fishermen and presented to the U.S. Fish Commission in 1878 to 1881.

The Gloucester, Mass., fishermen brought it in from a number of localities on all the fishing banks, from Georges to the Grand bank, in 30 to 300 fathoms. It is particularly common on the stony bottoms of Le Have bank, Western bank, and Banquereau, off Nova Scotia. It was also dredged by the U.S. Fish Commission off Nova Scotia and in the Gulf of Maine.

I formerly (1883) classed this as a doubtful variety of *A. nodosa*, but it appears to be a distinct species. According to the classification of Haddon (op. cit., 1889) it belongs to *Chondractinia*, for it lacks the ribbed or crested capitulum and the tentacular lobes found in *Actinauge*. It seems to be rather closely related to *C. nodosa* of Greenland, as determined by Haddon; but its verrucæ are larger, fewer, and not in such regular rows. Danielssen's *Actinauge nodosa*, as figured by him, is much more like this species, and belongs to the same genus, for Danielssen states that the capitulum is smooth, without ribs. Very likely it may be the same species.

The original description of *Actinia nodosa*, from deep water off Greenland, was very brief and imperfect. It would apply equally well to any of these large verrucose species. Probably several species occur there, as on our fishing Banks, and very likely he considered them all the same species. As Haddon's specimen came from Greenland, it may be the correct one.

Family **URTICINIDÆ.** New Name.

Bunodidæ Gosse, Ann. and Mag. Nat. Hist., ser. 3, vol. 1, p. 417, 1858; Actin. Brit., p. 183, 1860. Verrill, Revision Polyps, p. 15, 1864.

Tealiadæ R. Hertwig, op. cit., 1882.

Bunodactidæ Verrill, op. cit., 1899.

Cribrinidæ McMurrich, op. cit., 1902, p. 590.

Actinians with a large, circumscribed, endodermal sphincter muscle; numerous (12 or more pairs) of perfect mesenteries, mostly fertile, often sterile, sometimes in part. No acontia. Tentacles retractile. Column usually has adhesive suckers or verrucæ. Many species are viviparous.

Urticina (Ehrenberg, restricted, 1869).

Urticina Ehrenberg, Coral. Roth. Meeres, p. 33 (as sub-gemus), 1834. Type, *U. crassicornis*.

Rhodactinia L. Agassiz, Revue Zoolog. Soc. Cuvier, p. 394, 1847. Verrill, Revision Polyps E. Coast U.S., p. 18, 1864. Carlgren, Olga Exped. Actin., p. 79, 1902. Clubb, Antarctic Exped., Vol. IV, p. 9, 1908.

Tealia Gosse, op. cit., p. 417, 1858; Actinologia Brit., p. 205, 1860. Also of many other later authors.

Urticina (emended, type assigned) VERRILL, Trans. Conn. Acad. Science, vol. I, p. 469, 1869; Comm. Essex Inst., Vol. VI, p. 62 (28), 1869.

Actinians, often of large size, with numerous large retractile tentacles, usually perforate at tip. Column furnished with longitudinal rows of small retractile suckers capable of attaching foreign objects, but usually small and inconspicuous when contracted or not in use, or they may appear nearly obsolete. A feeble parapet.

Sphincter muscle very large, endodermal, circumscribed or cordiform. Perfect and imperfect mesenteries numerous; nearly all of the perfect ones, except the directives, may bear gonads, as well as many of those that are imperfect; those of the first and second cycles often sterile. The type species may be hexamerous, octamerous, or decamerous, most frequently decamerous. Neither acontia nor cinclidæ. Circular muscles of the tentacles may be partly ectodermal and extend into the mesoglœa or they may be entirely mesoglœal. Type species is viviparous.

Urticina crassicornis, (Müll.) Ehr.

Actinia spectabilis ? O. FABRICIUS, Fauna Gronlandica, p. 351, 1780.

Rhodactinia davisii AG., op. cit., 1847. VERRILL, Mem. Boston, Soc. N. Hist., Vol. I, p. 18, pl. 1, fig. 9 (descriptions, variations in colours, etc.), 1864; Amer. Naturalist, Vol. II, p. 259 (habits).

Tealia crassicornis (MÜLLER, 1776). GOSSE, Actinologia Brit., p. 209, pl. IV, fig. 1, (coloured). ANDRES, op. cit., p. 199, fig. 24, 1884. PARKER, Amer. Nat., XXXIV, p. 752, fig. 9, 1900. HARGITT, Anthozoa Woods Hole Region, p. 244, figs. 3, 4 (sections), 1914.

Urticina crassicornis EHRENBERG, 1834, p. 33. VERRILL, Trans. Conn. Acad. Science, Vol. I, p. 469, 1869; Comm. Essex Inst., Vol. VI, p. 62, 1867; Howgate Polar Exped., p. 152; also of many later articles; Amer. Journ. Science, Vol. VII, p. 216, 217, fig. 32 (hexamerous), 1899.

Rhodactinia crassicornis (*pars*) CARLGREN, Olga Exped., Actin., p. 39, 1909. CLUBB, (*pars*) Nat. Antarctic Exped., vol. IV, p. 9, pl. iii, fig. 22 (photograph of English specimen), 1902.

Urticina felina MCMURRICH, Trans. Royal Soc. of Canada, vol. IV, section 4, pl. 1 (general fig. coloured); pl. ii, figs. 2-4, (sections); pl. iii, fig. 5, (section), 1910, (not *A. felina* of Linnæus).

Plate XIX; Fig. 4. Plate XX; Fig. 13. Both from life. Plate XXVI; Fig. 7. Plate XXXI; Fig. 5.

This when well grown is a very large, stout, and bright coloured species, with a great number of large, thick tentacles, usually banded with red and white. In large specimens there may be 150 or more.

The exterior of the column usually has many longitudinal rows of rather distant, very small, imperforate suckers, which are capable of attaching foreign objects, though more frequently, when in still or deep waters, none are carried. These suckers are seldom conspicuous and when not in use are often so retracted as to be hardly noticeable, especially in specimens from rather deep water, thus contrasting with the species of *Tealiopsis*, in which they are conspicuous and persistent. The column wall is very soft, flexible, and changeable in form.

The tentacles can be entirely retracted and the capitulum and column margin rolled inward over the disk. The form, therefore, is very variable in specimens more or less contracted. In full expansion the height usually exceeds the diameter of the body, which may be cylindric, or swollen in the middle, or distally, etc

The colours, also, are very variable. The body-wall is usually more or less red, varying from pale red or pink to bright red, crimson, and dark red, often streaked or blotched with lighter and darker red, or in the case of littoral specimens, with blotches of dull olive green or dark red on a brownish red ground-colour. McMurrich (op. cit., 1910, Pl. 1) has well figured this littoral colour-variety. More rarely the body-wall is flesh-colour or pale pink, or even yellowish-white. The disk is nearly always lighter-coloured, and marked by conspicuous double lines of bright red or crimson radiating from the mouth to the bases of the tentacles, which they enclose, as in fig. 13 of Plate XX. These markings are very characteristic of the species and are seldom lacking. The tentacles are nearly always annulated with bands of red and white, or they are red with one or two bands of white.

The specimen figured on Pl. XX, fig. 13, from life, had the body bright cherry-red, blotched with paler red, and with pale red suckers; disk flesh-colour with crimson radiating lines and deep red lips; tentacles bright red with a median band of white and a white or pink tip, and a V-shaped lavender or pale lilac-coloured mark near the inner base, running down to the base as a narrow line.

The specimen figured on Pl. XIX, fig. 4, from life, was flesh-colour, streaked with a very light red, and the tentacles were very pale red, with a subterminal band of white, but the red radial lines of the disk were distinct. This example was over 6 inches (150 mm.) across the expanded tentacles.

The sphincter muscle is very large, roundish, and cord-like, or well circumscribed, often appearing oval, reniform, or subcordate in a cross section, (Pl. XXVI, fig. 7) with the radiating lines of muscle fibres very numerous, fine, and dichotomously branched. The proximal ones are arranged pinnately; the distal ones in a palmate manner.

The mesenteries of the first three cycles may all be perfect and many of them may be fertile, though those of the first two cycles are often sterile. The perfect mesenteries have a longitudinal muscle, on the inner half, with branching supports, but becoming very thin on the outer half. The mesenteries of the fourth and fifth cycles are imperfect and mostly fertile. Prof. McMurrich (op. cit., 1910, pp. 65, 66, Pl. ii and iii), has well described and figured the sphincter muscle and mesenteries. Hargitt (op. cit., 1914, figs. 3, 4) has also figured them.

The form of the sphincter muscle, as seen in cross sections, varies a great deal, largely due to the various states of contraction and modes of preservation, but also according to the age.

The arrangement of the mesenteries, which are very numerous in large examples, as well as of the tentacles, is most often strictly decamerous, but hexamerous and octamerous specimens are not uncommon. Two well developed siphongylphs and two pairs of directive mesenteries are usually well developed. Numerous pairs of perfect mesenteries of about three cycles are present and like most of the imperfect ones may bear gonads, except the directives. Large specimens may have five cycles, the fifth cycle often incomplete.

Eggs are retained in the body-cavity until they develop into well formed red young, with two or more cycles of tentacles.

This species is circumpolar, extending down on the Eastern American coast to Nantucket Shoals, Block Island and Watch Hill, R.I., and Fishers Island sound. It has been found off Alaska and British Columbia on the west coast, and perhaps in Puget sound. On the European side it reaches England and perhaps the Mediterranean as *U. coriacea.*[1] It was taken in Bering strait and the adjacent Arctic Ocean in considerable numbers by the North Pacific Exploring Expedition (1852-56), as recorded by me in 1867.

[1] According to Carlgren (1902), this form is a distinct species. More verrucose, etc.

John Murdoch, 1885, p. 162, reported from the region of Point Barrow, *Urticina crassicornis* and *Phellia arctica* Ver. (?), now *Pseudophellia arctica* Verrill. The former was described as orange red splashed in stripes with crimson. It was washed ashore in a gale in 1882, and was said to be plenty on the fishing grounds in 10 to 15 fathoms. A few were dredged off Point Franklin in 13½ fathoms. It is mainly a rather shallow water species. The greatest depth in which it was taken off the Atlantic coast, by the U. S. Fish Commission steamer "Albatross" was 141 fathoms. Not common below 50 fathoms. It is abundant between tides and in shallow water and often of large size on the shores of the Bay of Fundy in the cracks and crevices of ledges and also fully exposed. It is also common there in 10 to 20 fathoms. The specimens from off Watch Hill, R. I., and Fishers Island sound were taken in shallow water in 1873 and 1874, by me. The type of *R. davisii* was from Nantucket shoals, south of Cape Cod.

Some, at least, of the specimens from Puget sound, referred to this species by McMurrich (1901), seem to me to belong to a distinct species, having a firmer texture, more numerous and more prominent verrucæ; a bright red body; tentacles usually not annulated; and the disk often without red radial lines. See below under *U. columbiana*.

U. crassicornis, the type, is, however, the only species clearly determined, up to this time, as belonging to this genus, unless *U. coriacea* (Cuv.) is distinct, as claimed by many writers. A closely related species, described as the same, occurs in the Antarctic waters.

Brandt (Prodromus Descr. Anim. a Mertensio, p. 13, 1835) described in few words, from drawings made by Mertens, his specimens having been lost,[1] two species, one or both of which were perhaps colour varieties of this species. Both were from Alaska.

His *A. laurentii* had the body red, blotched irregularly with green and brown; tentacles vermillion; Bering straits. This was pretty certainly *U. crassicornis*, littoral form.

The colours described are essentially like those of some specimens taken at low tide at Easport, Maine, by me many years ago. (See Revision Polyps E. Coast, 1864, pp. 18, 19). But clear red tentacles seldom occur on specimens on our coast. No good notes on the living actinians of Alaska have been published in later years. McMurrich (op. cit., 1901, p. 31) refers to a coloured drawing by Alexander Agassiz, of a specimen referred to this species, which was coloured like the littoral form. He stated that the column was grass green, irregularly blotched with deep red; tentacles pinkish, with a dark red band a short distance above the base. No suckers were represented. Locality of the specimen was not given. Mr. Agassiz collected mostly in the Gulf of Georgia, while employed on the U.S. Coast Survey, about 1860.

Actinia elegantissima Brandt was described as having the body pustulous, greenish red or spotted with red or purple; tentacles of moderate size, dilated, white in the middle, purple at the end.

McMurrich has referred this to his *Cribrina elegantissma*, which he had from Puget Sound (op. cit., 1901, p. 18, Pl. i, fig. 7; Pl. ii, figs. 8-14), which is a *Tealiopsis* or former *Bunodes*. He may be correct, but the latter has not been obtained from Alaska in recent years, so far as I know, while *Evactis artemisia*, which is also a green verrucose species, is common there. Brandt's species may possibly have been the latter, but may have been the littoral colour variety of *U. crassicornis*, in which the colour is greenish mottled with red or brown. This form could hardly be called pustulous, though it often has rows of small papilliform suckers.

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[1] Prof. Louis Agassiz told me, many years ago, that Merten's collections were lost in a shipwreck.

Prof. McMurrich, op. cit., 1910, has erred, I believe, in adopting the specific name *felina*, as from Linnæus, for this species. It certainly is not his species, if his five-word description (1767) be taken into account.

It has no "*glande muricata*;" nor are the words "*striata laevis*" applicable to this species. His reference to Baster's figures should not be taken very seriously for he was often very loose in his references to the figures of earlier writers in various groups of animals, and at that time very few recognizable figures of actiniæ existed. Linnæus himself had only the slightest and most superficial knowledge of actinians and applied to the few that he did mention obscene or indecent names. Many writers, for the past hundred years, have rejected the names he gave to his Actiniæ on account of their indecency, in addition to the impossibility of deciding just what he did try to describe.

European writers have not agreed as to what species Linnæus had in view. Although some have identified his *A. felina* with the present species, others have referred it to *M. dianthus* (e.g. Bruguiere, 1789). The name and description by Linnæus apply far better to a gephyrean worm, with a muricate proboscis (armed with hooks) than to any actinian. His names should be forgotten. He, himself, rejected his earlier generic name, *Priapus*, (1761) apparently on account of its too conspicuous indecency.[1]

Urticina columbiana. New species.

Urticina crassicornis (*pars*) McMurrich, op. cit., 1901, pp. 28-34, pl. 1, fig. 6.

Plate XXIX; Figs. 1, 2. From life.

This large red species, often over four inches in diameter and height, occurs in Puget sound and in Port Townsend bay, etc. It has large and long tentacles. It appears to be closely allied to the preceding species, but is, I believe, specifically distinct. I have three good coloured drawings of it, made from living Port Townsend specimens by Mr. J. G. Swan. Although I have formerly seen large alcoholic specimens of it, and also drawings, I have made no recent dissections.[2]

The body-wall in the type figured is clear bright orange-red, and the very numerous conspicuous, raised, verruciform suckers are light yellow. They form many regular vertical rows and are much more notable, larger, and more persistent than those of *U. crassicornis.* The texture of the wall is rather thicker and firmer, and in partial contraction it usually forms many strong concentric wrinkles or "ruffles," on which the suckers, standing in rows, "look like bead-work."

The tentacles are long, thick, tapered, often subacute, and the larger ones are often more than one and a half inches (30 to 38 mm.) long. They are translucent, pale flesh-colour, or yellowish, without bands, but the 12 inner ones are red at the inner base. In the drawing there are about 72, but the number may be up to 200 or more. The disk has a broad bright red band near the tentacles, with small rays running from it part way to the mouth; oral region light yellow; lips pink.

It lacks the pairs of radiating red or purplish lines usually conspicuous in *U. crassicornis*, and the type lacks bands on the tentacles. The base is deep

[1] Under that genus (ed. X) he included both gephyrean worms and actinians. Personally I believe that his original *P. felina* was a muricate or armed gephyrean, to which his otherwise obscure description would apply, as well as its resemblance to a cat's penis, indicated by the name *P. felina*. No other explanation can account for the use of such a name, nor for his use of "*glande muricata*."

[2] In 1861, just before the Civil War, I prepared a report on the Anthozoa collected by the parties on the Northwest Boundary Survey. Several specimens of this large species were in the collection. They were dredged in Puget Sound. During the war that report and the illustrations and collections were lost, like many other things in Washington.

red beneath. The type, as figured from life, was 6 inches (150 mm.) across the tentacles in expansion; diameter of body, when contracted, about 4 inches (100 mm.)

The largest specimens that I have seen, considerably larger than the one described, came from the collections of the U.S. Northwest Boundary Survey. They were dredged in Puget Sound. The type described and figured was from Port Townsend bay, in 30 fathoms.

Professor McMurrich (op. cit., 1901, pp. 28-34, Pl. 1, fig. 6) has described similar specimens, in alcohol, from Puget sound, and he referred them to *U. crassicornis*, finding them, as to anatomical characters, like the latter. But I think he did not fully appreciate their different appearance in life. It often has happened that no apparent differences in internal anatomy can be found for distinguishing species that are perfectly distinct, in various other classes of animals, as well as among actinians, (e.g. species of *Sagartia* among Actinaria). Therefore most of his specimens, if not all, may have been of this species, especially the variety that was found living buried in sand. But it is possible that the true *U. crassicornis* may also occur in Puget sound, as well as in Alaskan waters.

McMurrich stated that some of his specimens had bands on the tentacles. The column of his arenicolous variety was bright red, "like a tomato baked in bread crumbs," and had sand attached to the suckers. Prof. McMurrich examined my drawings, now described (see his note, op. cit., p. 31) and noted the colours, etc. and stated that they represented a specimen "evidently the same as the arenicolous variety" described by him.

The exposed specimens that he described were either uniform red or orange-brown. He found much variation in the number and size of the suckers, owing to different states of contraction, but in nearly all the cases described they were evidently more numerous and more notable than in our Atlantic *U. crassicornis*.

He found considerable variations in the form and structure of the sphincter muscle. His specimens were decamerous with irregularities in the fifth and sixth cycles. He found from 81 to 104 pairs of mesenteries.

The notable variations in the form of the sphincter muscle, partly due to variable contraction, are such as to preclude the use of this feature as a reliable means for distinguishing allied species in this group. Among the Puget sound specimens McMurrich found the lamellæ of the sphincter usually arranged in a palmate manner, but in one case in a pinnate form (see his fig. 6, Pl. I). In this the form of the section was obovate, being one-third longer than broad. In east coast *crassicornis* it is often broader than long.

He found the longitudinal muscles of the tentacles entirely mesoglœal, and the mesenteries of the first and second cycles were sterile in the specimens examined.

Having studied many hundreds of living specimens of *U. crassicornis*, coming from numerous localities and various depths, I have never seen any from the Atlantic coast, having a similar colour pattern, or the same abundance and prominence of the papilliform suckers. Therefore I believe it should be considered a distinct species, even if the sphincter muscle and mesenteries are much alike. It is obvious that the form and size of those muscles must vary greatly according to the amount of contraction. They have also been found to vary even in different examples of a species from the same locality and preserved in the same way.

With our present knowledge, it appears that some of the internal organs are about as variable as the external colour, etc. At any rate it is unsafe to rely entirely on sections of alcoholic specimens, variously contracted, for the separation of allied species of a genus, or for uniting them. Living specimens must be consulted, as well as internal structure, to determine the real status of actinians.

U. crassicornis, under the name of *Rhodactinia crassicornis*, has been recorded from the Antarctic by J. A. Clubb (National Antarctic Exped., Nat. History, Vol. IV, Cœlenterata, p. 9, 1908).

As in other cases, the external characters of the living specimens are not known. Therefore I consider the identification as extremely doubtful. *U. crassicornis*, so far as known, is not a deep sea species, and on our coast it has not been found much south of Long Island, in the extensive series of dredgings made all along the U.S. coast and in the West Indies by the "Blake," "Alabatross," and various other vessels.

Therefore, I would propose to call the Antarctic species *Urticina antarctica*. As for the genus *Rhodactinia*, it is a plain synonym of *Tealia* Gosse. But the latter is a synonym of *Urticina* Ehr., 1834.

Rhodactinia had no definite status in nomenclature until I personally described it in 1864. Agassiz merely used the name without any description, and without reference to any described species. He spoke of it merely as a large red actinian. There are several other large red actinians from the same vicinity. I personally knew it only from having seen the original specimen. It was not a large one. It was certainly *U. crassicornis*, as now known.

I definitely restricted *Urticina* Ehr. to this type in 1864, and named *A. crassicornis*[1] (Müll.) as the type species. It was the first of the species referred to that group by Ehrenberg, and it also agrees with his diagnostic description. He did not quote Rapp's figure to illustrate it, but said that Rapp had confused two species.

Various species formerly referred to *Urticina* by me and others, when their internal structure was unknown, have since been found to belong to other genera. Of the East American species some belong to *Actinauge*, viz.: *nodosa* = *rugosa* Ver. and *A. longcornis*; *nexilis* to *Stephanauge*. See above.

My *U. perdix*, a very large, handsome, variegated, deep water species, is a *Paractis*, subgenus *Archactis* Verrill, 1899.

U. consors Verrill (1882), which is a large handsome, light red, or flesh-coloured, deep-sea species, living as a commensal on the back of a hermit-crab, is a *Sagartia* (*S. consors*). It has acontia and scattered cinclidæ; its mesenteries are regularly hexamerous in four cycles; six pairs are perfect and sterile. See figure in Bull. Mus. Comp. Zool., Vol. XI, p. 49, Pl. VIII, fig. 4, 1885.

The sphincter muscle is mesoglœal, strong, and divided into two portions; the upper is elliptical or fusiform in section. Mesenterial muscles are thin; two pairs of directives are attached to downward extensions or siphonoglyphs at the base of the stomodæum. Mesoglœa is firm; ectoderm is thin, soft, and easily destroyed in preserved specimens. Cinclidæ are mostly above the middle and hard to see.

U. callosa Verrill is a large, firm, sub-coriaceous, red or orange-coloured, somewhat verrucose species, from deep water, with very many short tentacles. It was made the type of the new genus, *Actinostola* Ver., in 1882, in the family *Paractidæ*. According to McMurrich, who examined the type, the genus *Dysactis* of Hertwig, 1882, is identical with *Actinostola* (op. cit., 1901, p. 209). The name *Dysactis* was used by me in 1864, for a very different genus. Therefore *Actinostola* must be used.

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[1] Andres has referred Ehrenberg's species to *A. equina* Linn., but that opinion seems to me unsound. Ehrenberg quoted *A. crassicornis* Gmelin and Lamarck, with doubt, as synonyms, and he described *equina* (as *mesembryanthemum*) on another page (p. 36) from personal observation. His *crassicornis* was, perhaps, *U. coriacea* (Cuv.). He gives its size as half a foot, tentacles short and thick. McMurrich has suggested *papillosa* Ehr. as the type (=*crassicornis*). This, he thinks, might avoid any doubt.

Tealiopsis Danielssen.

Tealiopsis DANIELSSEN, op. cit., pp. 45-47, 1890. Type, *T. polaris* Dan.

Bunodes GOSSE, Trans. Linn. Soc., XXI, p. 274, 1855, (not of DANIELSSEN, 1890, nor of HERTWIG); name is preoccupied by *Bunodes* EICHWALD, 1853, for a fossil.

Bunodactis and *Bunodella* VERRILL, Amer. Journ. Science, vol. VII, pp. 42, 43, Jan., 1899.

Cribrina MCMURRICH, op. cit., 1893; and 1901, p. 17, (not of EHRENBERG, 1834, nor of HADDON, 1890).

Column wall is muscular and flexible, furnished with longitudinal rows of true, permanent, verruciform suckers, to which foreign bodies may adhere; the rows may not reach the base, distal ones are usually largest; tentacles large, numerous, retractile, commonly with a terminal pore. Walls generally, if not always, imperforate. No acontia. Sphincter muscle large, circumscribed or cordiform, endodermal. Perfect mesenteries usually in 12 to 48 pairs, often variable in the same species.

Siphonoglyphs usually two, sometimes one or three or more, with corresponding pairs of directive mesenteries.[1]

All or most of the perfect mesenteries, except the directives, may bear gonads; also most of the imperfect ones.

The following species and others are viviparous. The genus *Tealiopsis* Dan.[2] is apparently equivalent to the typical *Bunodes* of Gosse and later writers, and to *Bunodactis* Verrill. As *Bunodes* is clearly preoccupied, it must be dropped. *Tealiopsis* is the next in order of priority and should be used. The type (*T. polaris* Dan.) is well described and illustrated. It is regularly verrucose and has 18 perfect mesenteries (See his Pl. 1, figs. 7, 8; Pl. VIII, figs. 2, 3). It resembles *T. stella*, but is more strongly verrucose, the lines of verrucæ reaching the base. Danielssen states that the walls are imperforate and acontia are lacking, and that the musculature of the column wall is endodermal.

Tealiopsis will receive numerous species. Among those that seem to belong here are *T. verrucosa* (Penn.); *T. balli* (Cocks); *T. thallia* Gosse; *T. rigidus* (And.); *T. sabelloides* (And.); (all of Europe); *T. inornata* Ver., Hong Kong; *T, japonica* Ver.; *T. pluvia* (Drayton in Dana); *T. stelloides,* West Indies; *T. manni* Ver., Hawaiian Is.; *T. elegantissima* (McMurrich, as *Cribrina*), Puget Sound; *T. bunodiformis* (Hertwig.); *T. octoradiata* (Carlgren) and *T. hermaphroditica* (Carlgren) as *Bunodes*, Antarctic. See also Clubb, op. cit., 1908, Pl. III, for figures.

Prof. McMurrich (op. cit., 1901, 1902) has used the name *Cribrina* (ex Ehrenberg, 1834) for this genus. I explained as early as 1864, that *Cribrina* Ehr. is essentially a synonym of *Cereus* Oken, 1915. The more typical species were the same in each. Ehrenberg did not fully describe his genus, but gave a Latin diagnosis[3] and applied to it the vernacular name, "Sieb-anemone" (Sieve-anemone), which is merely a translation of *Cribrina*, clearly referring to the

[1] See Dixon, G. Y. and A. F. on the variations found in *Bunodes thallia* and *B. verrucosa*. Proc. Royal Dublin Society, N. Ser., vol. VI, pp. 310-326, Plates IV, V, 1889.

[2] Carlgren (1902), according to McMurrich (1910, p. 78) has identified Danielssen's type with *Stomphia coccinea*=*S. carneola* Ver. This cannot be correct, for the latter is a perfectly smooth species, with no verrucæ, and its circular muscles are mesoglœal. It belongs to Paratidæ. If Carlgren made an examination of the supposed type, labels must have been interchanged, Danielssen's figures are good.

His general figure from life shows conspicuous rows of verruciform suckers as large as in *T. stella*, and his figures of sections of the wall also show verrucæ. He described the verrucæ and described the circular muscles as endodermal, as also shown in his sections. His type seems closely related to *T. stella*. See below and Plate XXX, fig. 1 for our *Stomphia carneola*.

[3] His diagnosis is as follows; "Poris lateralibus instructa (latere respirantia, tentaculis non perforatis)" op. cit., p. 40.

perforations in the body-wall, now called cinclidæ, characteristic of the family *Sagartiadæ*. He placed in the genus 10 species. At least 7 of these belong to the *Sagartiadæ*. The three that he had personally studied were *C. effœta* and *C. polypus*, now in *Calliactis; C. palliata*, now the type of *Adamsia*. Others were *plumosa*, the type of *Metridium* Oken; and *bellis*, the type of *Cereus* Oken. *C. filiformis* (Rapp) is a Sagartian; *C. diaphana* (Rapp) is an *Aiptasia*, of the same family.

The affinities of the three others are different: *coriacea* (=*crassicornis?*) belongs to *Urticina*, in which it was included on a previous page (p. 337) by him. Two other species, *verrucosa* and *glandulosa*, have been referred to *Bunodes*, but he described both of them as having vertical rows of pores. He evidently mistook the suckers, as figured, for pores. Of the *verrucosa*, his first species, he stated that no good figure existed. It is a typical *Bunodes* or *Tealiopsis* without pores. Yet McMurrich makes it the type of *Cribrina*, the "sieve-anemones," presumably because it was the first in the list of species, thus utterly ignoring Ehrenberg's diagnosis. But Ehrenberg did not always put his more typical species first, but rather in the middle of his lists. At any rate it is absurd to take for the type of a genus a species that is the opposite of what the author intended and described, and one that evidently had a place erroneously in his list only because of bad figures.

The only real generic character that he indicated is the perforated wall. Every species that he included either has perforations or else the figures, then available, led him to describe them as perforated. However, *Cereus* of Oken, 1815, was based on the same feature and included some of the same species. Therefore *Cribrina* should properly be regarded as its synonym. Were it to be revived at all, it should displace *Adamsia* or *Calliactis*, for those were the forms that he had personally studied and correctly described. Moreover, he had already put *papillosa* and other verrucose species under *Urticina* on a previous page, stating that the papillæ are imperorate.

He also put *crassicornis* in *Urticina* (first species), and that has imperforate papillæ or suckers, and may be identical with *coriacea*, which he placed in *Cribrina*, misled by figures, as in the case of *verrucosa*. Thus, to use one of these erroneous species as the type of *Cribrina*, as McMurrich has done, would make *Cribrina* a synonym of his *Urticina*.

Such a result shows the absurdity of entirely shifting the intentions and meaning of the author as to his genus *Cribrina*. If used at all it should be used only for perforate species of the family Sagartiadæ.[1]

The species that Danielssen referred to *Bunodes* had acontia and verrucose walls, with an endodermal sphincter muscle. It should be referred to a different genus and also to a different family. Perhaps it should go in *Madoniactidæ* (Dan.), if that family is to be kept separate from Sagartiadæ. That family has acontia, an endodermal sphincter muscle, and verrucose or sucker-bearing walls, according to Danielssen.

The type genus, *Madoniactis*, he states has six sterile perfect mesenteries. By extending the family to include genera with 12 or more perfect mesenteries it might include all the genera having acontia and an endodermal sphincter, and often verrucose walls, thus resembling typical *Bunodes* or *Tealiopsis* externally, when the cinclidæ are not easily to be seen, and still more closely resembling *Actinauge* and allied genera. These differ in having the sphincter mesoglœal.

Hertwig's *Bunodes* was a *Chitonactis*, one of the Sagartiadæ of the subfamily Chondractininæ, and his family Bunodidæ is a synonym of Sagartiadæ.

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[1] See also Haddon, op. cit., 1889, pp. 323, 324, who has independently expressed the same views.

Tealiopsis stella Verrill.

Bunodes stella VERRILL, Revision Polyps E. Coast U.S., Mem. Boston Soc., Nat. Hist., vol. I, p. 16, Plate I, figs. 1-8 (old and young), 1864; Amer. Naturalist, vol. II, p. 258. PARKER, Synopsis, Amer. Naturalist, Vol. XXXIV, p. 752, fig. 10 (after VERRILL).

Bunodactis stella Verrill, Amer. Journ. Science, Vol. VII, p. 42, Jan., 1899.

Cribrina stella MCMURRICH, Trans. Royal Soc. of Canada, IV, sect. 4, p. 76, Pl. III, figs. 6, 7, 1910 (sections). WHITEAVES, Catal. Marine Invert. E. Canada, p. 39, 1901 (after McMurrich).

Bunodes spectabilis VERRILL, Howgate Polar Exped., Bulletin U.S. Nat. Mus. No. 15, p. 152 (*non* Fabricus, 1780).

Plate XX; Figs. 4-12. Plate XXVI; Figs. 1-6. Plate XXXI; Fig. 3.

This species, when well grown, has about 120 rather long and large, smooth tentacles, in about four or five cycles; ordinary medium sized specimens have about 72, when about 25mm. in diameter. The body-wall is covered, except near the base, with many longitudinal rows of prominent, adhesive, verruciform suckers, with longitudinal sulcations between the rows (Pl. XXVI, figs. 6, 6a). Most of these suckers in preserved specimens are transversely elliptical, with a central cavity and a raised crenulated margin. They vary in size and elevation in adjacent rows, and are often so crowded as to be nearly in contact, but are separated by wrinkles. The marginal suckers or verrucæ are generally larger than the others and often swollen. While in the sea, fragments of débris or grains of sand are usually held by the suckers, but in aquaria they are generally soon discarded.

The colour of the column is generally translucent olive-green, varying to flesh-colour and to darker green. The disk is usually a lighter shade of the same colours, and almost always has six conspicuous radial lines of opaque white, each line running to one of the inner primary tentacles; the lines running from the two siphonoglyphs are the widest; the others are sometimes faint or lacking; similar lines sometimes go to the tentacles of the second cycle. The tentacles are generally of the same colour as the column, but paler and more translucent; they often have a crescent-shaped spot of opaque white on the adoral side of the base, and a band of the same near the middle, and sometimes another between these, but the latter may be lacking on the two inner cycles of tentacles. Inside of lips usually light orange.

Large specimens in expansion may be 50 mm. high and about 30-40 mm. in diameter of body.

This, like many allied species, is viviparous. The young in various stages of growth are to be found in considerable numbers in the body-cavity, below the stomodæum, between the mesenteries, and sometimes in the tentacles and stomodæum. When extruded they vary in size, but most are about 2—3 mm. in diameter and have from 12 to 24 tentacles and then are well formed; some are larger, up to 3—4 mm. with as many as 36 tentacles, and when of that size often have the radial white markings on the disk. (See Pl. XX, figs. 8-11.)

The larger specimens from Hudson Bay, 1920, contained eggs and well developed young, some of which I have figured, and also an egg (fig 8a).

The larger specimens may have five cycles of mesenteries, with more or less of the sixth cycle. Those of the fourth and fifth cycles are fertile. Two or more cycles of mesentries are perfect, with rather thin but wide longitudinal muscles on the inner part. Pl. XXXI, fig 3. Muscles of the tentacles are ectodermal. The sphincter is large, well circumscribed or cordiform, short ovate or nearly round in section, with the lamellæ fine, much branched and palmately arranged. (See Pl. XXVI, figs. 1, 2.)

Colonies of this species are sometimes found in large numbers, occupying the cracks and crevices of ledges covered with algæ at low tides, as at Eastport, Maine, and Grand Manan island. In other places it occurs in sheltered tide pools, buried to its tentacles in sand, as at Cape Elizabeth, Maine, where it was first found; or sometimes under stones.

The specimens from Hudson bay, taken in 1920 by F. Johansen, were found in shallow water, buried in sand. All the adults contained young. They comprised one specimen from a small island between Long island and Cape Jones, August 31, and two specimens from the bay outside Richmond gulf, August 19.

I have examined many large specimens received from Cumberland gulf, Penny harbour and Gravel beach, head of gulf, June 1, 1878, from the Howgate Expedition to Baffin Island. It is a very local species on the northern coasts of New England and the Bay of Fundy, but it seems to be common in arctic waters. It has never been taken by us in deep water. It is essentially a littoral and shallow water species.

Professor McMurrich (1910) described young specimens from Passamaquoddy bay, N.B., and gave figures of the sphincter muscle and a perfect mesentery. The latter has a wide but not very thick longitudinal muscle on the inner half. His figure of the sphincter is not very different from my own figures from a Hudson bay specimen. (See Pl. XXVI, figs. 1, 2.).

One Hudson bay specimen had a large amphipod crustacean in its stomach. Another had a long, slender nematode parasite, about 25 mm. long, halfway through the basal membrane.

Evactis Verrill.

Evactis VERRILL, Trans. Conn. Acad. Science, Vol. I, part 2, p. 471, 1869. Type, *E. artemisia*.

Cribrina (pars) MCMURRICH, op. cit., 1901, p. 17 (not of Ehrenberg).

Urticinidæ having ectacmeous tentacles and the column wall perforated by pores, capable of ejecting water, and bearing rows of notable verruciform suckers. Internal structure similar to that of *Tealiopsis*.

McMurrich (op. cit., 1901) united this genus to *Tealiopsis* (as *Cribrina*) because he failed to find lateral pores in his badly contracted specimens. The evidence that such pores exist and are of use seems conclusive. (See below.)

Were we compelled to unite the two genera, the name *Evactis* would have to be adopted for the whole, for it has priority over any other available name. That course, however, seems to me to be entirely unwarranted.

Evactis artemisia (Drayton) Verrill.

Actinia artemisia DRAYTON, in Dana, Report U.S. Expl. Exped., Zoophytes, p. 149, Atlas, Pl. IV, fig. 38, 1846.

Evactis artemisia VERRILL, op. cit., 1869, p. 471.

Cribrina artemisia MCMURRICH, op. cit., 1901, p. 23, Pl. II, figs. 15, 16; Pl. III, figs. 18–20 (structure). TORREY, op. cit., 1902, p. 390.

This species was originally described from Discovery harbour, Puget sound, where it was said to be abundant living buried in sand. The specimens seen by me, 1861, were also from Puget sound, as were those described and figured with structural details by McMurrich. Torrey records it from Sitka, Yakutat, Popof island and Dutch harbour, Alaska, abundant.

The type specimens were figured as fully expanded. They were yellowish green with dark sap-green suckers, fading out below. Tentacles variable in colour; disk greenish, darker near tentacles; lips flesh colour. Diameter, in expansion, 2·25 inches.

McMurrich quotes Prof. Calkin's notes on the colour. He says the column was greenish yellow above, and yellowish white lower down; tentacles with scarlet or purple tips. The type had the outer tentacles one inch long; inner ones 0·5 inch. It ejected water from small lateral pores "as from a watering pot." McMurrich failed to find any pores in his strongly contracted specimens, but that was not strange, they are often hard to find in alcoholic Sagartiadæ.

Prof. W. K. Fisher has told me that specimens, kept by him in an aquarium, did eject strong currents of water from the sides when disturbed, as when he was cleaning off the mucous, secreted abundantly by them.

The existence of lateral pores and the ectacmerous condition of the tentacles, very unusual in this family, certainly warrant the retention of the genus *Evactis*.

Epigonactis Verrill.

Epigonactis VERRILL, Amer. Journ. of Science, Vol. VII, p. 378, May, 1899. Type, *E. fecunda* VERRILL.

Two large and remarkable species of this genus have been brought in from the fishing Banks, by the Gloucester, Mass., fishermen. Neither of them has been seen in the expanded condition and their colours are unknown. Both carry numerous eggs and young embedded in deep pits on the upper part of the column.

They were described and figured by me in the American Journ. of Science, vol. VII, pp. 376-380, figs. 35, 36, 1899.

In internal structure they are similar to *Urticina*, and doubtless belong to the family *Urticinidæ*. Capitulum, above the thick collar, is smooth, but sulcated in contraction.

They seem to be nearest related to *Pseudophellia*, which carries the eggs and young in the same way, but they do not have the firm epidermal coating present in that genus. The sphincter muscle is largely circumscribed; perfect mesenteries are numerous and fertile, up to 24 pairs or more. Tentacles are stout and numerous.

Epigonactis fecunda Verrill, (op. cit., p. 378, fig. 35) came from the Banks off Nova Scotia, in 15 to 200 fathoms.

E. regularis Verrill, (op. cit., p. 380, fig. 36), came from the Newfoundland banks, in deep water.

Pseudophellia Verrill.

Pseudophellia VERRILL, Amer. Journ. Science, vol. VII, p. 377, 1899. Type, *P. arctica* Ver.

Column, except the capitulum, is covered with a firm epidermal coating; toward the middle it has transverse rows of sunken pits containing eggs or young. Capitulum smooth. Tentacles of moderate size and not very numerous. Sphincter muscle is endodermal and circumscribed. Perfect mesenteries numerous.

Pseudophellia arctica Verrill.

Verrill, Amer. Journal Science, vol. VII, p. 377, fig, 34, type, 1899.

Phellia arctica Verrill, Proc. Essex Inst., Vol. V, p. 328, 1869; Trans. Conn. Acad., Vol. I, p. 490, 1869. Murdoch, op. cit., 1885, p. 162.

Plate XXXI; Fig. 2.

This species is one of the few actinians that carry the eggs and young attached to the exterior of the body until they develop. The greater part of the column is covered with a thick epidermal coating, as in *Phellia*, but it is easily removed. No verrucæ nor pores were seen. Sphincter muscle is large, ovate in section. Perfect mesenteries in 24 pairs; their muscles are thick. It was taken north of Bering strait in 30 fathoms (N. Pacific Expl. Exped.) It is, apparently, allied to *Epiactis*. The *Phellia arctica?* recorded by Murdoch was a rough thick species covered with sand. It was taken in $2\frac{1}{2}$ to 5 fathoms on the Arctic coast of Alaska. Another specimen, perhaps not the same species, was white and translucent. As the internal structure was not examined in either case the identifications are doubtful.

Family **BOLOCERIDÆ** McMurrich.

Large actinians having numerous stout tentacles which are not retractile, but usually readily cast off. Column usually smooth, secreting mucous abundantly. No cinclidæ nor acontia; usually no suckers nor verrucæ. Mesenteries regularly hexamerous; many pairs fertile and perfect. Sphincter muscle relatively small, endodermal, mostly diffuse.

Bolocera Gosse, 1860.

Type, *Bolocera tuediæ* (Johnst.) Gosse.

Carlgren has separated the following species from *B. tuediæ*, with which it had long been united. No doubt they are closely allied, but our American specimens appear to have much longer and more numerous tentacles than the typical *B. tuediæ*.

Bolocera longicornis Carlgren.

Bolocera tuediæ Verrill, Amer. Journ. Sci., V, pp. 5, 14, 1873; VI, p. 440; VII, 1874, pp. 413, 500; Vol. XXIII, p. 315, 1882 (distribution); Bull. Mus. Comp. Zool., XI, 1883, p. 59, (not of Gosse). Whiteaves, List. Invert., p. 41, 1901. Verrill, op. cit., 1885, pp. 514, 534.

Bolocera longicornis Carlgren, Ofversigt af Vetenskaps-Akad. Forhandlingar, No. 8, pp. 241-250, 1891. McMurrich, op. cit., 1894, p. 155.

Plate XXIII; Fig. 1.

This is a large species easily distinguished by its smooth, lubricous, stout, usually cylindric, orange or red body, and by the very large, non-retractile tentacles, easily cast off. It often expands to 150 to 200 mm. (6 to 8 inches) across the tentacles. The longer tentacles are often 50 to 75 mm. (2 to 3 inches) in length, and 10 to 12 mm. in diameter. The body is ordinarily 50 to 75 mm. (2 to 3 inches) in diameter and height, often higher than broad when expanded.

The longer inner tentacles are large and long and usually swollen toward the base, tapering to the obtuse tip. They are soft and lubricous, with fine longitudinal striations, due to muscular fibers; at the base they have a strong circular muscle capable of detaching them by contraction.

They are in about three or four submarginal rows. The inner are much larger than the outer ones.

The colour of the disk is deep orange-red, finely radiated with darker lines, which are often indistinct, but sometimes very conspicuous. Margin of mouth is thickened and has numerous folds, usually brighter red than the disk, often rose or red-lead colour, but sometimes the same as the disk. At each end there is a large siphonoglyph formed by two conspicuous thick folds with a deep sulcus between them. These are usually bright red or rose-colour, varying to purple, and brighter than the lips, both within the stomodæum, and at the edges. Tentacles usually about the same colour as the disk, but marked longitudinally with lines, which are alternately highly coloured and more or less translucent, but without any transverse bands. The outer ones are smaller and often paler and the tips are usually pale and have a terminal pore.

The column is usually unicoloured and of the same colour as the disk, but mostly paler; most frequently deep salmon, orange, or orange-red, generally smooth, and usually having a faintly vermiculate appearance due to contraction. One specimen had the disk and tentacles bright rose-red, with bright blood-red lips, the siphonoglyph purplish red, the body deep salmon, becoming orange toward the base and rosy toward the summit. In this the body in partial contraction was broad urn-shaped; transversely and longitudinally wrinkled, with a conspicuous fold below the tentacles, on which as well as below. the surface was raised between the intersecting grooves.

Some specimens had the body yellowish white or pale salmon and the outer tentacles the same colour, or even translucent white with opaque white lines, but the inner tentacles and disk deep rose-red in one and orange-red in another; in the former the border of the mouth was dark brown, the siphonoglyphs salmon; in the other the border was pale lemon-yellow with rosy angles. Another specimen had a bright orange body and outer tentacles, but the inner tentacles and disk dark brown; the border of the mouth bright orange-red.

When detached, which often happens, the tentacles retain their plumpness and fusiform shape, and are capable of contracting and expanding, so as to change their forms for some time, so that they resemble entire living worms or holothurians.

These detached tentacles have powerful nematocysts and are capable of stinging the human hands painfully, especially when the skin is softened by overhauling the wet contents of the dredges. They were often very plentiful in the deep water dredged materials and gave some of us much trouble by their stinging. They are often about as long and as large as a man's smaller fingers and usually light red or pink in colour, with paler striations and a soft lubricous surface. They have a basal circular muscle that closes the aperture where they break off, but the opening in the disk remains open for some time. It is not uncommon to find dredged specimens from which all or part of the tentacles have broken away, leaving open pores in the disk. We often dredged large numbers of loose tentacles with no corresponding bodies.

Hertwig's genus *Liponema* (Voy. Challenger, VI, p. 158) was based on a *Bolocera* from which all the tentacles had broken off, according to McMurrich, who has examined the type. (See Proc. U. S. Nat. Mus., XVI, p. 209, 1894).

This species is abundant and widely distributed off the U. S. Coast, especially on more or less muddy bottoms in rather deep water. Its known range is from the fishing Banks off Nova Scotia to deep water off Cape Fear, N.C. In depth it ranges from 37 to 1,106 fathoms, but it is not common in less than 100 fathoms.

Carlgren records it from off the Scandinavian coasts in 40 to 80 fathoms.

Five large specimens were also dredged by the "Blake" at Stations 303, 309, 310, in 304 and 260 fathoms, off southern New England.

It was dredged at a large number of localities by the U.S. Fish Commission parties from 1872 to 1887, in the deeper parts of the Bay of Fundy, in 50 to 109 fathoms; off Nova Scotia, in 50 to 100 fathoms; Gulf of Maine, in 50 to 150 fathoms; off Casco bay, in 40 to 90 fathoms; Massachusetts bay, in 40 to 52 fathoms; off Cape Cod, in 37 to 90 fathoms. Off Martha's Vineyard, on the Gulf Stream slope, it has been dredged, often in abundance and of large sizes, at many localities, in 160 to 500 fathoms, and sparingly in 65 to 100 fathoms, in 1880 to 1887.

A few specimens have been brought from the fishing Banks, off Nova Scotia, by the Gloucester, Mass., fishermen.

A closely related species (*B. kerguelensis*) has been described by Studer from the Antarctic ocean, off Kerguelen island; and another, *B. occidua*, by McMurrich from the Pacific.

Parasites and Commensals.

We often found in the stomach of this species, a very remarkable parasitic lernean crustacean (*Antheacheres dubenii* Sars). It is soft and usually pink in colour, or like its host. The sexes differ much in form and both are often living in the same stomach.

We also occasionally found a large commensal orange coloured scaly annelid (*Polynoe aurantiaca* Verrill) living among the long tentacles and agreeing with them in colour. (See Verrill, op. cit., 1885, p. 514, pl. XXXVI, figs. 167, 168; pl. XL, fig. 175.)

Eubolocera. New genus.

Type, *Bolocera multicornis* Verrill, 1879.

I propose to establish a new genus for this remarkable species, on account of its short, broad form, with a multitude of mesenteries and tentacles, the tentacles almost covering the very wide disk, and standing crowded in about 20 rows in the large specimens. The sphincter muscle is similar to that of *Bolocera*.

The disk and tentacles are not retractile. The muscles of the mesenteries are thin and feeble.

Eubolocera multicornis Verrill. New name.

Bolocera multicornis Verrill, Proc. U.S. Nat. Mus., p. 198, Nov., 1879; Explorations made by Albatross in 1883, Annual Report Comm. Fish and Fisheries, for 1883, p. 536, [14] 1885.

Plate XXIII; Figure 2.

Eubolocera multicornis is a large, bright red species, or about red-lead colour, with over 200 crowded tentacles, which are of moderate length, 14-18 mm. long, or about equal to one-fifth the diameter of the disk. The tentacles are of about the same colour as the column and not banded. The very broad disk of the type is convex and about 3·75 inches (194 mm.) in diameter; total height at centre is 30 to 33 mm. The column is very short and thick, much narrower than the disk, when in full expansion.

It was first known from off Cape Cod, on "Clarks Ledge," near Georges bank, in 45 fathoms, later elsewhere off Cape Cod, in 33 to 90 fathoms, in 1881 and 1882. It doubtless lives also on the other more northern fishing Banks, in rocky places. *B. brevicornis* McMurrich, from the Pacific, seems to be a similar species.

Family PARACTIDÆ Hertwig (emended).

Actinians destitute of acontia and cinclidæ. Tentacles numerous. Sphincter muscle is mesoglœal, either thick or diffuse. Usually more than one cycle of perfect mesenteries, up to three or four or more cycles; all or nearly all may be fertile. Imperfect mesenteries usually numerous, up to the sixth cycle in some adults, and mostly fertile.

No acrorhagi nor pseudobranchiæ. Column usually smooth or wrinkled, but without real verrucæ or notable suckers, though small suckers may occur. Aboral disk adherent; it may be large or much reduced. In some deep sea genera the tentacles are not retractile.

Stomphia Gosse.

Stomphia Gosse, Annals Nat. Hist. Ser. 3, Vol. III, p. 48, 1859; Actin. Brit., p. 221, 1860. Carlgren, op. cit., 1892. Verrill, Amer. Journ. Science, Ser. 4, Vol. VII, 1899. McMurrich, op. cit., 1910, p. 77.

Column soft, smooth, without verrucæ or suckers, very changeable in form, thin in sections. Basal disk, thin, broad in expansion, but can contract to small size. Disk may be flat, concave, or convex, very mutable. Tentacles numerous, moderately stout, retractile. Two siphonoglyphs; labial lobes numerous, small. Mesenteries thin, numerous, 12 to 24 pairs or more perfect and mostly fertile; longitudinal muscles feeble.

Gosse (op. cit., 1860, p. 225) states that the sexes, in the types, are separate and that the gonads of the male are salmon-color, while those of the female are brilliant scarlet, in "grape-like clusters." He also records the discharge of "globular ova of the size of mustard seed and of a rich scarlet hue" (p. 223). This is of interest, because *Urticina crassicornis* is viviparous, discharging well developed young ones, often with two or more cycles of tentacles.

According to McMurrich (1910) Carlgren has united to this smooth species, the strongly verrucose *Tealiopsis polaris* Dan. and also *Sagartia repens* Dan., and others. Danielssen described *S. repens* as having acontia.

Neither species, as figured from life, looks like *Stomphia carneola*.

Stomphia carneola (Stimpson) Verrill.

Actinia carneola Stimpson, Invert. Grand Manan, p. 7, 1852.

Actinia nitida (provisional name) J. W. Dawson, Canadian Naturalist, 1858.

Rhodactinia davisii (pars) Verrill, op. cit., 1864, pp. 19, 20.

Stomphia churchiæ Gosse, op. cit., 1859; Actin. Brit., p. 22, pl. VIII, fig. 5, 1860. Andres, op. cit., 1884, p. 369. Carlgren, Kongl. Svenska Vet. Akad. Handl., vol. XXV, 2, p. 80, Pl. 1, VIII, IX, X, 1892 (anatomy).

Stomphia carneola Verrill, op. cit., 1899, pp. 206-208, figs. 24-24d (description, structure, synonymy, etc.)

Stomphia coccinea (pars) Carlgren, op. cit., 1902. Probably not *A. coccinea* Müller, 1776. McMurrich, op. cit., 1910, p. 77.

Plate XXX; Fig. 1.

The general characters of this species are stated above in the generic description. As indicated it is very protean in form in confinement. Although normally cylindrical, rather higher than broad, it may become more elongated or extremely short; it may be hour-glass shaped, or become much swollen, as in Pl. XXX, fig. 1, with the basal disk appearing relatively small. The disk, also, is protean in form, changing from concave to convex. Tentacles are rather stout in full expansion, but may be rather long and tapered, numerous, up to 96 or more in good size specimens. The region of the sphincter muscle sometimes shows a slight thickening.

The colour is also variable. Large specimens usually have the column translucent pink or flesh-colour or pale greenish, with paler mesenterial stripes showing, but it may also be mottled or streaked irregularly with pale red, rose-red, or scarlet, but the capitulum, just below the margin, is generally paler, without red mottlings, but this area is often poorly defined.

The tentacles are often translucent pale flesh-colour or pink, with two or more, often three, bands of carmine or light rose-red, the distal one at the tip. The basal band usually extends around the sides of the tentacles and often extends inward as a partial radial line on the disk. The disk is coloured similarly to the column; it often has a circle of light red or rose-red spots, or a continuous ring of red or scarlet around the mouth, and another circle of red spots farther out towards the tentacles.

Nearly always there are two small flake-white spots in front of each tentacle of the inner circle, more noticeable in the young, in which the other colours are paler and the texture more translucent. The two siphonoglyphs are usually bright red or scarlet; inside of mouth is pink or salmon-colour. The sphincter muscle in the larger specimens is well defined in sections with an ovate or clavate outline, varying in form according to the amount of contraction and the age.

It often grows to rather large sizes. Some examples had the column in expansion over 2 inches (50mm) high and nearly as broad; others were considerably larger. More commonly it is about half that size; tentacles about 10-16mm long.

This handsome species often closely resembles *Urticina crassicornis* in its colours, especially when young, and it is very often confounded with the latter, when they occur together, as they often do in the bay of Fundy and the sheltered bays near Eastport, Maine. It seldom has the notable red radial lines on the disk and running out between the tentacles generally, but not always, characteristic of *U. crassicornis*.

The best way to distinguish it is to make a transverse section of the sphincter muscle, which is mesoglœal instead of being large, circumscribed endodermal, as in *Urticina*.

It never has small suckers, usually more or less evident on *Urticina*, nor any verrucæ, characteristic of *Tealiopsis*. (See above, p. 110 G, note). It is destitute of acontia and cinclidæ, which distinguishes it from all the Sagartiadæ.

McMurrich (1910), following Carlgren, adopts for this species the name *Stomphia coccinea* (Müller, 1776). I fail to see any good evidence that the *A. coccinea* of Müller was this species. Gosse and others have referred it to *Sargartia coccinea*, with more reason, I believe.

This is essentially a rather shallow water species, and seldom littoral. It occurred frequently in my many dredgings, from 1860 to 1872, in the bay of Fundy, Eastport harbour, Maine, South bay, etc., in 8 to 35 fathoms. It did not occur in the later deep dredgings of the U. S. Fish Commission. It has not been found South of Cape Cod.

Dawson dredged it in the mouth of the St. Lawrence. McMurrich records it from Passamaquoddy bay, young, (1910). It generally occurs on gravelly or stony bottoms, attached to stones and dead shells. It seems to be rather rare on the northern European coasts. Gosse records several examples from Moray Firth, Loch Long, etc., all brought up on the lines or nets of fishermen. There are no reliable Arctic records known to me.

Family **HALCAMPIDÆ** Andres, 1884.

Ilyanthidæ (pars). Many authors.

Column usually narrow and much elongated, generally without a definite basal disk or with a very small one; most often the base is pointed, with or without a central pore Tentacles usually few (8—24); most frequently 12. Mesenteries few, hexamerous; most often only 6 or 12 pairs; all may be perfect and fertile; those of the second cycle may be imperfect; sometimes the mesenteries exceed the number of tentacles. Sphincter muscle feeble, diffuse, or lacking. Mesenteries usually have a strong, often narrow or circumscribed, longitudinal muscle. A conchula may be either well developed or lacking.

Sub-family **HALCAMPINÆ** Verrill. New name.

Halcampidæ which lack a conchula and apparently a pore at the aboral end of the body. Scapus sulcated, it may be naked or it may be covered with a loosely attached epidermal coating consisting mainly of mucous, fine sand, etc. Tentacles usually 12, sometimes 10, 14, 20, or 24; mesenteries 12 to 24; 12 usually perfect and fertile. Longitudinal mesenterial muscle strong, restricted.

Genus **Halcampa** Gosse.

Peachia (pars) Gosse, Trans. Linn. Soc., XXI, p. 271, 1855.

Halcampa Gosse, Ann. and Mag. of Nat. Hist., 3rd series, i, p. 418, 1858; Actinologia Brit., p. 246, 1860. Andres, op. cit., p. 100, 1884.

Column very contractile, much elongated and slender in expansion, occupying holes in the earth or among rocks, etc., but able to creep about, adhering by the sides.; in contraction irregularly cylindrical, often with constrictions; column-wall membranous throughout, translucent, with or without adherent sand, etc. Base capable of being enlarged and greatly distended, without a distinct disk, but capable of adhering slightly by its surface to foreign bodies by very minute sucker-like organs; apparently imperforate. Tentacles 12, rarely 10, short, in two cycles. Perfect mesenteries, usually 12. They are very thin next the wall, but near the middle have a very strong, longitudinal, muscular thickening, which narrows both above and below. The peripheral pores of the mesenteries are large and well defined; six pairs are imperfect.

Halcampa duodecimcirrata (Sars).

Edwardsia duodecimcirrata M. Sars, Nyt. Mag. Nat. Hist., VI, n. 10, p. 142, 1851. Mobius and Meyer, Weig. Arch. f. Naturges., Jahr. 29, b. 1, p. 70, pl. III, figs. A, D, 1863.

Edwardsia farinacea (pars) Verrill, Amer. Journ. Sci., Vol. VII, pl. VIII, fig. 5, 1874 (not fig. 4, nor the text).

Halcampa farinacea (pars) Andres, op. cit., 1884, p. 102.

Plate XXI; Figures 1, 2, 2a.

Column changeable in form, often nearly cylindrical, at other times swollen in the middle or posteriorly, capable of contracting to less than half its full length. Column is usually covered with scattered, feebly adherent, fine grains of sand and small foraminifera when first caught, but it soon discards these when in an aquarium.

The following descriptions are from living specimens taken in the Bay of Fundy, in 60 fathoms, on a soft muddy bottom, in 1872. Tentacles 12, rather short, blunt, about half as long as the diameter of the column. Alternately a little longer and shorter.

Length, in expansion, 25 to 30 mm; diameter, 4-5mm; length in contraction, 10 to 12 mm.

Column usually cylindric, pale salmon colour, varying to yellowish brown, coated thinly with minute grains of sand and foraminifera, except near the ends. The disk usually protrudes; near the lips there is a circle of small purplish brown spots and another circle of the same colour near the bases of the tentacles, the two connected by brown radial lines. These spots are long-oval, their pointed end outward. Each tentacle has a spot of reddish brown on each side of its base, and has about six wavy or crescent shaped transverse spots of reddish or pale brown, alternating with white or flesh-colour. The six alternate shorter tentacles are a little darker than the others, due to the darker brown spots. The brown markings often run down to a point or become V-shaped on the inner side of the bases of the tentacles.

Column below the tentacles clear salmon-colour, with pale purplish brown double spots alternating with the tentacle bases. On the shorter dark tentacles the brown transverse markings often run together on the outer side forming a median brown spot.

One small specimen from the same place has a median line of brown spots on the tentacles interrupted by flake-white spots; lips whitish, surrounded by 12 brown spots, midway between the mouth and tentacles, and with another circle of brown spots near the bases of the tentacles.

Another specimen from the Bay of Fundy, off Head harbour, Grand Manan island, in 50 to 60 fathoms, was 38 mm long, 5 to 6 mm in diameter. Like the preceding, it was covered in the middle with fine sand that it soon entirely cast off, leaving the whole surface clean, smooth and translucent, showing the insertions of the mesenteries as white lines bordered with purple; general colour of the column pale salmon. Tentacles salmon-colour, crossed by about five wavy bands of purplish brown; most of these surround the tentacles and run down into a V-shaped or W-shaped mark on the inner surface; the basal band is darkest. The mouth has 12 white labial lobes; a circle of small purplish spots, alternating with white, surrounds the mouth; another circle of triangular purplish spots is situated farther out; at the inner bases of the tentacles there is another circle of lighter purplish brown spots. Below the outer bases of the tentacles there is a circle of 12 purple spots, divided by white lines; the alternate spots run down as purplish lines alongside the mesenterial white lines.

This specimen agrees closely with one figured on Plate XXI, fig. 1.

This species was dredged by us in many localities in the Bay of Fundy; Eastport harbour; South bay, near Eastport, Maine, 1864-1872, and in Casco bay, 1873.

It occurred only sparingly, usually only one at a time, in 6 to 90 fathoms, on sand or mud bottoms.

Variety **nitida**. New variety.

Plate XXI; Figures, 2, 2a.

Tentacles 10, short, thick, obtuse, usually about half as long as the diameter of the disk, or somewhat longer in full expansion.

The column is cylindrical and has a thin loosely attached coating of fine sand grains on the middle portion; both ends without sand, soft and smooth, translucent, with ten longitudinal white lines, due to the mesenteries; on the capitulum there are ten stripes of dull brown, alternately lighter and darker, corresponding with the tentacle bases; these stripes are specked with flake white irregular spots, becoming more evident near the tentacle bases.

The tentacles have a pair of lateral brown spots on their outer bases, forming a conspicuous circle of 20 brown spots; their tips are translucent; on the inner surface there are about 5 wavy brown bands and spots, some of them extending around back of the tentacles; they alternate with transverse lines of yellow or white; the basal band is the darkest and often V-shaped or M-shaped.

The mouth has 10 brownish labial lobes; the disk is pale yellow, with 10 radial rows of pale brown spots, running to the tentacles, separated by pale or white mesenterial lines. Length about 1 inch (25mm); diameter of column about 3 mm. Described from living specimens.

Type locality, off No Man's Land, in 19 fathoms, Sept. 2nd, 1871, U. S. Fish Commission.

Halcampa (?) **anomala.** New form.

Plate XXXI; Fig. 4.

This form, which must be abnormal, is remarkable for having an unusual number and arrangement of the tentacles.

It has 14 normal shaped tentacles, about equal in length, and 3 smaller ones, each united to one of the larger ones as if it were partially split off from it, or had arisen as a bud from its side. One of the larger tentacles stands nearer the mouth than the others. The larger tentacles are thick, mostly obtuse, rather longer than half the diameter of the disk as seen in the living specimen, and probably not fully expanded. They are crossed by about 7 more or less curved or waved reddish brown markings or bands, alternating with bands of yellowish white.

The disk is ornamented with circles of reddish brown spots alternating with those of yellowish white. Two lateral white spots at the base of each tentacle run down on the capitulum. Column is pale flesh-colour. Length, in expansion, 44 mm; diameter about 6 mm. Internal structure was not examined. On account of its similar colouration it is referred with doubt to this genus, though it has an abnormal number of tentacles. Described from a living specimen.

A single specimen was taken in Massachusetts bay, off Race point; Station 292, 19 fathoms, fine sand and mud, by the U. S. Fish Comm. in 1879.

The branched form of some of the tentacles is doubtless abnormal.

Halcampa farinacea (Verrill) Andres.

Edwardsia farinacea VERRILL, Amer. Journ. Science, vol. XLII, p. 118, 1869; Ann. and Mag. Nat. Hist., Ser. 4, vol. IV, p. 163, 1869; Proc. Amer. Assoc. Adv. Sci., for 1873, pp. 353, 368, pl. VI, fig. 1; Amer. Journ, Sci., Vol. VII, p. 413, Pl. VIII, fig. 4, 1874 (not fig. 5).

Halcampa farinacea (*pars*) ANDRES, op. cit., 1884, p. 102 (references incorrect.)

Plate XXI; Fig. 3.

Column changeable in form, not very slender, often swollen in the middle or near the base, tapering upward, but sometimes swollen near the tentacles, partly covered with small, firmly adherent grains of sand, the internal lamellæ showing through faintly, but becoming more distinct on the naked, transparent, swollen basal portion, which is marked by 12 corresponding whitish sulcations, meeting at the end and alternating with some finer lines. Upper part of column is transparent and naked for about 3 or 4 mm.

Tentacles 12, rather short, in a single circle at the margin of the disk, not crowded, pale yellowish white, sprinkled with fine flake-white specks which become more crowded on the inner median line and at the tips. Disk small, often protruded; mouth largely dilatable, sometimes elevated on a cone; lips with 12 irregular lobes. Disk and naked space below the tentacles pale yellowish white, finely speckled with flake-white, the disk with faint whitish radiating lines. Length, 12-15 mm; diameter, 4-5 mm; of disk, 3-4 mm. The type locality was South bay, near Lubec, Maine, in 8 fathoms, mud, 1872. It was subsequently taken by us in various places in the Bay of Fundy and Casco bay, in 10 to 95 fathoms.

The fig. 5, as of the disk, pl. VIII, Am. J. Sci., 1874, is not this species. It belongs to *H. duodecimcirrata.* Andres united the two species and erred in his references.

Sub-family **SIPHONACTININÆ** Verrill. New name.

Family *Siphonactinidæ* Andres, 1884, (emended).

Halcampidæ having one siphonoglyph prolonged into a lobed conchula, capable of being protruded. Posterior end usually provided with a pore. Tentacles usually 12, rarely 8 or 10. Six pairs of perfect strongly muscular mesenteries; often four or more pairs of narrow, imperfect, fertile ones.

Some of the species are parasitic on jelly-fishes, at least while young; others burrow in the earth.

Siphonactinia Dan. and Koren.

Siphonactinia Danielssen and Kören, Fauna Litt. Norvegiæ, ii, p. 88, pl. 12, figs. 4-6, 1856; Annals and Mag. Natural History, Ser. 2, vol. XVIII, p. 219, pl., 1856.

Bicidium L. Agassiz, Proc. Boston Soc. N. Hist., VII, p. 24, 1859. Verrill, Revision of the Polyps of the Eastern Coast of the United States, Memoirs of Boston Soc. of Nat. Hist., Vol. I, p. 31, Pl. 1, figs. 14, 15, 1865.

?Peachia (*pars*) Gosse, Actinologia Brit., p. 243, 1860 (not of 1855). Verrill (*pars*), op. cit., 1866, 1873.

Philomedusa (*pars*) Andres, op. cit., p. 112, 1884; (? not of Müller, 1860).

Bicidium McMurrich, Proceedings Zool. Soc., London, II, p. 967, 1913.

Column naked, soft, elongated, in life very changeable in form, often cylindric, or tapering to the aboral end, where there is no disk, but a central contractile pore, often tightly closed in contraction. Both ends are capable of invection. In expansion the oral end is usually the larger. Tentacles 8 or 12, usually 12. Mesenteries usually 12, all perfect, with thick longitudinal muscles. Circular muscles of the column are mesoglœal, moderately developed, somewhat stronger near each end; sphincter little or not at all differentiated.

Usually there is only one siphonoglyph, which may become tubular by union of its edges, ending in a simple three-lobed conchula, capable of protrusion. Surface of column capable of adhesion by means of minute suckers, usually not visible to the naked eye unless in use.

The genus *Siphonactinia* Dan. and Kören, 1856, appears to be identical with *Bicidium* Agassiz, 1859. Its conchula is terminated by three simple lobes, as in the latter. It is represented as much exsert and tubular, but I have seen the conchula of *Bicidium parasiticum* exsert to nearly the same extent, and the edges of its siphonoglyph can cohere, making a tubular form.

Andres makes it identical with *Peachia* Gosse, 1855, but *P. hastata*, the typical species of *Peachia*, has 10 pairs of mesenteries and a more complex conchula.

Philomedusa Müll. (1860, p. 57, Pl. 2, fig. 1) is now believed to be the parasitic larval form of a Mediterranean *Halcampella*, according to Haddon. But if identical with *Bicidium*, as Andres supposed, the latter name and also *Siphonactinia* are both earlier names.

The larvæ of a species of European *Halcampa* (*H. chrysanthellum*) are also parasitic on jelly fishes (t. Haddon). A closely related species (*H. farinacea* Ver.) is common on our coast and its larval form should be looked for on our hydromedusæ.

Siphonactinia parasitica (Ag.). New name.

Bicidium parasiticum L. Agassiz, op. cit., p. 24, 1859. Verrill, op. cit., p. 31, pl. 1, figs. 14, 15, 1864. Hargitt, Anthozoa Woods Hole Region, p. 239, fig. 2, 1914. McMurrich, op. cit., p. 967, pl. 98, fig. 8, 1913.

Peachia parasitica Verrill, Proc. Boston, Soc. Nat. Hist., Vol. X, p. 338, 1866; Invert. of Vineyard Sound, p. 739, (445), 1873. Haddon, Proc. Royal Dublin Soc., 1887, p. 475.

Philomedusa parasitica Andres, Le Attinie, p. 112, figs. 9, 9b, after Verrill, 1884.

Plate XX; Figures 2, 3. Plate XXV; Figure 3 (section).

The following description was made from living specimens parasitic on *Cyanea arctica* in Eastport harbour, Maine, where it was abundant.

Body variable in form and size. In full extension elongated, up to 80 mm long and 12 to 14 mm. in diameter; the same specimens in contraction usually tapering to the base. In contraction usually elliptical or ovate, often swollen toward the basal end; sometimes nearly spherical; no basal disk; aboral end often involuted; true pore seldom visible.

The visible pore may often be due to a temporary deep infolding of the integument at the center, owing to the contractile movements of the mesenterial muscles and the circular muscles near it, even when the real pore is tightly closed by its sphincter muscle.

The column-wall is soft, and it has 12 sulcations corresponding to the mesenteries, visible through the wall; intervals between the sulci are convex, crossed by many transverse wrinkles, and toward the base each has a longitudinal row of six to eight minute paler or thin spots, simulating pores, but probably serving as suckers, not always visible to the naked eye.

The tentacles, in expansion, are about 12 mm. long, thick, often swollen at the base; tips have a terminal pore, often rather conspicuous. Perhaps microscopic suckers are present, for the sides of the body are adhesive to the sides of an aquarium, etc.

The mouth, when contracted, is often nearly regular, with nine equal lobes or folds, and three others, obtusely rounded, standing a little farther back at one end of the mouth forming a conchula in connection with the deep siphonoglyph. But the mouth and lips take various forms, according to the state of contraction. The conchula can be much protruded at times. It adheres to the jelly-fish partly by means of the mouth-lobes.

The color of the body varies from uniform light flesh-colour to light brown, greenish brown, or liver-brown. Sometimes the darker brown specimens have pale flesh-coloured tentacles, with brown tips, a narrow light brown band on the distal third, and a diffuse spot of the same colour at each side of the base. Inside of lips whitish; lips flesh-colour; disk paler with white radial lines running out between the tentacles, due to insertions of the mesenteries.

When well expanded in life, the conchula is often much exserted, sometimes nearly as long as the tentacles. It has three nearly equal, rounded, thick lobes, a simple median and a similar but shorter lateral one on each side, with a deep groove between them (Pl. XX, fig. 3). Sometimes the two adjacent lip-lobes, which are less prominent, seem to reinforce the conchula and are then larger than the other lip-lobes, but similar in form. Mouth and lips very changeable.

This species is not uncommon on *Cyanea arctica*, from Cape Cod to Nova Scotia, in summer. It is uncertain whether its adult form is yet known.

The following generic description applies to the specimens that I formerly considered the adult state, but the conchula is so different that it may well be entirely distinct. Moreover, it has 10 pairs of mesenteries. At any rate no intermediate stages have been found during the past 47 years, so far as I know.

Prof. McMurrich has described a closely allied species from Puget sound, near Vancouver island, under the name *Bicidium æquoreæ*, parasitic on a species of *Æquorea*. He found no aboral pore in the contracted specimen, and no conchula, but his figure of the labial lobes is much like those of the same parts in some alcoholic specimens of our species. No doubt it belongs to the same genus. It had twelve perfect mesenteries. I believe it should be called *Siphonactinia æquoreæ*, in spite of the reduced conchula.

Bicidiopsis. New genus.

Form and general appearance much as in *Siphonactinia* and *Peachia*. In life very changeable in form, contracting and expanding its body actively, especially when burrowing.

The column-wall is soft and naked, but provided with circular muscles, more aboundant towards the ends, both of which are capable of involution. The column-wall usually shows 10 or 20 sulcations due to the insertion of the mesenteries; in contraction it is much wrinkled. Tentacles usually 12, sometimes 8 or 18, of moderate length, rather stout, about equal, nearly in one circle. Mouth large, with large labial lobes. One deep and often tubular siphonoglyph, capable of extension and bearing the conchula. The conchula consists of three thick basal lobes, each surmounted by one or two small papilliform or nipple-shaped processes; often there are five of these, one median and two pairs lateral; but there may be only one lateral pair.

The sphincter muscle is mesoglœal and but little dilated, even in much contracted specimens.

The mesenteries are 20, in 10 pairs; 6 pairs are perfect, with thick longitudinal muscles, recurved in the distal part; 4 pairs are small and imperfect, though some may unite with the stomodæum near its bottom; some or all may extend to the aboral end; others to about the mid-length of the stomodæum. The pairs of imperfect muscles are in the sulcar exocœles and sulco-lateral exocœles, as in *Peachia hastata*, as figured by Haddon (op. cit., 1889, p. 338, fig. 1). Viewed from the inside the 12 perfect mesenteries, and sometimes the others, reach nearly to the centre of the base, which is occupied by a small, roundish, central pore, or in contraction by a thick area of muscular tissues closing it. Toward the aboral end of the column there are some very small and nearly transparent spots, as viewed from the inside, which may be small suckers or else minute pores closed by contraction; they are in rows, but not numerous.

This genus seems closely related to *Peachia* Gosse, especially to *P. triphylla,* which has a three-lobed conchula. But that was not the typical species. The earlier described species, *L. hastata,* must be taken as the type of *Peachia.* That species has a far more complicated conchula, but its mesenteries are arranged in essentially the same way, though the longitudinal mesenterial muscles are very different in form, being recurved, much wider and not so thick, and pinnate instead of reniform or crescent shaped as in our species.

Both have two cycles of mesenteries, those of the second cycle being undeveloped in the sulcular lateral exocœles, so that there are but 10 pairs of mesenteries in each genus. But the arrangement is strictly hexamerous. The failure to develop two pairs of mesenteries of the second cycle does not change the regular hexamerous condition of the six primary perfect pairs.

The only external character for the separation of *Bicidiopsis* from *Peachia* that can now be relied upon is the great difference in the conchula.

In *P. hastata* the conchula is described and figured by Gosse (Actin. Britanica) as very large, consisting of two large rounded lobes, bearing 12 to 20 processes, more or less divided, and therefore very different from that of our species. He states positively that it has a basal pore, as in our species.

McMurrich failed to find a terminal pore in preserved specimens that he described under the name *Peachia quinquecapitata,* from Nanoose bay, Vancouver Island, in 15 to 25 fathoms (op. cit., 1913). Probably the pore was tightly closed in his specimens. His species belongs to *Bicidiopsis,* as here defined.

Andres described a species, evidently of this genus, under the name *Siphonactinia tricapitata,* but having only three papilliform processes on the conchula. One of his specimens had 18 tentacles; the other two had 12 tentacles each. He did not describe its internal structure but gave a good coloured figure. It closely resembles *B. tubicola* in form and colour. It should be called *Bicidiopsis tricapitata.*

I have separated this genus from *Siphonactinia* on account of the presence of 20 mesenteries, instead of 12; and because of the more elaborate conchula, which carries a group of papilliform lobules, not found in that genus.

Bicidiopsis tubicola. New species.

Plate XX; Figure 1.

The following description was made from two living specimens taken by me in the harbour of Eastport, Maine, at low water mark of a very low tide, burrowing in sand and gravel, up to the tentacles.

The body of the larger specimen in partial expansion was nearly cylindrical, about three times longer than broad, obtusely rounded and perforated at the base, without a basal disk. The body-walls are salmon-colour and somewhat translucent, allowing the mesenteries to show through as whitish lines. The intervals between these lines are swollen and transversely corrugated by wrinkles; posteriorly the surface appears somewhat reticulated by wrinkles, enclosing polygonal areas. No suckers are ordinarily visible, but the creature can adhere to the side of a glass dish by the surface of the body, indicating the presence of minute or retractile suckers; minute round pits, which may be contracted suckers, are often visible with a lens on the preserved specimens.

Tentacles twelve, large, stout, tapering, but usually obtusely pointed. Their colour is pale salmon, brown at the inner base, and crossed by four bands of light brown. The disk is small, brownish around the mouth, outside of this it has a circle of pale salmon, and is then brownish at the bases of the tentacles. The mouth is salmon-colour inside. It is furnished with a large, prominent, often exsert, three-lobed conchula at one end, connected with a deep siphonoglyph. The lateral lobes are swollen and each is terminated by two small dark brown papillæ. A median or terminal process is longest, often reaching to the middle of the tentacles, or beyond, when expanded in life.

The larger specimen, as studied in life, and not fully extended, was about 75 mm. (or 3 inches) long and 25 mm. in diameter; tentacles about 10 mm. long; 3 mm. in diameter. The other specimen was about two thirds as large, 40 mm. long and 18 mm. in diameter. When first found they were considerably longer. Taken August 26, 1870, buried in holes in gravel and sand, under large stones, at low tide, a little south of Dog island, Eastport, Maine. This was before the harbour became polluted by the offal from many sardine factories built there in later years, which has now destroyed most of the rich fauna originally found there, even under the wharves, where the extreme tides were about 28 feet.

This species was for many years thought by me to be possibly the adult free stage of the parasitic *Bicidium parasiticum*, and the description was not published for that reason, hoping that additional free specimens might be found. This has not happened during nearly fifty years, so far as I know, until similar specimens were found in Hudson bay by Mr. F. Johansen in 1920. (See below.)

Its general appearance is somewhat like the parasitic species, but the colour is entirely different, and it is much larger. The most important external difference is in the conchula, which in this species is larger, much elongated, with two papillæ on the lateral lobes, and with the median process three-parted. In the parasite, the three lobes are simple and the organ is much less developed.

I have never made sections from these specimens and at present they are not available for examination. They belong to the collections of the Yale University Museum, now in storage.

Bicidiopsis arctica. New species.

Plate XXV; Figs. 1-1k. Plate XXVI; Fig. 8. Text Fig. 16.

Two specimens sent to me from the Geological Survey of Canada were from the east side of Richmond gulf, in 15 to 20 fathoms, taken June, 1899, by A. P. Low. Catalogue No. 54, (Cœlenterates), Victoria Memorial Museum, Ottawa. Type. I have made some sections from them, for anatomical details. See Plate XXV; figs. 1–1k.

As strongly contracted in alcohol they are soft, with many transverse wrinkles, due to contraction. One is nearly spherical; the other is ovoid. They are somewhat translucent, pale flesh-colour, and the mesenteries show through the integument. They have twelve stout, somewhat long, blunt, equal tentacles, crowded in two alternate rows. They taper but little and are strongly annulated with wrinkles (fig. 1c). Their walls are thick and muscular. The mouth has at one end a prominent three-lobed "conchula," with a deep sulcate siphonoglyph, tubular in part. (Pl. XXV, fig. 1b.) The conchula has two large bilobed lateral lobes, each bearing two small nipple-shaped appendages, the central lobe, as contracted, is smaller, less swollen, and bears a small median papilla. In the larger Hudson bay specimen there is a firm central muscular thickening at the aboral end, with no pore to be seen without careful examination; it is not larger than a small pinhole. In the other specimen there is a round terminal pore, nearly 2 mm. in diameter, with the ribbed ectoderm extending into it by invection and forming a tube (fig 1k). It was filled with a mass of partly digested food, etc., and the bottom lobes of the stomodæum were nearly in contact with its inner lumen.

In a transverse section twelve complete mesenteries and eight incomplete ones can be seen (Pl. XXV, fig. 1; pl. XXVI, fig. 8). They are unequal in the two sides of the body, due probably to contraction. Their longitudinal muscles in the upper part are large, restricted, somewhat reniform or crescent-shaped in

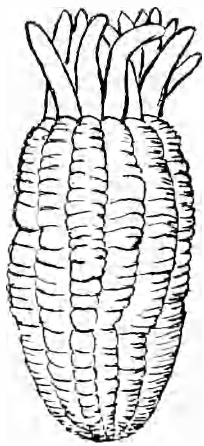


Fig. 16. *Bicidiopsis aretica* Verrill. Type. From a contracted Hudson bay specimen.

sections, thick in the middle region, thinning out towards each edge, and recurved (Pl. XXV, fig. 1a). At the base of the stomodæum, they are thinner and not recurved (Pl. XXVI, fig. 8). All the perfect mesenteries bear convoluted mesenterial filaments (Pl. XXV, figs. 1f-1h). The mesenteries all reach nearly to the central pore in the posterior end, and end abruptly (figs. 1j, 1k). The sphincter muscle (fig. 1e) is thin and diffuse. The column-walls are rather thin, the ectoderm layer (g), being thick, glandular, and soft externally (fig. 1i). The mesoglœa (1) shows five, six, or more, narrow parallel lines for the circular muscles (h^1).

This species is evidently very closely related to *Bicidiopsis quinquecapitata* (McMurrich), referred to *Peachia* by him. He described it as from Nanoose bay, Vancouver island, in 15-20 fathoms. (Proceedings of the Zoological Society of London, 1913, p. 963, pl. 98, figs. 1-4).

His species has the same number and the same arrangement of mesenteries, and the retractor muscles of the mesenteries have nearly the same form. Its conchula is three-lobed, the median lobe is small and bears a median papilla; each side lobe bears two papillæ, as in my species. Thus the conchula has essentially the same structure as in the Hudson bay specimens.

The agreement is so close that it is possible that the two belong to the same species, but additional specimens should be studied before this can be decided definitely.

Prof. McMurrich, in the same article, (p. 967, Pl. 98, figs. 5-7) described *Bicidium æquoreæ*, a new species found parasitic on the bell of *Æquorea forskalli*, and suggested that it may be the larval form of the preceding species. It has a rudimentary conchula, and lacks the five papillæ. It had only 6 pairs of mesenteries, all of them perfect.

Its mesenterial muscular pennons were much thinner than in the preceding species. It seems to me unlikely to be the young of the latter. It was nearly as large. I believe it should be called *Siphonactinia æquoreæ*.

Family **EDWARDSIDÆ** Andres, 1880.

Column elongated, slender, without an adherent basal disk; usually with the thicker middle portion, or scapus, covered with a firmly adherent dark epidermal coating, into which the naked capitulum and the aboral naked area can be retracted. Sometimes without a central coating. Tentacles mostly slender, rather few, often 16, rarely up to 48. Perfect mesenteries fertile; usually only eight; two pairs of directives; 4 lateral ones not paired; all others narrow and imperfect. Sometimes small rudiments of few or many additional ones occur near the disk. Some species are able to adhere to stones, etc., by means of their sides. Apparently no aboral pore. The species usually live in tubes and crevices or buried nearly up to the tentacles in sand or mud; some are parasitic on jelly-fish while young (e.g. *Edwardsia leidyi* Verrill, of the New England coast.)

Edwardsia Quatr.

Edwardsia (*pars*) Quartrefages, Comptes rendus, Acad. Sci., Paris, XIV, p. 630, 1842; Annals and Mag. Nat. Hist., Ser. 2, Vol. XVIII, p. 65-109, 1842. Gosse (*pars*), Actin. Brit., p. 254, 1860. Torrey, op. cit., 1902, p. 376. Andres, op. cit., p. 90, 1884, (restricted).

Tentacles usually 16, often alternately longer and shorter. Scapus covered with a firmly adherent epidermal coating; its wall is thickened by a thick mesoglœal layer, much thicker than in the capitulum or physa. Rudimentary mesenteries about eight; sometimes more near the disk.

The species having more than 16 tentacles were separated from this genus by Andres, under the name *Edwardsiella*.

Edwardsia elegans Verrill.

Edwardsia elegans Verrill, op. cit., 1869, p. 162. Andres, op. cit., 1884, p. 95.

Plate XXI; Figs. 5, 6. Text Figure 17.

The type specimen of this species was immature. Its length in life was 25 mm.; diameter, 2·5 mm.; length of tentacles, 2·5 mm.; length of bare capitulum, 2·5 mm.

Specimens subsequently found in the same localities were four or five times as large, up to 100 to 150 mm. long, and differed somewhat in colour. They undoubtedly belong to the same species, but for convenience may be designated as variety *picta*.

The type had 16 slender tentacles, which were pale flesh-colour with a median light orange-red line beneath, distally; the capitulum was pale pink, with 8 white lines due to insertions of the mesenteries; disk pale flesh-colour; labial lobes pale yellow. Taken at low tide at Clark's ledge, near Eastport, Maine, and at Indian island, N.B., Aug. 21, 1864.

Edwardsia elegans, variety **picta.** New variety.

Plate XXI; Figs. 5, 6. Text Figure 17.

A large and long form, the longest being 150 mm. long. A living specimen 75 mm. long and 5 mm. in diameter, had the naked basal portion 25 mm. long.

The central coated portion or scapus was slightly sulcated and transversely wrinkled; epidermal coating was firmly adherent, pale orange-brown, or dirt-brown.

Tentacles 16, long, slender, very mobile, variously curved, sometimes spirally, and often recurved, up to 10 to 12 mm. long. They were, in life, pale flesh-colour or yellowish, with a reddish median stripe on the outer surface distally and to near the tip; on the adoral side, near the base, there is a transverse spot of opaque flake-white or pale yellow, and an oval spot of the same on the outer side of the base running downward in a V-shaped marking, and extending upward as a white line; on alternate tentacles the V-shaped spots sometimes connect with the yellow spots on the capitulum.

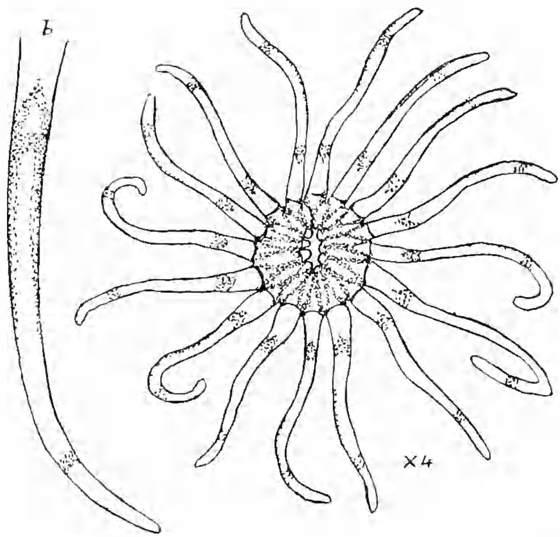


Fig. 17. *Edwardsia elegans*, var. *picta*, Verrill. Type, view of the expanded disk and tentacles, from life; x about 4; b. one of the tentacles, more enlarged. By the author.

The disk is usually projected in a low cone; the mouth has 8 small labial lobes; eight lines of reddish or purplish brown run from between the labial lobes and split in front of the tentcales, so as to pass each side of a tentacle; shorter radii of the same colour run to the bases of the alternate tentacles, but often do not reach the labial lobes. Between the reddish lines there are often squarish white spots, forming a circle; or else a continuous white line.

The naked capitulum, which in extension may be 35 mm. long, has eight pale depressed lines, at the insertions of the mesenteries. Just below the tentacle bases there is a circle of light lemon-yellow angular spots; below these there is a band of alternately larger and smaller often ill-defined spots of light reddish or purplish brown; the smaller ones, situated a little higher, taper down into a line below; the larger spots are usually emarginate above and sometimes below. Below the reddish spots there is a band of 8 broad-oval pale yellow spots, each divided medially by the pale pink line at the mesentery insertion. Below these spots the capitulum is pale orange, light flesh-colour, pinkish, or yellowish, like the naked basal area.

Found first at low water of a very low tide in gravel under stones at Clarks ledge and Prince's cove, Eastport, Maine, 1864 and 1868.

A slightly different colour variety occurred at Dog island, not far from Clarks ledge, at low water mark.

This had 16 long slender tentacles, often recurved against the column when well expanded in confinement. The disk was often protruded in a conical form, with the 8 small labial lobes prominent. The disk had 8 flake-white radial stripes separated by narrower lines of purplish brown. The tentacles had a basal spot of red brown on each side and a basal squarish spot of flake-white; towards the middle a crescent-shaped transverse spot of white and a smaller white spot near the tip. Capitulum bright salmon-colour with eight mesenterial lines of white and a circle of purplish brown spots near the bases of the tentacles. Greatest length, 38 mm. This, in addition to the littoral localities, has been dredged by us in various places, in the Bay of Fundy and Casco bay, in 10 to 64 fathoms; also in Portland, Maine, harbour in 9 fathoms, July 28, 1873, (specimen figured, Pl. XXI, fig. 6).

Edwardsiella Andres.

Edwardsiella Andres, op. cit., p. 93, 1884.
Edwardsia (*pars*) of most writers.

Tentacles more than 16, varying from about 20 to 26, or more. Rudimentary mesenteries near the disk vary in number and arrangement, according to age, often more numerous than the tentacles, sometimes as many as 36. Perfect mesenteries have a thick longitudinal muscle; all are fertile; two pairs of directives; basal muscle well developed.

Wall of column has imbedded capsules of nematocysts; scapus has its mesoglœa thickened; its epidermal coating is firmly attached.

Edwardsiella sipunculoides (Stimpson) Andres.

Actinia spunculoides Stimpson, Marine Invt. of Grand Manan, p. 7, pl. 1, fig. 2, 1853.

Edwardsia sipunculoides Verrill, op. cit., 1864, p. 28, pl. 1, figs. 12, 13; op. cit., 1863, p. 58. Torrey, Proc. Washington Acad. Sciences, vol. IV, p. 378, figs. 8-15, pl. XXIV, figs. 1-3, 1902 (from Alaska).

Edwardsiella sipunculoides Andres, op. cit., pp. 93, 95, 1884, figs. 5, 5b, (after Verrill).

Plate XXVI; Fig. 9. Plate XXXI; Fig. 1. Text Figure 18.

Column very elongated, cylindrical, with eight longitudinal sulcations, between which it is somewhat swollen in the form of broad, rounded, slightly prominent ridges, crossed in contraction by numerous strong transverse wrinkles. The tentacles are about 24 to 36 in number, varying with the age, arranged somewhat crowdedly in two rows close to the margin. They are long, slender, tapering to a point, the outer ones a little shorter than the inner, which are twice longer than the diameter of the disk, or even more; mouth with four small prominent lobes on each side.

The colour of the scapus coating is usually yellowish brown or mud-colour, but varies according to the colour of the mud where found; the basal naked area is pellucid yellowish white; capitulum yellowish white surrounded, about midway between the tentacles and sheath, by a ring consisting of eight lunate, arrow-shaped, or square, opaque white spots, which are close together and sometimes extend downward at their lower angles, forming a white line along the sides of each sulcation; sometimes there is a trace of another ring of smaller white spots lower down; tentacles transparent yellowish white, sprinkled with numerous flake-white dots, sometimes with small white spots at the outer base. Lips and stomodæum bright red, disk usually convex, yellowish, with faint white radii, and often with white spots surrounding the bases of the tentacles.

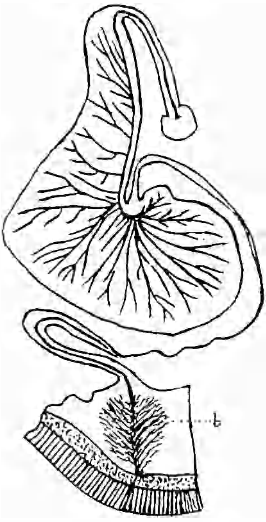


Fig. 18. *Edwardsiella sipunculoides* (Stimpson). Transverse section of a perfect mesentery of a specimen from Alaska; b, basal muscle. After Torrey.

Length of the largest specimens, when in full expansion, about 5 inches (125 mm.); in diameter about 4-5 mm.; when contracted about 36-45 mm. in length.

Some specimens (No. 108) from near Eastport, at Clark's ledge, differed considerably from the typical ones in colour. Naked parts of the column were clear salmon-colour; no spots on the capitulum, but light lines, due to the mesenteries; stomodæum pink; tentacles pale salmon, with a darker salmon-coloured central line; disk salmon-coloured, no spots. Tentacles are about 36, closely crowded in two rows, very slender and pointed in extension; length about twice the diameter of the disk, more numerous and more slender than usual in typical specimens of the same size.

The epidermal coating of the scapus is firm, obscurely 8-grooved, colour dark yellowish brown; length in life about 50 mm.; diameter, 4-5 mm. These were found under a stone in a tide-pool, some were lightly attached to small pebbles by the naked aboral end or *physa*, probably by adhesive mucous.

Torrey (op. cit., 1902) has described the structure of this species with good figures. He found as many as 32 small rudimentary mesenteries in a specimen having 25 tentacles (Pl. XXVI, fig. 9). They were irregularly arranged; the number between adjacent perfect mesenteries varied from 4-6; one occurred between each pair of directives.

The muscle pennon on the perfect mesenteries is very thick with branched supports, and is restricted to the inner part of the mesentery. The column has numerous scattered nematocyst capsules, and a very thick mesoglœa in the scapus.

Common formerly near Eastport, Maine, near Dog island, Clark's ledge, Princes cove, etc., between tides and at low tide mark, and at Grand Manan island, N.B. One small specimen, apparently the young, about 25 mm. long, was taken off Grand Manan in 60 fathoms. Dredged by us in Casco bay, 1873, in 48 to 64 fathoms.

Recorded from Henley harbour, Chateau bay, southern Labrador, by A. S. Packard, 1865. Gulf of St. Lawrence, off Prince Edward island (Whiteaves).

Torrey, 1902, described specimens from Dutch harbour, Unalaska (Harriman Alaska Exped.)

This species has been found in very few places, and usually very sparingly in its localities. In the vicinity of Eastport, Me., at a point just south of Dog island, I once succeeded (1861) in obtaining several hundred specimens in a very short time by turning over the large stones. They were seen projecting from the mud, chiefly near the edges of the stones, looking much like some species of worms. As many as fifteen to twenty were sometimes found under a single stone. They here occupy the lower third of the littoral zone. When put in sea-water they expand readily and move about with worm-like gyrations. When touched, they suddenly jerk away the upper part of the body before withdrawing the tentacles.

Drillactis. New genus.

Type, *Edwardsia pallida* Verrill. Body long, slender, changeable, worm-like, integument soft, with no adherent epidermal coating on the column; scapus and capitulum not notably differentiated; tentacles 18 to 24 or more, changeable in form.

Drillactis pallida. New name.

Edwardsia pallida VERRILL, Notice of Recent Addit. to Mar. Invert., Part I, in Proc. National Mus., II, p. 198, 1879.

Halcampa pallida ANDRES, op. cit., 1884, p. 105.

Plate XXI; Figures 4, 4a.

A long, slender, soft, flaccid, gray or whitish species. Column smooth, soft, destitute of any permanent investment, but sometimes with grains of sand, slightly adherent; surface faintly longitudinally sulcated, and sometimes finely wrinkled transversely. The form is changeable, elongated, nearly cylindrical, but often tapered at the posterior end, and often swollen in some places.

Tentacles 12 to 24, often 18, very changeable in form, varying from short fusiform or club-shapes to long and slender forms, which are often curled and two to three times as long as the diameter of the disk, or even longer, often acute at the tips, or when swollen the tip may be acuminate. (See Pl. XXI, figs. 4a, b-i).

The tentacles are usually pale greenish or grayish white, often with a pale olive-green central line, interrupted by a line of opaque white spots, often ten to twelve on a tentacle, or sometimes by transverse lines of white; the central dark line is sometimes absent. Column is translucent, dull gray or grayish white, or pale flesh-colour, striped with narrow flake-white lines, due to the mesenteries, between which the dark or purplish internal organs show through; a circle of lunate spots of opaque yellowish white is situated just below the tentacles, corresponding with the broader longitudinal stripes. Disk is often much protruded, yellowish white, radiated with opaque white spots; or these spots may be prolonged into whitish lines, fading out lower down; peristome sometimes brownish.

Length up to about 4 inches while living and in extension (80 to 100 mm.); diameter 4 to 6 mm. Tentacles may extend to 12-16 mm., or two to three times the diameter of the body.

In confinement this species secreted from its column a coating of soft and rather loose mucous. It is not attached to the tubes or burrows in which it lives. It twists and wriggles about like an earth-worm when out of its burrows.

Type locality, Provincetown, Mass., in sand at low-water (U.S. Fish Commission).

It is possible that this species may prove to be the adult form of the peculiar parasitic species frequently found adhering to the jelly fish, *Mnemiopsis leidyi*, on the coast of New England in summer. The latter was named by me *Edwardsia leidyi* in 1899 (Amer. Journ. Science, vol. VI, p. 496, figs. 2, 3). It has not been raised much beyond the stage when it has eight short tentacles, and sometimes rudiments of 8 others. It is smooth and lubricous, vary changeable in form, from very long and slender to short ovoid or globular. Its colour is reddish, rosy, or purplish

Family **CERIANTHIDÆ.** M. Edw. and Haime, 1852.

Body much elongated, tapered to the base, without a basal disk, but usually with a terminal pore. Tentacles of two kinds, marginal and labial; all elongated and slender, very numerous in adults and arranged in many cycles. One siphonoglyph. Mesenteries very numerous, unequal, arranged bilaterally, few (2 to 10 or more) reach the posterior end. Most species form coherent tubes of mud, mucous, etc. Some live at the surface of the sea, even when large.

Cerianthus Delle Chiage, 1830.

Cerianthus borealis Verrill.

Cerianthus borealis Verrill, Amer. Journ. Science, Vol. V, p. 5, 1873; Proc. Amer. Assoc. Adv. Science, Vol. for 1873, p. 391, 1874 (in Explorations of Casco Bay); Ann. Report U.S. Fish Comm. for 1883, p. 534, 1885; Webster's International Dictionary, Edit. of 1904, pp. 1606, 1977 (good original figures of type supplied by me; also in an earlier edition). Smith and Harger, Trans. Conn., Acad. Sci., Vol. III, p. 54, pl. II, fig. 5, 1874. Kingsley, Tufts College Studies, No. 8, pp. 345-361, figs. 3-5, adult, and fig. 1, three views of young *Arachnactis*, 1904.

Cerianthus borealis McMurrich, in Journ. Morphology, vol. V, p. 147, pl. IX, figs. 9-13, 1891. E. L. Mark, Selections Embryological Monographs, Polyps, pl. XII, figs. 16-23, 1884, in Mem. Mus. Comp. Zool., vol. IX, 1884.

Arachnactis brachiolata A. Agassiz, Proc. Boston, Soc. Nat. Hist., vol. IX, p. 159, 1862; Journ. Boston Soc. Nat. Hist. vol. VII, p. 525, 1863 (young).

Plate XXII; Figs. 1-4. Text Figures 19, 20, 21, a, b, b^1; 22.

This species grows to a very large size. Ordinary adult specimens may have the body from 175 to 225 mm. in length and 40 to 50 mm. in greatest diameter of body; breadth across expanded tentacles 125 to 150 mm. (5 to 6 inches); the longer inner marginal tentacles being 50 to 60 mm. long; outer marginal ones 20-25 mm.; the oral tentacles 25 to 30 mm.; larger specimens sometimes occur. One from off the coast of Maine was about 18 inches long (450 mm.) and 7 inches (175 mm.) across the expanded disk; others were somewhat larger.

It occupies a very long, rough, thick, flexible tube, composed of mud and various debris, cemented together by hardened mucous, but very smooth inside. These tubes, one to two feet long, are often taken in deep water without the occupant. In natural positions at the bottom they are probably much longer.

The body is smooth; in contraction usually more or less wrinkled lengthwise. It may taper regularly or be somewhat swollen or vase-shape toward the anterior end, and expanded close to the margin.

The marginal tentacles are very numerous, long and slender, tapering to slender tips; the inner rows, much longer than the outer ones; not very contractile. The oral or labial tentacles are about one-third as long as the longer marginal ones, or up to about 20 to 30 mm. long. The number of marginal tentacles may be 150 to 200 or more, in large examples. There is a central pore in the posterior end. According to Kingsley five pairs of mesenteries reach the aboral end, to near the pore. He found it to be a hermaphrodite species.

The colour in life is somewhat variable. In the types the body was dark chestnut-brown, often tinged with bluish or purplish near the margin; disk pale yellowish brown; around the mouth, within the circle of labial tentacles, deep brown with paler fine radii; labial tentacles pale chestnut-brown; outer tentacles light chestnut-brown or deep salmon, the longer ones transversely barred with five to eight deep reddish brown spots partially divided in the median line by paler colour. Some specimens had the body orange brown; others dull bluish or greenish gray, or mud-colour. Other variations were noted. This species has been taken at many places in the Bay of Fundy; Bedford basin; Gulf of Maine, 110, 156 fathoms; off Casco bay, 35 to 75 fathoms; off Georges bank, etc., in 20 to 150 fathoms on soft muddy bottoms, and also off southern New

19 20

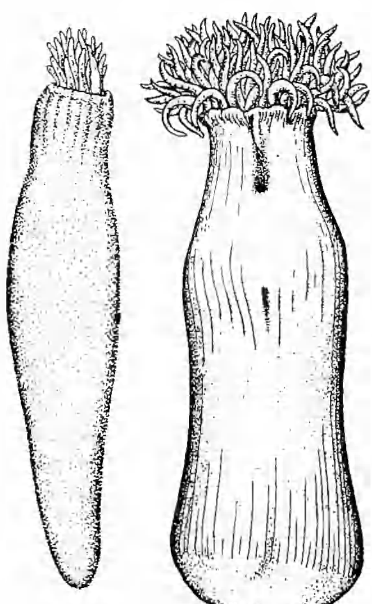


Fig. 19. *Cerianthus borealis* (?) Verrill. A young specimen which has lost its marginal tentacles; but retained the labial tentacles, thus resembling an *Ilyanthus:* x 2. By A. H Verrill.

Fig. 20. The same (?). A larger abnormal specimen that appears to have been injured and repaired and has also lost the marginal tentacles; x 2. By. A. H. Verrill.

England in 18 to 264 fathoms. Off Watch Hill, R.I., in 18 fathoms, young. It was also brought from the fishing Banks off Nova Scotia by the Gloucester, Mass., fishermen. It seems to be a common species in deep water, judging by the number of empty tubes brought up in the dredges. It also occurs in the Gulf of St. Lawrence (Whiteave's coll.)

Young specimens from 25 to 35 mm. long are often found off the New England coast in moderate depths.

One of these, about 33 mm. long, is figured (×2) on pl. XXII, fig. 3, from life. This had 22 slender marginal tentacles; the labial tentacles were relatively shorter than in the adult. The body wall was translucent, so that the larger mesenteries could be seen by translucency. The aboral end was mobile and changeable in form, often inflated, as in the figure. In colour it was similar to some of the adults, but the body was pale greenish brown.

When the marginal tentacles of such specimens are broken off, as often happens in a dredge containing stones, shells, etc., the young *Cerianthus*, with its margin contracted, and showing the labial tentacles, very much resembles an *Ilyanthus*, and may easily be mistaken for that genus when superficially examined (fig. 19). When more closely examined the thick margin shows its real nature. Of course an examination of the interior by sections shows the difference at once.

A small specimen, about 75 mm. long and 6 mm. in diameter, taken off Watch Hill, R.I., July 31, 1874, in 18 fathoms, had the body pale purplish brown anteriorly, greenish brown to olive posteriorly; just below the outer bases of the tentacles was a ring of orange-brown; outer tentacles flake-white at base; inner marginal tentacles had a spot of purple on each side and on the front of the base; labial tentacles were purplish, with some flake-white at the tips. Some of the marginal tentacles had a white stripe at about the middle, on each side.

Arachnactis brachiolata A. Agassiz.

Young larvæ of *Cerianthus*.

Text Figures 21, a, b, b[1], 22. Plate XXII; Fig. 4.

Two stages of development of this interesting larval form were taken Oct. 4, 1913, at Station 27 *t*, *u*, Collinson point, Alaska, swimming under ice in about 1 fathom of water.

According to Mr. F. Johansen's notes, these larvæ were floating with the rounded basal end upward, and the four larger tentacles downward. The tentacles were slightly curved at the tips, and spread out in a quadrate. The tips of these outer tentacles were orange-brown, elsewhere the larvæ were pale yellowish brown, the ends being darker. The length was about 4–5 mm. Two pairs of inner or oral tentacles were observed.

The three specimens received by me represent two diverse stages of development. (See Text Figures 21, *a*, *b*). The younger stage (*a*) has two pairs of outer tentacles well-developed, but somewhat unequal, with rudiments of one of the third pair. It has two rudimentary oral tentacles and a large, slightly emarginate, protruding oral lobe or lip. The body is short and thick, evenly rounded posteriorly. One pair of mesenteries is conspicuous. The other specimen (b, b[1]) is considerably older. It has the third pair (i, i, i) of tentacles pretty well developed and crossed by a whitish band on the inner surface. There are rudiments of four oral tentacles (two pairs) unequally developed. Eight unequal pairs of mesenteries can be seen by translucency; only one pair reaching nearly to the end of the body.

The specimens are well preserved in formaline, but are heavily stained with dark greenish brown, so that the internal structure cannot well be seen. The stomodæum is visible as a short sac below the mouth. There are two large distinct mouth-lobes, unequal in size.

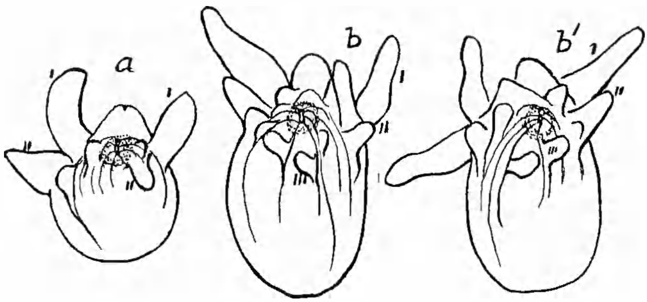


Fig. 21. *Arachnactis brachiolata* A. Agassiz. The larva or young of a *Cerianthus*, probably of *C. borealis* Ver. A very young stage with but two pairs of the tentacles of the outer row (i, ii), and with rudiments of three tentacles of the inner circle; also traces of 8 mesenteries; much enlarged. Canad. Arc. Exped. C. C. A later stage of the same larva, viewed from opposite sides; three pairs of outer tentacles (i, ii, iii) are now developed, but of unequal sizes; also two pairs of the inner or oral circle, in a rudimentary form; eight unequal mesenteries are visible and also two prominent labial lobes, and the stomodæum. Much enlarged. Drawn by the author.

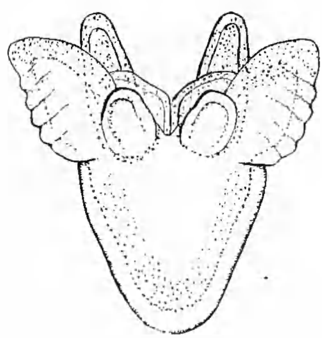


Fig. 22. The same. From a very young New England specimen. Much enlarged. By J. H. Emerton.

These stages do not quite correspond in the state of development with similar larvæ previously described, but they appear to be identical with the similar larvæ found on the northern New England coast. (See Text Fig. 22, and Pl. XXII, fig. 4). The latter is probably the larva of *Cerianthus borealis* Verrill, a common form in the deeper waters of northern New England, the Gulf of St. Lawrence, etc., and the only species known from the very northern waters of America, but not yet reported from the Pacific coast.

For additional details concerning *Arachnactis brachiolata*, see G. S. Kingsley, Description of *Cerianthus borealis*, Tufts College Studies, No. 8, 1904, with three figures of larvæ from Casco bay. Also J. L. McMurrich, The Genus Arachnactis, Journ. Experimental Zoology, Vol. IX, No. 1, 1910, pp. 159-168, fig. 4, (compared with other species). Also Journal of Morphology, Vol. V, p. 147, pl. IX, figs. 9-13, 1891.

Additional species of Actinaria from Alaska and adjacent waters and probably inhabiting waters of British Columbia have been recorded in the following works:—

H. B. Torrey. Papers from the Harriman Alaska Expedition, xxx; Anemones, with Discussion of Variation in *Metridium*, Proc. Wash. Acad. of Sciences, vol. IV, pp. 373-410, plates XXIV, XXV, and text-cuts, 1902.

He described *Edwardsia sipunculoides* (Stimpson) Verrill; with anatomical details. From Dutch harbour, Alaska.

Charisea saxicola, new genus and species, Sitka, Alaska.

Cribrina artemisia = *Evactis artemisia* (Drayton) Verrill. From Sitka, Yakutat, Popof island, Dutch harbour, and Puget sound. *Epiactis prolifera* Verrill. From Puget sound to San Pedro and Pacific Grove, Cal. *Epiactis ritteri*, new sp., Popof island.

J. P. McMurrich, Report on the Hexactiniæ of the Columbia Univ. Exped. to Puget Sound during the summer of 1896, Annals New York Acad. Science, Vol. XIV, No. 1, pp. 1-48, plates I-III, 1901. In this work he described *Metridium dianthus* (Ellis) and its variations, from Puget sound, etc.

Cribrina elegantissima (Brandt) McMurrich. Should be *Tealiopsis elegantissima* (McMurrich) Ver. Identified doubtfully with Brandt's species, and only by the colours based on Mertens' drawings. (Brandt's authority better be omitted). The specimens collected by Mertens are said to have been lost by shipwreck. Puget sound; Sitka (Brandt).

Cribrina artemisia (Pickering, in Dana) = *Evactis artemisia* Verrill. Discovery bay. Recorded from Alaska by Torrey. See above. Common in Puget sound. Shore and shallow water.

Urticina crassicornis (Müll.) Ehr. Anatomical studies, variations. Now considered a distinct species by me. (*U. columbiana* Verrill.) (See page 107 G.)

Anthopleura xanthogrammica (Brandt). Body greenish to light. Tips of tentacles pink or bright red. According to Brandt, his species had copper-green tentacles. Identification is very doubtful. Port Townsend and San Francisco. (Sitka, Brandt).

Epiactis prolifera Ver., op. cit. 1869, p. 492; op. cit., 1899, p. 377, fig. 25. Recorded from Puget sound to Pacific Grove, Cal., by Torrey. Colours described. Anatomical details given. First recorded by me from Puget Sound.[1]

J. P. McMurrich, in Proceedings of the Zoological Society of London, for 1913, Vol. II, pp. 963-967, Plate XCVIII. On two new Actinians from the coast of British Columbia. The species described are *Peachia quinquecapitata* and *Bicidium æquoreæ*. Both were from the coast of Vancouver island. The former belongs to my genus *Bicidiopsis* of this report; the latter to *Siphonactinia*, as here defined. (See above pages 125 G, 128 G.)

[1] Larvæ of small size were found inside the original specimens, similar to the smaller ones carried in the pits on the outside. Some of the latter had twelve tentacles.

EXPLANATION OF PLATES.

PLATE XIX.

Fig. 1. *Actinauge verrillii* McMurrich. Side-view of a living specimen partly expanded. About ½ natural size. The base enclosed a ball of mud for anchorage.

2. *Actinauge rugosa* Verrill. New species. A medium size specimen in life with the body strongly contracted; about ½ natural size.

3. The same. Type. View of a large living specimen, nearly expanded. About natural size.

4. *Urticina crassicornis* (Müll.) Ehr. View of the disk and expanded tentacles of a large living specimen, with nearly plain-coloured tentacles. About ¾ natural size.

5. *Chondroctinia tuberculosa* Verrill. Type. View of an alcoholic specimen. About natural size. Drawings by J. H. Emerton, except No. 2, by the author.

PLATE XIX.

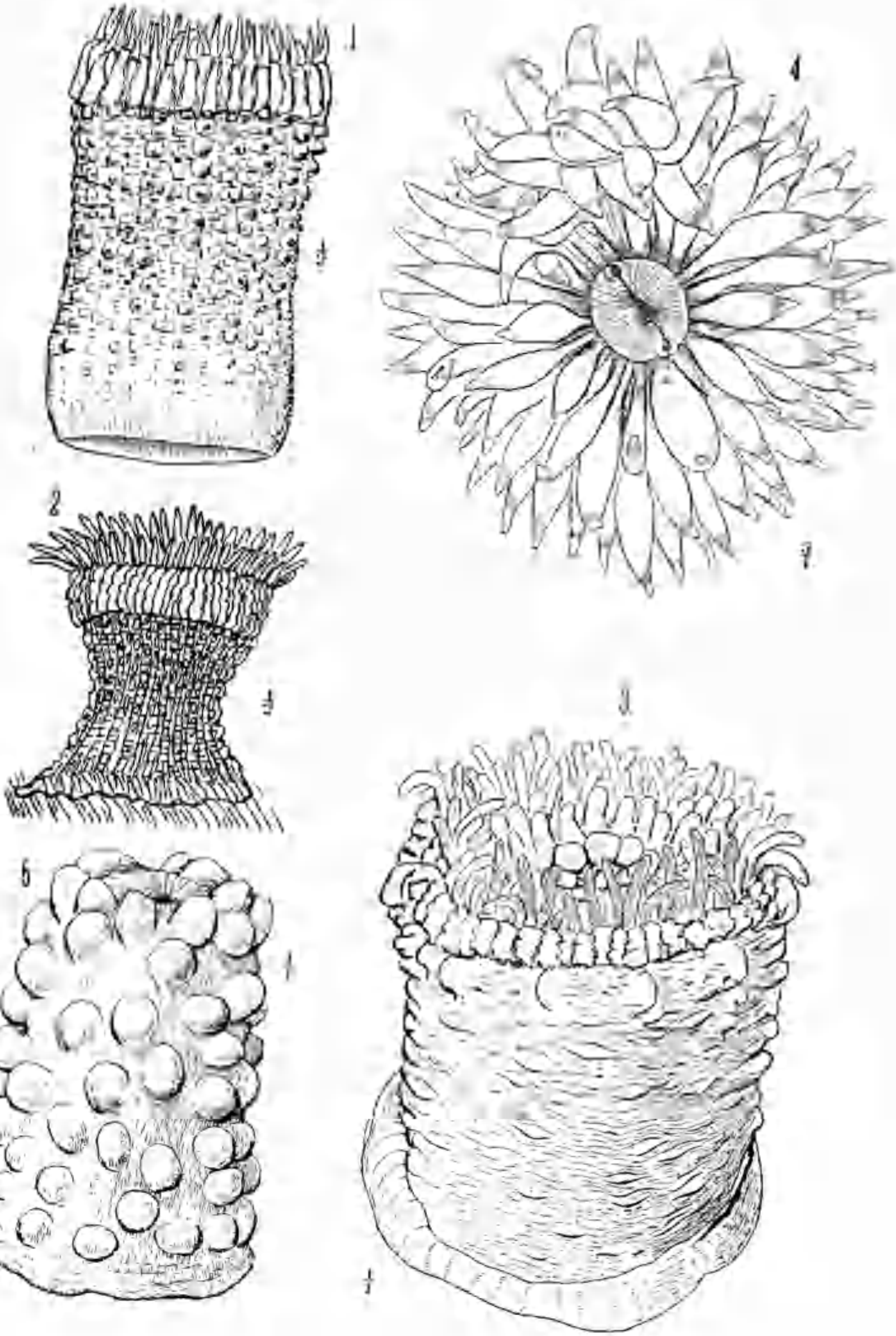


PLATE XX.

Fig. 1. *Bicidiopsis tubicola* Verrill. New species. Type. Side view from life. About natural size. By J. H. Emerton.

2. *Siphonactinia parasitica* (L. Ag.). Anterior part. From a large living specimen. Conchula is nearly retracted; x 2.

3. The same. View from life of the disk and tentacles, with the mouth distended; conchula is but little protruded; x about 3.

4. *Tealiopsis stella* Verrill. Side view of an alcoholic specimen from Hudson bay; x $1\frac{1}{2}$.

5. The same. One of the cotypes, contracted and covered with adherent sand, etc.; natural size.

6. The same. Type. From a living expanded specimen: $\frac{3}{4}$ natural size. After E. S. Morse.

7. The same. Part of a longitudinal section, showing the sphincter muscle (s); t, tentacles; v, verrucæ; u, mesoglœa of body wall; f, foramen in a perfect mesentery; r, an imperfect mesentery. Enlarged.

8. The same; (a) an egg, x 2; (b) larva, nat. size; taken from a Hudson bay specimen; (c) one of the extruded young, contracted; x about 3.

9. The same. One of the young, soon after birth, from life; x about 4.

10 and 11. The same. Two of the young taken from inside of an alcoholic specimen from Hudson bay; x 4.

12. The same. Disk and tentacles; 1-4, are tentacles of first to fourth cycles; l, d, d, two directive tentacles; about $\frac{3}{4}$ natural size. All by the author.

13. *Urticina crassicornis* (Müll.) Ehr., Disk and tentacles of a large living decamerous specimen, about $\frac{2}{3}$ natural size. Copied from a photograph by A. H. Verrill.

PLATE XX.

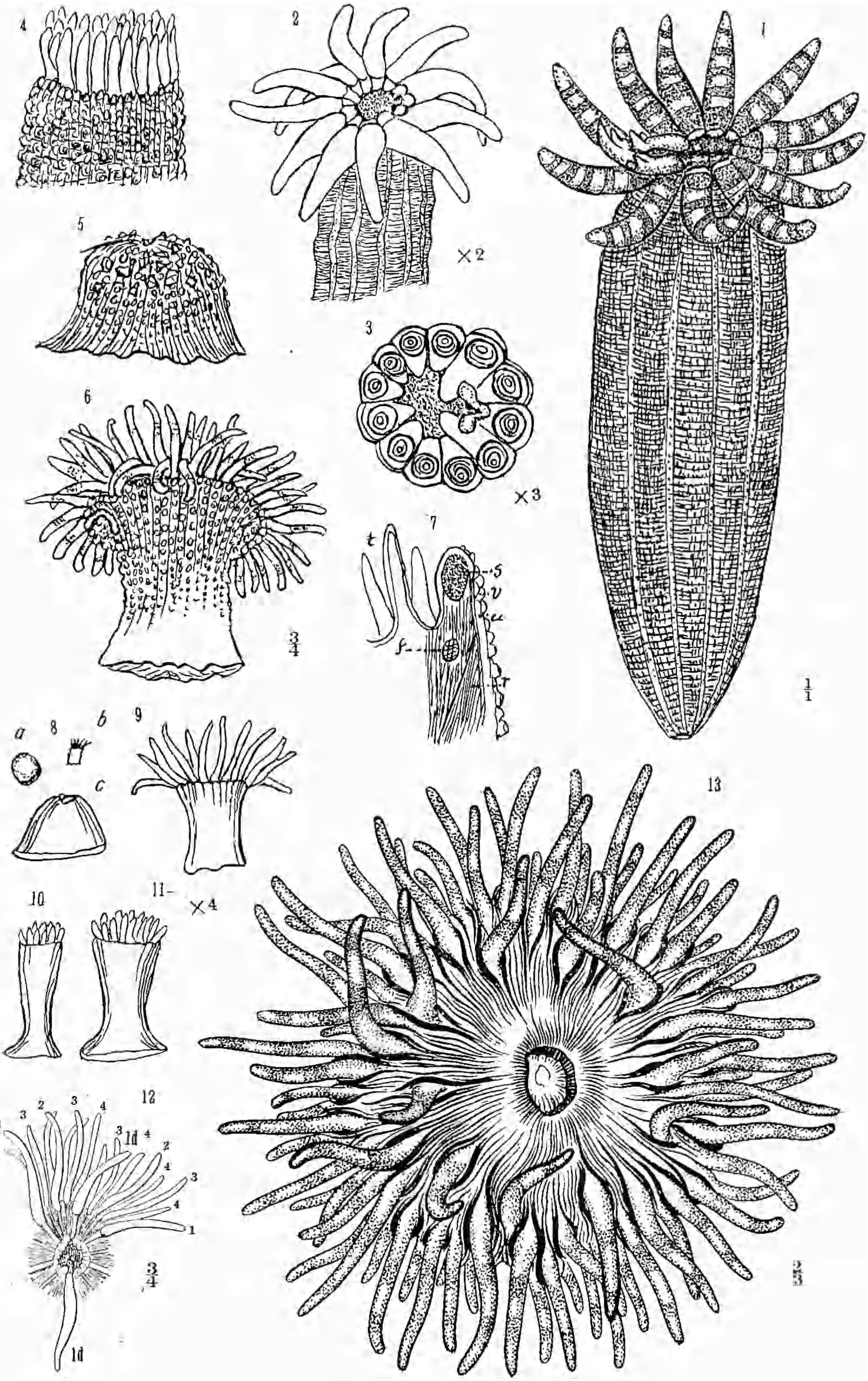


PLATE XXI.

Fig. 1. *Halcampa duodecimcirrata* (Sars). General figure from life; x 4.
2. The same. Variety *nitida*, new. Type. View of the upper part from life; x 4.
2a. The same specimen. View of the disk and tentacles; x about 3½.
3. *Halcampa farinacea* (Ver.). General figure from life; x about 4.
4. *Drillactis pallida* Ver. General figure from life; x about 2. Type.
4a. The same; a, b, c, d, several forms assumed by the tentacles; more enlarged.
5. *Edwardsia elegans*, var. *picta* Ver. Side view of upper parts from life; x about 6. Type.
6. The same. Another colour variety, from Portland, Maine, general figure from life; x 3½.

Figures 1, 5, 6 were by J. H. Emerton; the others by the author.

PLATE No XXI.

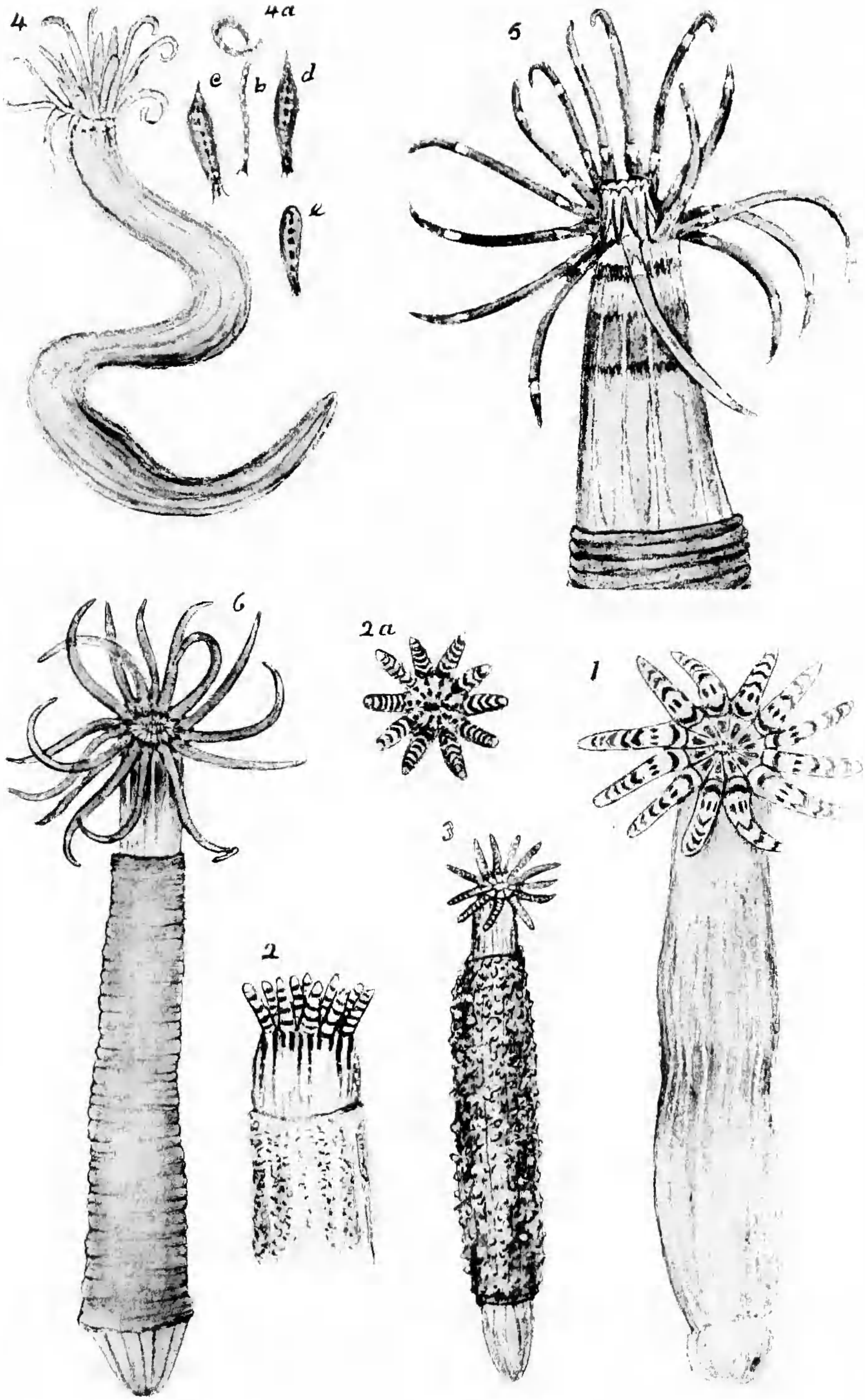


PLATE XXII.

Fig. 1. *Cerianthus borealis* Ver. View of the expanded disk and tentacles of a living specimen. About ½ natural size.
2. The same. Side view from life. About ⅓ natural size. Both by J. H. Emerton.
3. The same. A young specimen. x 2.
4. The same; larva in the brachiolaria stage. Much enlarged.
5. *Stephanauge nexilis* Verrill. A group of three, contracted, and surrounding the denuded axis of a live *Balticina*. About ⅔ natural size. From the Banks.
6. The same. One partly expanded from another group. About ¾ natural size. It had a few acontia exposed.
7. *Raphactis abyssicola* (Moseley?) Verrill. A smooth specimen having the same amplexicaul habit as the last, strongly contracted and showing plainly a few cinclidæ; x 2.

Drawings by J. H. Emerton.

PLATE XXII.

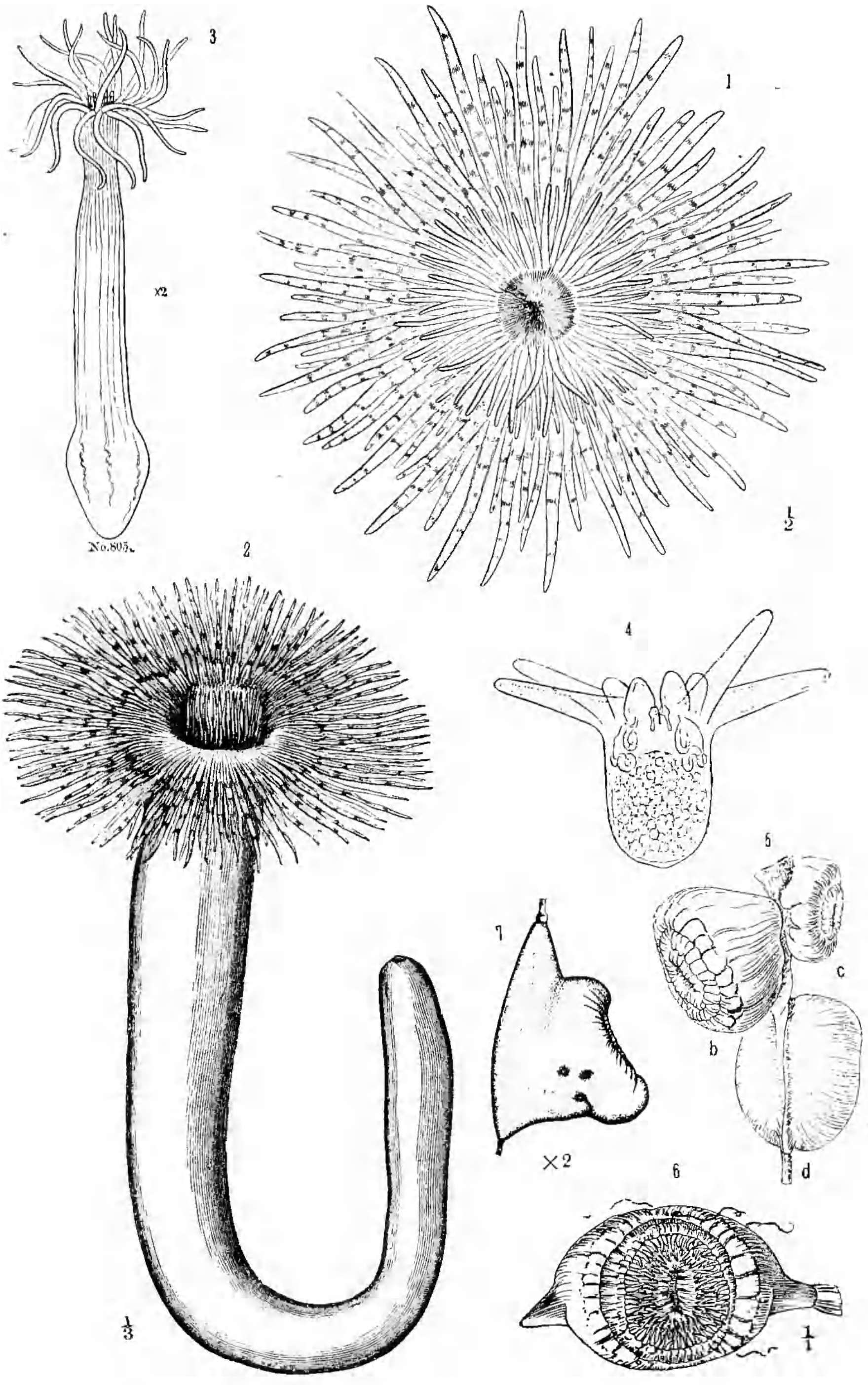


PLATE XXIII.

Fig. 1. *Bolocera longicornis* Carlgren. From a living specimen; about $\frac{2}{3}$ natural size. Not full grown. By J. H. Emerton. Colour, orange red; tentacles, pink.

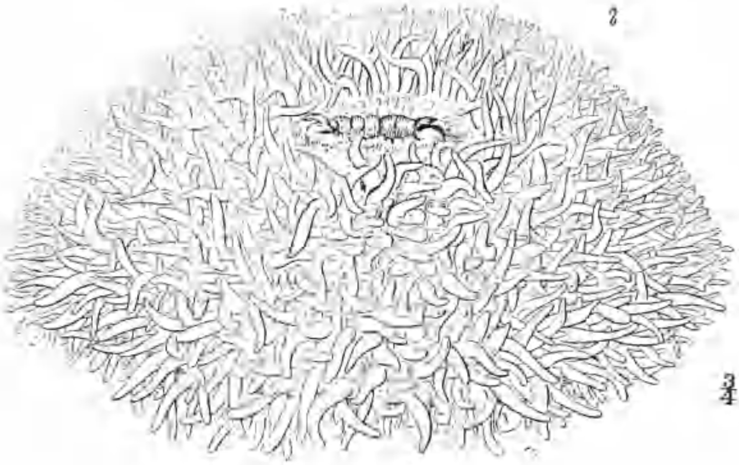
2. *Eubolocera multicornis* Verrill. Type. From a fresh, but not living, specimen. About three-quarters natural size. Colour, light red.

PLATE XXIII.

1

$\frac{1}{2}$

2



$\frac{3}{4}$

PLATE XXIV.

Fig. 1. *Actinauge borealis.* New species. Longitudinal section of the upper part of the column; e, sphincter muscle; c, retracted capitulum; h, mesoglœa; g, ectoderm with remains of dark coating; d, invected disk; t, t′, bases of crowded tentacles; v, larger tubercles of the parapet; m, upper ends of the mesenteries, pink in colour; o, oral region of disk.

1a. The same, less enlarged; letters the same; the inner long slender crowded tentacles (t′, t″) were turned inward, reaching the base of the stomodæum.

1b. The same; part of a transverse section made near the oral disk, where the mesenteries of the first and second cycles are all perfect and nearly equal.

1c. Another part of the same section.

1d. Another section from the same region more enlarged.

1e. Another part of the same section;
I, I, mesenteries of the first cycle; II, a mesentery of the second cycle; r, r, sections of angular ridges of the endoderm; p, outer layer of stomodeal wall; h, mesoglœa; e, endoderm; g, ectoderm; v, verrucæ; i. endoderm.

1f. The same. Transverse section at about the middle of the stomodæum; i, i, primary perfect mesenteries; ii, iii, iv, mesenteries of second to fourth pairs with gonads removed; letters as in last.

1g The same. Longitudinal section of wall.

1h. The same. Another longitudinal section more enlarged; lettering as in 1e.

2. *Actinauge rugosa* Verrill. Longitudinal section of the upper part of the column-wall; c, capitulum; e, sphincter muscle; h, mesoglœa; g, ectoderm; v, verrucæ of parapet; d, disk; t, bases of tentacles.

All drawings by the author.

PLATE XXIV.

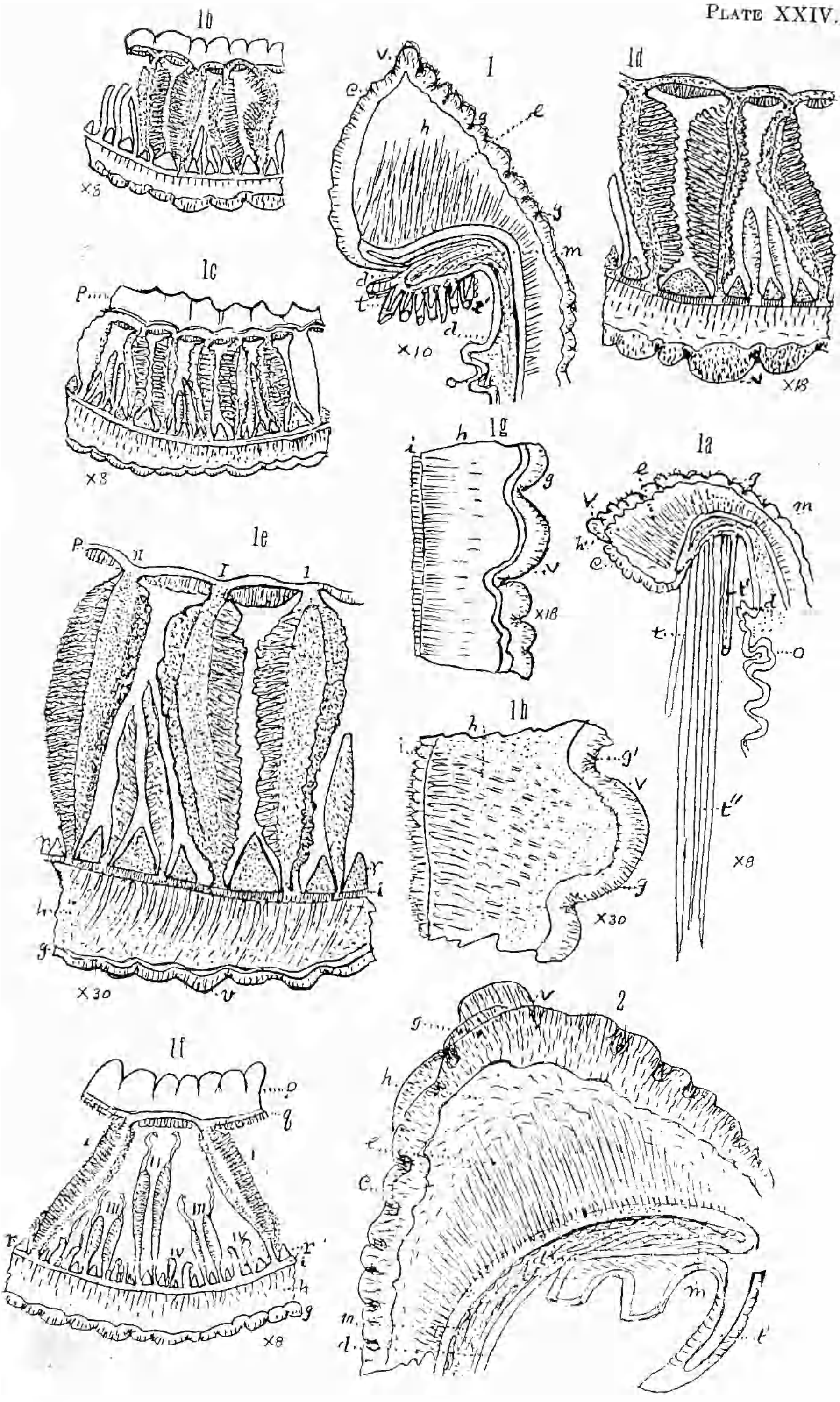


PLATE XXV.

Fig. 1. *Bicidiopsis arctica* Verrill. Type. Transverse thick glycerine section across near the upper part of the column, showing 12 perfect and eight imperfect mesenteries; d, sulcar; d′, sulcular directives and siphonoghlyphs; 1, 1, gonads on imperfect mesenteries; o, stomodæum. Schematic, in part.

1a. The same. One of the perfect mesenteries more enlarged.

1b. The same. Conchula and siphonoglyph much enlarged.

1c. The same. Distal part of a tentacle; much enlarged.

1d, a, b. Sections of two tentacles compressed into angular forms by crowding.

1e. The same. Longitudinal section, in the region of the sphincter muscle (e); much enlarged.

1f. The same. Portion of a mesenterial filament partly uncoiled. 1g. Another portion more enlarged; 1h, trifid portion.

1i. The same; transverse section at base of the stomodæum, showing the bases of the directive mesenteries (d); g, ectoderm; h, mesoglœa; h′, lines of circular muscles.

1j. The same; terminal pore and ends of mesenteries seen from inside; enlarged.

1k. Section of aboral end and pore expanded; m, mesentery; p, pore.

2. *Metridium dianthus* (Ellis). A large living specimen with some acontia emitted; from Massachusetts Bay; n, n, acontia; about $\frac{2}{3}$ natural size.

3. *Siphonactinia parasitica*. Two of the mesenteries in transverse section. After McMurrich, with some changes.

Figures 1-1k, were made from rather thick sections mounted in glycerine-jelly and therefore differ from hardened sections in Canada balsam. By the author. Fig. 2, after J. H. Emerton, with some changes.

PLATE XXV.

PLATE XXVI.

Fig. 1. *Tealiopsis stella* Verrill. Vertical section of the sphincter muscle and a tentacle of a Hudson bay specimen; x 10.

2. The same. Sphincter muscle more enlarged.

3. The same. Part of a rather thick transverse section showing a mesentery of the third cycle (III) and a pair of those of the fourth and fifth cycles (IV, V) covered with gonads, densely crowded; g, ectoderm; h, mesoglœa; c, circular muscles; i, endoderm; x 18.

4. The same. Part of a transverse section showing two imperfect mesenteries deprived of gonads. Lettering as in fig. 3; x 25.

5. The same. Longitudinal section of the column wall, showing branched lamellæ of the circular muscles, etc.; x 10.

5a. The same. More enlarged; g, ectoderm; h, mesoglœa; i, endoderm; c, circular muscle lamellæ; x 18.

6. Surface view of some of the suckers on the middle of the column; x 18.

6a. One of the suckers more enlarged; x 30.

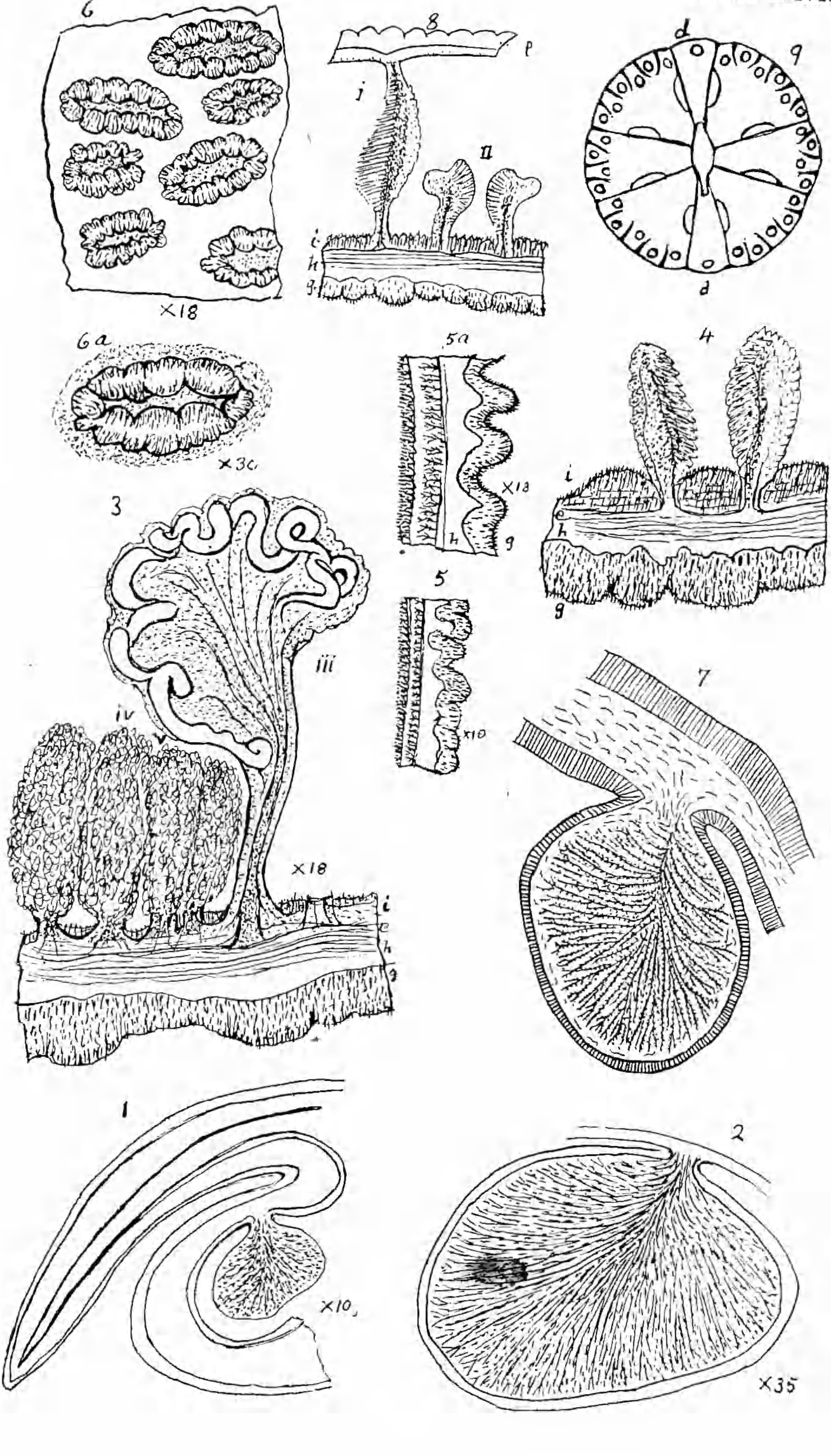
7. *Urticina crassicornis* (Ehr.) Section of the sphincter muscle. After Hargitt.

8. *Bicidiopsis arctica* Verrill. Type. Part of a thick transverse section made near the lower part of the stomodæum (P.), showing a perfect mesentery (i) and a pair of the imperfect ones deprived of gonads. Lettering as in fig. 3. From a Hudson bay specimen.

9. *Edwardsiella sipunculoides* (Stimpson). A diagrammatical section near the disk showing the arrangement of the rudimentary mesenteries and bases of the tentacles; d, d, directives. After Torrey, from an Alaskan specimen.

All the figures, except 7 and 9, were made by the author from rather thick sections, mounted in glycerine-jelly, to avoid more shrinkage.

PLATE XXVI.


6
×18
8
e
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ii
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d
9
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6a
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4
i
h
g
3
iii
iv
×18
i
e
h
g
5
×10
7
1
×10
2
×35

PLATE XXVII.

Fig. 1. *Actinauge rugosa* Verrill. New species. Longitudinal section. Enlarged. cp, infolded capitulum: a, a, tentacles: e, sphincter muscle; d, f, verrucæ or tubercles; o, stomodæum; p, wall of stomodæum; n, its external layer; m, s, 1-4, perfect mesenteries of 1 to 4 pairs; r, a pair of primary perfect mesenteries; g, ectoderm of body wall; i, endoderm; n, mesoglœa; c, circular muscles of body-wall; 1, 1, gonads and mesenterial filaments; b, sufrace of base; t, section of base; x about 2.

2. *Actinauge verrillii* McMurrich. Longitudinal section of a rather small specimen, enclosing a ball of mud (s) in the bulbous base. Lettering as in Fig. 1, with the addition of b, tentacle lobe; m, mouth lobes; k, section of disk; v, opening of the bulbous base; x about 1½. Drawings by A. H. Verrill.

PLATE No XXVII.

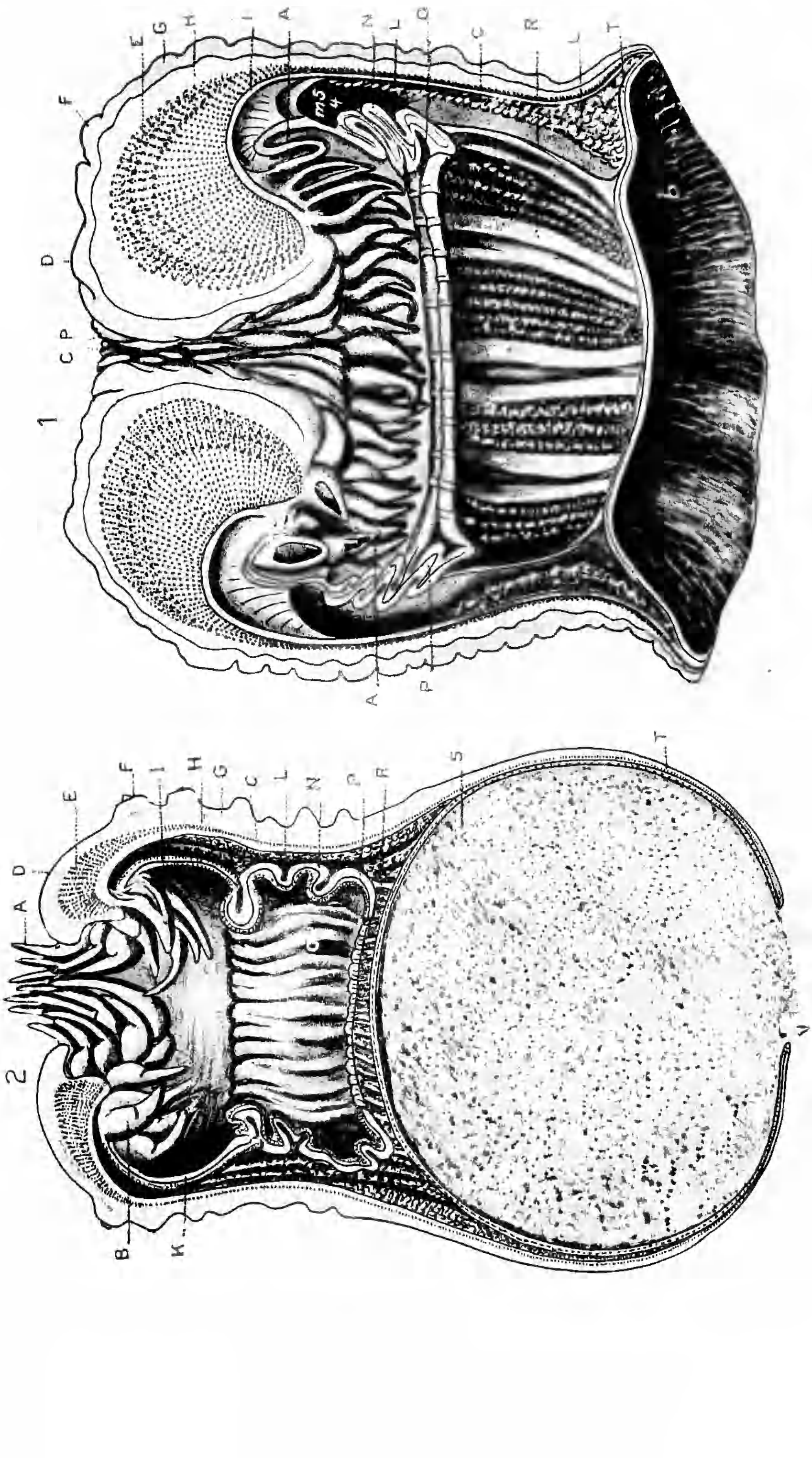


PLATE XXVIII.

Fig. 1. *Stephanauge nexilis* Verrill. Cotype. Longitudinal section, from a photograph; x about 2.
2. The same. Another specimen. Transverse section across the upper part, cutting the inner part of the retracted disk and invected tentacles.
3. The same specimen. A section made a little lower down.
4. The same specimen. A section made still lower down, x 2. By the author.

PLATE XXVIII.

PLATE XXIX.

Fig. 1. *Urticina columbiana.* New species. Partly contracted. About $\frac{2}{3}$ natural size.
2. The same specimen. View of expanded disk and tentacles from a living specimen. About $\frac{2}{3}$ natural size. Both drawn in colors by Mr. J. G. Swan.

Colour of body bright red, with pale yellow papillæ or suckers; tentacles lighter red; base dark red.

PLATE No XXIX.

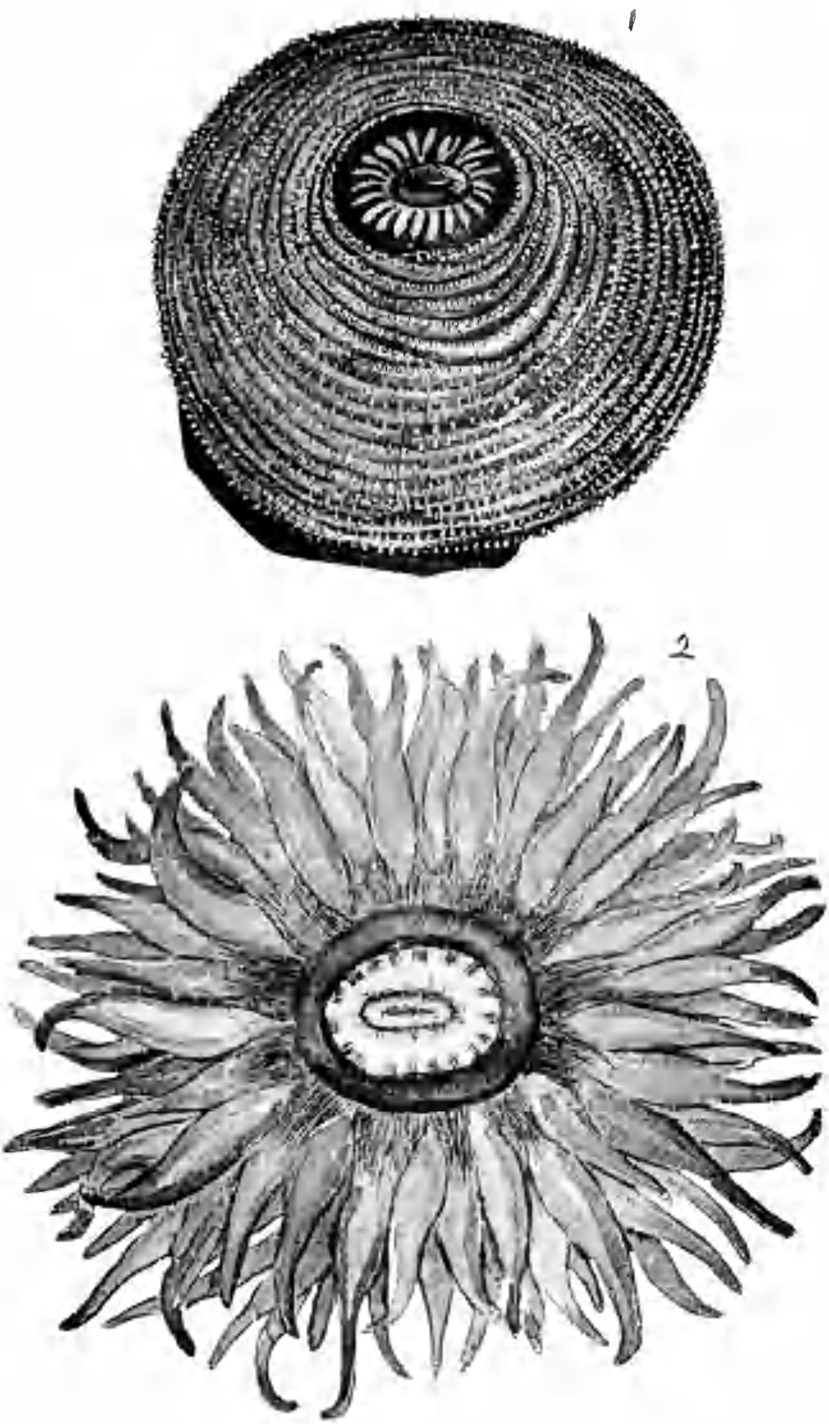


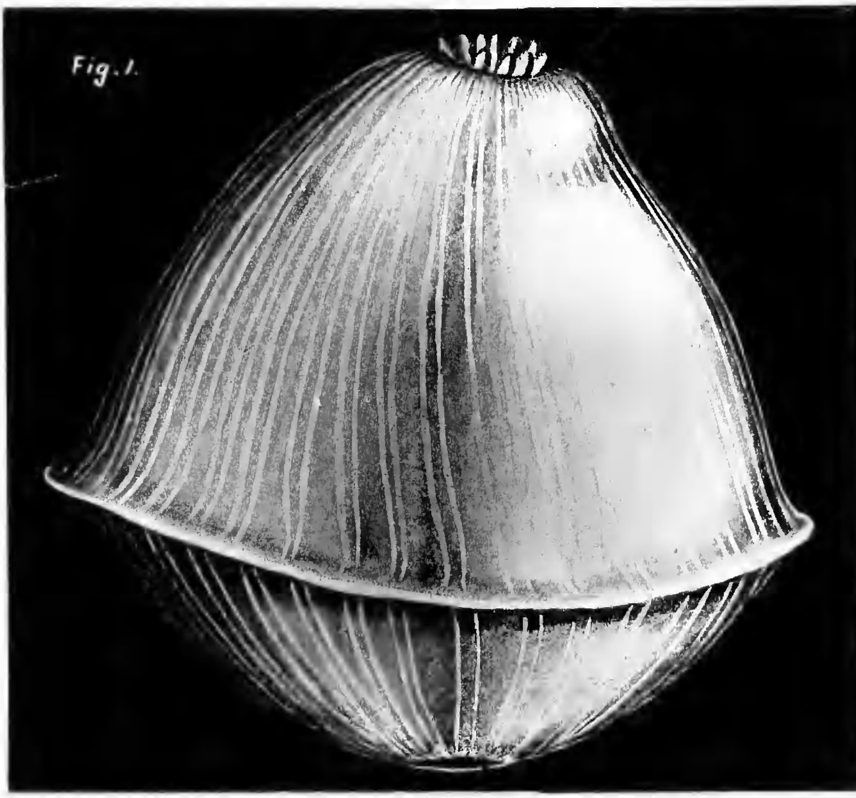
PLATE XXX.

Fig. 1. *Stomphia carneola* (Stimp.). Side view of a living specimen of a pale flesh-coloured variety, in one of the odd shapes it often takes. From Bay of Fundy. By J. H. Emerton, natural size. Colour, pink, translucent.

2. *Actinauge verrillii* McMur. View of the upper part showing the capitulum (c); verrucæ (v, v,); tentacle lobes (l); and tentacles (t). Enlarged. Drawing by A. H. Verrill.

3. *Stephanauge nexilis* Verrill. Type; transverse section near the disk; 1-1, 6 primary pairs of mesenteries; d, d, directives; P, stomodæum; s, s, siphonoglyphs; g, ectoderm; h, mesoglœa; i, endoderm. Enlarged from a photograph by A. H. Verrill.

Plate No XXX.



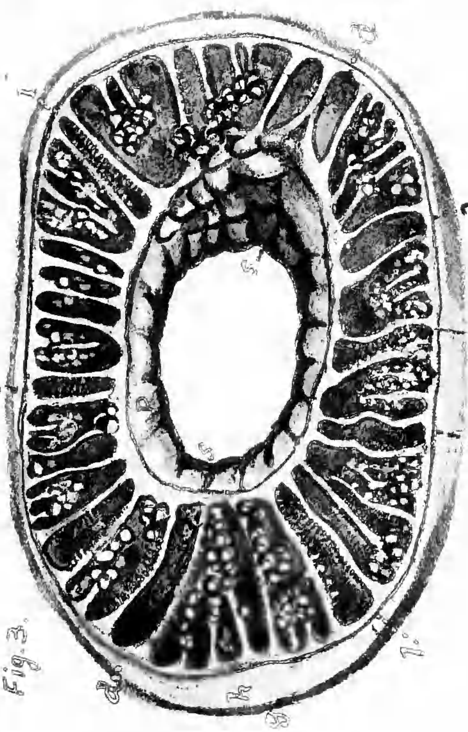


Fig. 3.

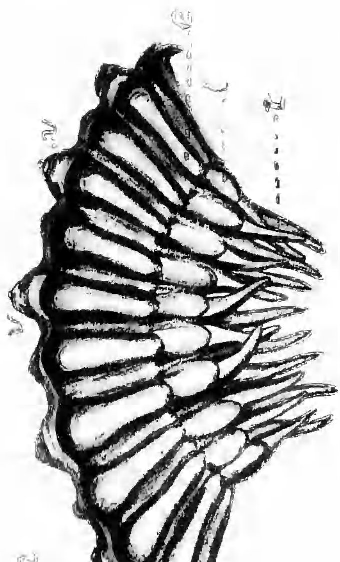


Fig 2.

PLATE XXXI.

Fig. 1. *Edwardsiella sipunculoides* (Stimpson). Side view of the upper part of the column and bases of the tentacles, from life, x about 4. By the author.

2. *Pseudophellia arctica* Verrill. Type. Side view, with part of the outer coat removed. Eggs and larvæ show near the base. By A. H. Verrill.

3. *Tealiopsis stella* Verrill. Transverse section of a perfect mesentery from a Hudson bay specimen; m, longitudinal muscle; b, basal muscle; i, endoderm; p, outside of stomodæum. By the author.

4. *Halcampa* (?) *anomala* Verrill. New. Side view of the type, from life; x about 4; b, one of the branched tentacles more enlarged. By the author.

5. *Urticina crassicornis* Ehr. Transverse section of a tentacle; g, ectoderm; h, mesoglœa; i, endoderm; l, muscle lamellæ, after McMurrich. Much enlarged.

6. *Metridium dianthus* (Ellis). From a photograph of a small living specimen. Somewhat enlarged.

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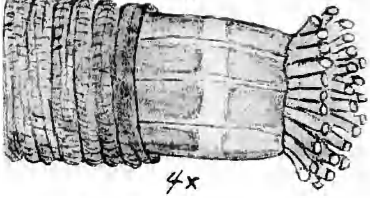

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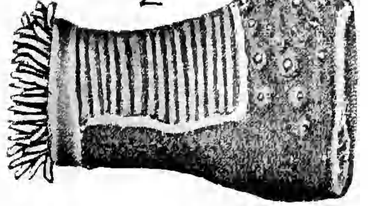

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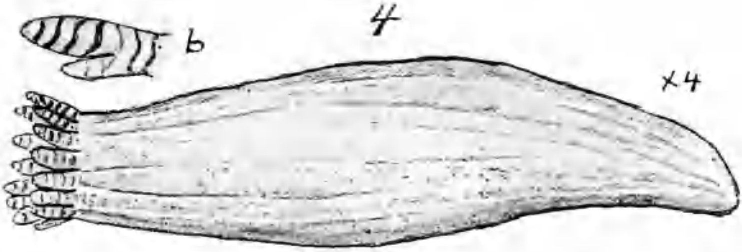

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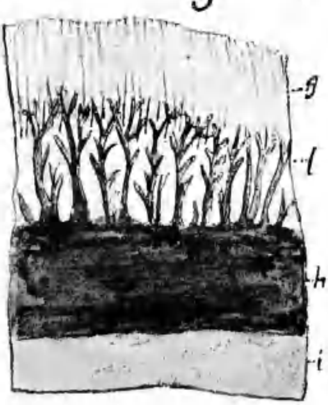

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