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Contents of Vol. V D

THE DANISH INGOLF-EXPEDITION

VOLUME V

12

ACTINIARIA

PART II

BY

OSKAR CARLGREN

WITH 6 PLATES AND 95 FIGURES IN THE TEXT

COPENHAGEN
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Preface.

It is now about twenty years since the first part of the report of The Ingolf-Actiniaria was published. Several circumstances have retarded the publication of the second part, I think, however, that this delay has not been altogether a loss. On the contrary, our knowledge of the forms provided with acontia has increased during the interval, especially since the systematization of the nematocysts has been carried out. I have here followed the classification proposed by Weill (1935), but somewhat modified by me (1940), of the nematocysts. As I have previously pointed out, it is sometimes difficult to distinguish especially the microbasic p-mastigophors from the microbasic amastigophors in preserved material, but I think that, in the main, my determination of the types is correct. In this connection I will note that the breadth of the nematocysts was given as somewhat too small in part I of the Ingolf-Actiniaria, because I then used too low a magnification. In this part I have described several species new to science, some of them not belonging to the Acontiaria. The latter have been added in an Appendix. Several species only very shortly characterized by me (1928, 1940) have here been given a more detailed description.

I have written this paper according to nearly same plan I have indicated in 1921 in the first report of the Actiniaria of the Ingolf expedition.

I. Description of the species.

Subtribus Acontiaria.

Nynantheae the pedal disc of which is provided with basilar muscles and acontia or organs like acontia. Sphincter usually mesogloeal.

Family Bathyphelliidae.

Acontiaria, the acontia of which carry only basitrichs. Mesenteries differentiated into macro- and microcnemes. Sphincter mesogloeal.

I proposed this family in 1932 for the genera *Bathyphellia*, *Acraspedanthus* and *Phelliogeton*.

Genus **Bathyphellia** Carlgr.

Bathyphelliidae with broad pedal disc. Column divisible into scapus and scapulus, the former with cuticle and tenaculi. Sphincter strong, mesogloeal. Tentacles hexamerously arranged, fewer than the mesenteries. Longitudinal muscles of tentacles and radial muscles of oral disc ectodermal. Two siphonoglyphs. Mesenteries hexamerously arranged, those of the last cycle growing from the aboral end upwards. 6 pairs perfect, 2 pairs of directives. Only the perfect pairs fertile and provided with filaments and acontia. Retractors of the perfect mesenteries concentrated, also present but weak on the stronger imperfect mesenteries. Nematocysts of the acontia only basitrichs. Cnidom: spirocysts, basitrichs, microbasic *p*-mastigophors.

Type and single known species. *B. margaritacea*.

The genus is easily distinguished from *Acraspedanthus* Carlgr., which has a smooth column and more mesenteries in the distal than in the proximal part, and from *Phelliogeton* Carlgr., the indistinct scapus of which lacks cuticle and tenaculi. It cannot be identical either with *Paraphellia* Hadd., which also is devoid of a cuticle and has the mesenteries of the second and third order fertile, or with the imperfectly known *Euphellia* Pax, which according to Pax is provided with cinclides in longitudinal rows, or with *Cataphellia* Stephenson, which also has cinclides and comes near *Hormathia*. *Phellia*, *Isophellia* Carlgr. and probably *Decaphellia* Bourne belong to the Sagartiidae and Isophelliidae inasmuch as the acontia contain microbasic amastigophors as well as basitrichs.

Bathyphellia margaritacea (Dan.).

Pl. III fig. 10

Phellia margaritacea n. sp. Danielssen 1890 p. 51, Pl. 3 fig. 7, Pl. 12 figs. 6–12, Carlgren 1928 p. 258, 300.
Bathyphellia margaritacea (Dan.) Carlgren 1932 p. 262.

Diagnosis: Body cylindrical, in expanded state somewhat higher than broad, in contracted state of about same length and breadth. Column divisible into scapus and scapulus, without cinclides but with tenaculi. Sphincter very strong, broad, alveolar, not stratified, perfectly separated from the endodermal muscles of the column, its muscle meshes narrow, in its uppermost part larger. Tentacles cylindrical, rather short, in number between 24 and 36, hexamerously arranged, the last cycle incomplete. Longitudinal muscles of tentacles and radial muscles of oral disc ectodermal. Pairs of mesenteries arranged in 2 or 3 cycles, the third cycle incomplete. Only the first 6 pairs perfect, fertile and provided with filaments and acontia. Retractors of the perfect mesenteries [illegible] at the part of [illegible] Mesenteries of the [illegible] with weak [illegible] Nematocysts [illegible] of the tentacles [illegible] partly 24–31 [illegible] 12–4 μ, microbasic [illegible] 10–14 × about 2 μ, [illegible] basic p-mastigophors, [illegible] Spirocysts of ten-

[illegible] covered with a [illegible] with somewhat [illegible] base, the uppermost [illegible] DANIELSSEN).

[illegible] Length of the column [illegible] 18 cm, and at the margin 1 cm [illegible] contracted state up to 1 cm

[illegible] Norw. Deep Sea 78° 19′ N, 8° 11′ W, 2700 m. [illegible] 1898 No. 26 77° 58′ N, 5° 10′ E, 2138 m. [illegible] N. A. exp. St. 363 several specimens; [illegible] N, [illegible] W, 27[illegible] (Swedish Spitzberg exp. 1898 No. 27); [illegible] N, [illegible] W, 17[illegible] (Swedish Spitzberg exp. 1898 No. 28); [illegible] N, [illegible] E, 2[illegible] Bottomtemp. [illegible] 1.6° (Norw. N. A. exp. [illegible] 72° 42′ N, 14° 10′ W, 2000 m (Kolthoff exp. 1900 St. 29); [illegible] N, [illegible] W, 2[illegible] (Kolthoff exp. 1900 St. 13); 71° 59′ N, [illegible] E, 2[illegible] Bottomtemp. [illegible] 1.3° (Norw. N. A. exp. St. 295); [illegible] N, 7° [illegible] W, 2[illegible] Bottomtemp. [illegible] 1° (Ingolf exp. St. 113) [illegible] 66° 15′ N, 8° 23′ W, 1889 m. Bottomtemp. [illegible] St. 117; [illegible] 67° 14′ N, 8° 18′ W, 1619 m. [illegible] Ingolf exp. St. 111 numerous specimens; [illegible] N, 7° 2[illegible] W, 18[illegible] Bottomtemp. [illegible] 1.1° (Ingolf exp. St. [illegible] 6[illegible]° 53′ N, 6° 22′ W, 1960 m. Bottomtemp. [illegible] M[illegible] 1900 St. [illegible]. Fig. 93 shows the distribution [illegible]

[illegible] The oral disc provided with a cuticle, is [illegible] attached to a stone or to shells (e. g. of [illegible] and incrusted with *Globi-* [illegible] greater than the column. The column [illegible] more or less cylindrical, in contracted

[illegible] part of the scapus with [illegible]

[illegible] capitulum and scapulus, [illegible] which are not very [illegible] between the papillae [illegible] at the incrustations [illegible] of the scapus [illegible] considerably [illegible] scapulus is rather

long[illegible] and in the contracted state longitudinally sulcated. The number of the tentacles varies between 24 and 36. The specimens examined had 24 tentacles, one 28 and one (the largest specimen) 36. DANIELSSEN states, that there were 24 [illegible] 24 tentacles, but this statement is probably incorrect. At least the species is sexually ripe in a stadium with 26, probably 24 tentacles. The arrangement of the tentacles is hexamerous, the cycles are, however, closely set, so that it seems as if the tentacles were arranged only in two cycles, at least in contracted specimens. The tentacles are devoid of swellings at their bases, in the contracted state cylindrical and rather short (in the expanded state "about the same in length as the breadth of the oral disc" DANIELSSEN). The oral disc is rather wide and furnished with rather indistinct, radial furrows. The actinopharynx is more or less folded according to the state of contraction, of ordinary length and provided with 2 siphonoglyphs symmetrically arranged. There are no distinct gonidial tubercles.

Fig. 2. *Bathyphellia margaritacea*. Sphincter.

Anatomical description: The ectoderm of the scapus is rather high, except in the tenaculi, the mesogloea rather thick, in the sphincter region considerably thickened. The mesogloea-cells are small and poor in protoplasma. The endodermal circular muscles are weak, on the other hand the sphincter (textfig. 2) is very strong and elongated so that its proximal part is situated in the scapus. It fills up most of the breadth of the thickened mesogloea and is alveolar. It is neither stratified nor concentrated, but decreases rapidly in its undermost part and is wholly separated from the endodermal circular muscles of the column. Its muscle meshes are narrow, in the upper- and innermost part larger and show a tendency to be drawn out in a radial direction. The ectoderm of the scapulus is of ordinary height and contains nematocysts

17–19 × about 2 μ in size. Moreover I have, in the maceration preparations, found nematocysts and spirocysts of same size as those of the tentacles but these capsules belonged probably not to the scapulus but were stuck on the drawn in tentacles.

The ectoderm of the tentacles is high and provided with rather numerous nematocysts and very numerous spirocysts. The ectodermal, longitudinal muscles of the tentacles are weak at the outside of their bases, at the inside considerably stronger. Here the folds of the muscle lamella reach about the same thickness as the mesogloea. In the upper part of the tentacles the muscles are about equally developed on both sides. The radial muscles of the oral disc are ectodermal, weak in the inner part of the disc as also in the radial furrows, somewhat stronger between the furrows. The ectoderm of the actinopharynx is considerably higher than that of the oral disc. The actinopharynx is devoid of longitudinal muscles, its mesogloea is thinner than its ectoderm, in the 2 siphonoglyphs thickened.

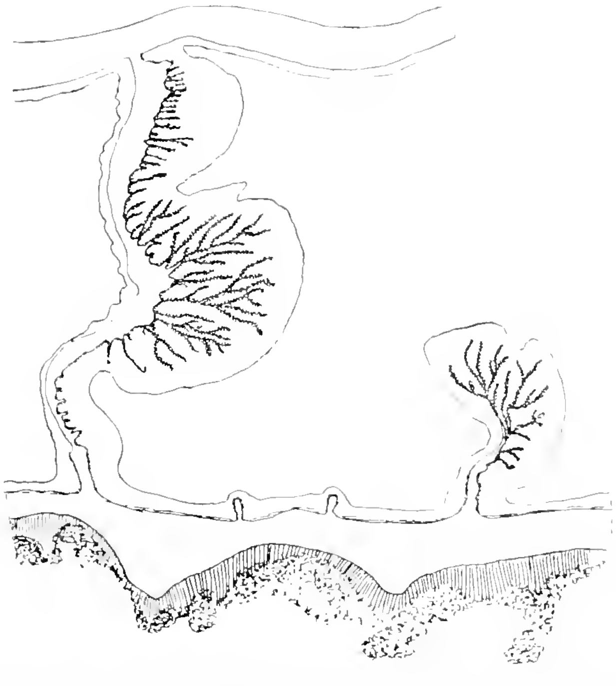

Fig. 3. *Bathyphellia margaritacea.* Cross-section of a directive mesentery and of one mesentery of the second and two of the third order in the lower part of the actinopharynx.

The mesenteries are hexamerously arranged in 2 or 3 cycles, of which the third is incomplete, as a rule usually consisting of a few pairs some of which reach the distal end of the body. In one specimen with 26 tentacles I have counted, however, about 18 mesenteries at the base. The exocoels, in which the mesenteries of the third order arise, do not correspond in the specimens. The 6 first pairs of mesenteries are perfect, the others imperfect. The longitudinal muscles of the perfect mesenteries form distinct retractors. In the uppermost part of the mesenteries they are concentrated and have high folds, in the aboral part of the actinopharynx and below it the pennons are more diffuse with the highest folds in the outer part of the mesenteries. Also the mesenteries of the second order, and rarely the strongest mesenteries of the third, are provided with rounded but weak retractors as seen in cross-sections. Usually the mesenteries of the third order are very weak and project only a little beyond the surface of the endoderm. In textfig. 3 I have drawn one directive, one mesentery of the second order and 2 mesenteries of the third at the level of the lower part of the actinopharynx. The parietobasilar and basilar muscles are weak. Only the mesenteries of the first cycle have filaments, acontia and reproductive organs. The ciliated tracts of the filaments are well developed, as also the acontia.

Genus **Daontesia** nov. gen.

Bathyphelliidae divisible into scapus and capitulum. Scapus with tenaculi and with cinclides at the limbus. Sphincter strong. Tentacles not numerous, hexamerously arranged, as numerous as the mesenteries. Two siphonoglyphs and 2 pairs of directives. Perfect pairs of mesenteries 12, provided with filaments. At least the mesenteries of the first cycle fertile. Retractors diffuse, strong. Cnidom: spirocysts, microbasic *p*-mastigophors, basitrichs.

I have previously referred the species described below to the genus *Sagartiogeton*. It recalls in some respects also *Kadosactis* but several masceration preparations, as well as sections of isolated parts of the acontia, have shown that only basitrichs were present in these organs, wherefore the genus must be united either with the family Hormathiidae or the family Bathyphelliidae. Because the mesenteries of the third cycle are well developed but, as it seems, lack filaments and acontia, I refer the genus to the latter family though it shows a certain relation to *Chondrophellia*, a Hormathiid. In fact the genus forms a link between the typical forms provided with macro- and microcnemes and those the mesenteries of which are not so differentiated. Such transitional forms exist also between the families Isophelliidae and Sagartiidae.

Daontesia praelonga (Carlgr.).

Pl. III fig. 1. Pl. V fig. 1.

Sagartiogeton praelongus n. sp. CARLGREN 1928 p. 259, 302.

Diagnosis: Body elongated. Tenaculi of the scapus very close set, very numerous, especially in the upper part of the scapus. Their cuticle multistratified, giving the scapus a shaggy appearence. Cinclides at the limbus probably arranged in longitudinal rows. Sphincter strong, alveolar. Tentacles and mesenteries about 48, hexamerously arranged. Two siphonoglyphs and 2 pairs of directives. Perfect pairs of mesenteries 12. Inner parts of the mesenteries curved towards the exocoels, those of the directives towards the endocoels. Retractors of the mesenteries diffuse, strong, especially those of the perfect pairs, with numerous high folds. Parietobasilar muscles weak. Only the perfect pairs provided with filaments. Dioecious. Nematocysts of the scapulus 17.5–22 × about 2.8 μ, often a little curved, basitrichs, those of the tentacles 26–31 × about 2.8 μ, those of the actinopharynx partly 21–34 × 4.2–5.5 μ, microbasic *p*-mastigophors, partly 21–31 × 3.5 μ, basitrichs, those of the filaments partly 21–31 (34) × 3.5–5.5 μ, microbasic *p*-mastigophors (length of exploded shaft that of the capsule or a little shorter) partly 21–24 (28) × about 2.8 μ, partly 12–17 × 1.5–2.5 μ, both basitrichs, rare, those of the acontia 45–58 × 3.5 μ, in very small specimens 41–48 μ, basitrichs. Spirocysts of tentacles about 21 × 2.5–60 × 5.5 μ.

Colour in alcohol. Scapus dirty grey.

Dimensions in contracted state. 1) length of the body 2.2 cm, breadth 1.3 cm, inner tentacles about 0.6 cm long (RYDER leg.), 2) length of the scapus 1.6 cm, breadth of basal disc 1 cm, that of the upper part of the scapus 0.8 cm (Ingolf exp. St. 64), 3) length 0.8 breadth 0.4 cm (smallest specimen).

Occurrence: Danmark Strait 65°39′ N., 28°25′ W., 1041 m. Ryder 1888. 1 specimen. S. of Iceland 62°06′ N., 19°00′ W., 1960 m. Bottomtemp. 3.1 (Ingolf exped. St. 64) 1 specimen. E. of Iceland 65°34′ N., 7°31′ W., 1435 m. Bottomtemp. 0.8 (Ingolf exped. St. 105) 1 specimen, basal part lacking. W. of Faroe Islands 61°32′ N., 11°36′ W., 1356 m. Bottomtemp. 2.40 (Ingolf exped. St. 4) 1 specimen, basal part lacking.

The distribution of the species is given in fig. 94, p. 76.

Exterior aspect. The pedal disc of the largest specimen is to a great part torn up, that of a smaller specimen well expanded and provided with a cuticle to which mud is attached. The column [illegible] tracts the [illegible] some places [illegible] the former is [illegible] part [illegible] than but [illegible] invested [illegible] part of the sectioned [illegible] arranged in longitudinal [illegible] below, but owing to [illegible] part I have not been [illegible] part of the scapus [illegible] of ordinary length and

[illegible] the same as the mesen- [illegible] sectioned specimens, I counted [illegible] at least 50 mesenteries [illegible] 70 or somewhat fewer [illegible] rather broad at their [illegible] at least in the contracted [illegible] transversally sulcated. [illegible] the largest specimen very

[illegible]

[illegible] The two [illegible] [illegible] from the actino-

[illegible] examination [illegible] The papillae of the [illegible] the probable

chitinized ectoderm cells join the mesogloea with the cuticle in some places. These connections are, however, mostly not situated on the summit of the mesogloeal papillae but a little on the side, while the summit is provided with a very thick cuticle forming

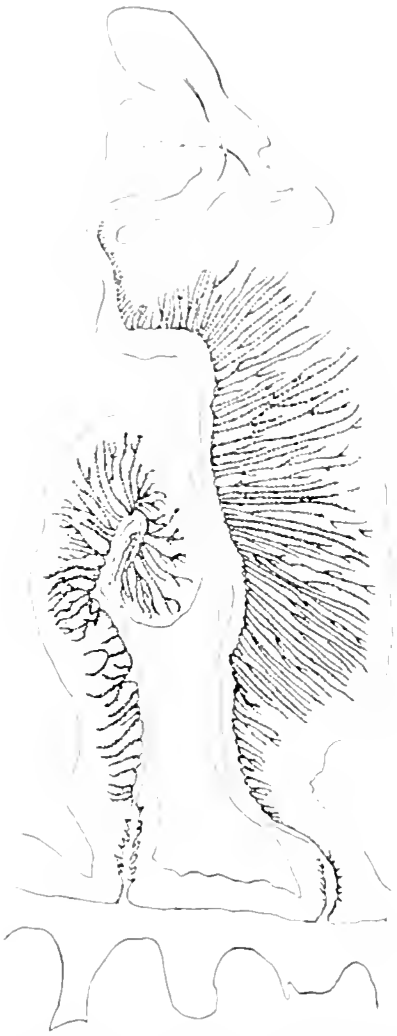

Fig. 5. *Daontesia praelonga.* Section of two mesenteries of the second and third cycles in the region of the ciliated tracts.

numerous strata. The greater part of the papillae is formed by the cuticle, whereby the papillae come to have a very characteristic appearence. In the figure 1 Pl. V, I have given a longitudinal section of some papillae with contiguous parts of the column-wall. Between the chitinized ectoderm-cells gland cells are probably intercalated, though they were torn up during sectioning. The mesogloea of the column is of ordinary thickness and extended into the papillae. The cinclides seem to be exclusively invaginations of the ectoderm. The ectoderm of the scapulus is about as thick as that of the scapus, its nematocysts numerous. The circular muscles of the column are weak, the sphincter on the other hand very strong, long and broad. It occupies the whole, strongly thickened mesogloea of the scapulus and the uppermost part of the scapus, and is wholly separated from the endodermal circular muscles of the column (fig. 4). Its muscles are small in the lowermost part, in other parts it consists of larger and smaller muscle meshes and its structure is alveolar. They are of about the same width but diminish rather rapidly proximally.

The ectoderm of the tentacles is high, its nematocysts few, its spirocysts numerous. The longitudinal muscles of the tentacles are ectodermal and developed to the usual extent. The radial muscles of the oral disc agree with the longitudinal muscles of the tentacles, and are about equally developed at the insertions of the mesenteries as between them. The ectoderm and the mesogloea of the actinopharynx is commonly of about same thickness, in the ridges, and especially in the 2 siphonoglyphs, the mesogloea is thicker. All nematocysts of the actinopharynx are broader in their basal end.

The arrangement of the mesenteries is, in the largest specimen, 6 + 6 + 12 + 1 = 25 pairs. The extra pair is situated next to the one directive pair. In a second specimen there are 24 pairs. 12 pairs are perfect in the whole tract of the actinopharynx, the others imperfect. The retractors form strong, diffuse pennons distributed over the greater part of all mesenteries, though they are considerably weaker in the mesenteries of the third cycle than in those of the others but here also fairly strong (fig. 5). The folds of the muscle lamella are very high and close set but not much branched. The inner parts of the mesenteries are curved towards the exocoels in the non-directives, towards the endocoels in the directives. The parietobasilar muscles are not strong, and form only short, rather few folds. In the larger individuals the two first cycles of mesenteries are certainly provided with filaments. On the mesenteries of the third cycle I have seen neither filaments nor acontia, though these mesenteries reach the margin. The ovaries were lost from the mesenteries in the larger specimens, in a smaller one at least the mesenteries of the first cycle were fertile.

Remarks see the genus.

Family Sagartiidae.

Acontiaria with mesogloeal sphincter. Mesenteries not differentiated into macro- and microcnemes. Their acontia provided with microbasic amastigophors and basitrichs.

Genus Sagartia.

Sagartiidae with well developed pedal disc. Column with scattered suckers (constructed as the warts but without any endodermal evaginations), capable of attaching foreign bodies. Cinclides present. Sphincter mesogloeal, fairly well developed. Tentacles fairly numerous. Longitudinal muscles of tentacles and radial muscles of oral disc ectodermal. Siphonoglyph one or two, distinct. Number of mesenteries about the same at the base as at the margin. More than 6 pairs of mesenteries perfect. No differentiation of the mesenteries into macro- and microcnemes. Retractors of the mesenteries diffuse or somewhat concentrated, never circumscribed. Gonads present on the mesenteries of first cycle onwards. Sometimes asexual reproduction. Acontia well developed. Cnidom: spirocysts, microbasic amastigophors, microbasic *p*-mastigophors, basitrichs.

Sagartia troglodytes (Price).

Pl. VI fig. 4.

Literature and synonyms see Stephenson 1935 p. 324–325, also *Sagartia troglodytes* Price Carlgren 1930 p. 4; 1939 p. 8; 1940 p. 13 figs. XIV 6–8; Pax 1936 p. 113.

Diagnosis: Pedal disc wide. Column in expanded state pillar-like, in full extension many times higher than broad, in the upper two-thirds provided with strong, adhesive suckers. Cinclides scattered, evaginations of the endoderm as well as invaginations of the ectoderm, generally the evaginations are the stronger. Sphincter strong, separated from the endodermal muscles of the column by a thin lamella, gradually diminishing downwards, in its upper part filling up almost the whole mesogloea and here reticular, in its lower part more alveolar. Tentacles conical, relatively short, hexamerously arranged, up to 192. Two distinct siphonoglyphs. Mesenteries hexamerously arranged, up to 192, 2 pairs of directives. At least 12 pairs perfect. Retractors of the mesenteries diffuse, bandlike with comparatively low folds, directive retractors concentrated. Parietobasilar muscles fairly well developed, basilar muscles weak but distinct. Acontia very slender, emitted only on strong stimulation, with small nematocysts. Never asexual reproduction. Nematocysts of the column partly 11–12 × 2 μ, basitrichs, partly 12–17 × 3.5–4 μ microbasic amastigophors, those of the tentacles partly 10–22 × 2–2.5 μ, basitrichs, partly 14–17 × 2.5–3 μ, few, microbasic amastigophors, those of the actinopharynx partly 22–24 × 4–4.5 μ, microbasic *p*-mastigophors partly 22–27 × about 2.5 μ, basitrichs, those of the filaments partly 12–21 × 1.5–5 μ, microbasic *p*-mastigophors, partly 17–20 × 2–2.5 μ, basitrichs, those of the acontia partly 17–29 × 3.5–about 4 μ, microbasic amastigophors, partly 12–17 × 1.5–2 μ, basitrichs. Spirocysts of tentacles up to about 22.6 × 3.5 μ.

Colour very variable (see Gosse (1860) and Stephenson (1935)). The individuals from Bohuslän are usually coloured as follows. Column pale salmon red, in its upper part greyish or greenish with pale suckers and white longitudinal bands most conspicuous at the base, where longer bands alternate with shorter ones. Cinclides without coloured annulus. Tentacles seldom opaque white, greyish, sometimes with a longitudinal, brownish or olive-green band on each side and with two or three cross-bands of yellowish-white. At the base of the stronger tentacles a distinct B-mark of more or less deep-black colour; at the base of the outer tentacles only a black spot. Oral disc greyish to greyish-black with thin ochre coloured, longitudinal lines and white cross-lines. In the middle of each radius of the two or three oldest cycles a white patch. The colour-variety *melanoleuca* of Gosse is not rare on the Swedish west coast.

Size: height 4 cm or more, diameter of base 3.4 cm, of disc 2 cm (Stephenson 1935). The individuals from the Scandinavian waters seem not to reach the size of those from Great Britain.

Occurrence: Iceland: Heimaey, Vestmannaeyar, Grindavik, Keflavik.

Faroe Islands: Trangisvaag (Fjeldstrup).

Norway: Skluna: Bessahorne; Vallersund, Lersvik, low water (Dons); Svalbardvagen, Titran, low-water (Dons); Trondheim fjord: Brisund among see-weed, low-water (E. Pettersson); Rognvaldsvag low-water (Dons); Herdla, low-water (Carlgren).

Sweden. Bohuslän. Gullmaren: N.V. of Flatholmen (Bock); Gasvik; Strommarne, a few metres (Carlgren and others), between Kallsö and Vargo 11–12 m (Wahrberg and Eliasson).

Denmark: Limfjord: Livo Bredning (Petersen); west of Fur (Carlgren); N. of Hanstholm 57° 21' N. 8° 38' E. 33 m. (Dana). Frederikshavn 8 m (Kramp); N. of Borrebjerg bank 8 m, Marens bank (Kramp); Hirtsholms north-west bank 2–3 m (Kramp). Hellebæk (Mortensen 1910); (N. of Faeno 30 m (Carlgren 1929), mouth of Koldingfjord 14 m (Carlgren 1929): the occurrence of the specimens in the two latter localities is somewhat dubious as I cannot find any proof of them.)

Further distribution: North Sea, coast of Great Britain and Ireland. Atlantic coast of France. Probably also the Mediterranean.

Exterior aspect: The pedal disc is wide, not undulated, the body conical, in strong extension pillar like and then considerably higher than broad. The column is, in its upper part, provided with [illegible] only outside the [illegible] of the mesenteries [illegible] is fastened, and the [illegible] The margin is [illegible] relatively short in com[illegible] and hexamerously [illegible] (Gosse). The oral disc [illegible] numerous longitudinal [illegible] siphonoglyphs.

[illegible] The ectoderm of the column is [illegible] cells. The structure of [illegible] as in *Isaba, Bunodactis* [illegible] takes no part in the [illegible] Pl. VI [illegible] The cinclides are partly [illegible] partly invaginations of the ecto[illegible] form the canal to about same ex[illegible] part of the canal is covered by the [illegible] circular muscles of the column are [illegible] The sphincter is strong, separated from the [illegible] column by a thin lamella of the mesogloea. [illegible] part it fills up almost the whole mesogloea, [illegible] gradually. Its structure is reticular, especi[illegible] part, sometimes the lower part is more alveolar. [illegible] radial muscles of the oral disc are strong.

[illegible] are hexamerously arranged with two pairs of [illegible] individuals examined). At least 12 pairs are perfect. [illegible] of the stronger mesenteries are band-like and diffuse, [illegible] height and often a little branched, some[illegible] retractors of the directives are a little concentrated. The [illegible] muscles show few folds, but are, at least in larger [illegible] situated on a shelf of the mesogloea. The basilar [illegible] are weak but distinct. All stronger mesenteries are fertile. [illegible] are very thin, but long.

[illegible] never observed asexual reproduction in this species. [illegible] from the Swedish coast seem to be oviparous. In [illegible] individual from Titran (Norway) there were, however, embryos [illegible] coelenteric cavity.

The species is easily recognised by the scattered adhesive [illegible] and above all by the thin acontia, the nematocysts of [illegible] are very small (the microbasic amastigophors never longer [illegible] 12 individuals examined). As to the appearance of the [illegible] see CARLGREN 1940 p. 43. For further details of ex[illegible] and colour see STEPHENSON 1935.

Remarks: This species is often confounded with other *Sagartia*[illegible] and with *Cereus pedunculatus* (*Heliactis bellis*) and vice [illegible] It is at present impossible to state if it occurs in the Me[illegible] VON HEIDERS *S. troglodytes* from Triest is a *Cereus*. [illegible] short description 1880 of his *troglodytes* from Marseilles [illegible] information that he has examined this species.

Sagartia elegans (Dal.)

[illegible] literature see STEPHENSON 1935 p. 306, also [illegible] CARLGREN 1924 p. 27.

[illegible] CARLGREN 1929 p. [illegible] PAX 1936 p. 112 fig. 68.

[illegible] Column with scattered suckers [illegible] upper part. Cinclides present in the upper [illegible] at the limbus. Upper cinclides princip[illegible] lower ones invaginations of [illegible] a little undulated and overhanging. [illegible] reticular orally, in smaller individ[illegible] separated from the endodermal [illegible] diminishing downwards, in its [illegible] whole breadth of the mesogloea. [illegible] up to about 192 hexamer[illegible] The longitudinal muscles of tentacles and radial muscles of oral disc ectodermal. Actinopharynx with longitudinal ridges. One siphonoglyph or two. Three cycles of mesenteries perfect in regular specimens. One pair of directives or two. Retractors of mesenteries diffuse, forming a band about in the middle of the mesenteries, provided with fairly low folds on the non-directives. The three first cycles of mesenteries fertile. Asexual reproduction by fragmentation (tearing). Acontia thick and very numerous, after stimulation rapidly ejected from the mouth and the cinclides. Nematocysts of the column partly 18.3–24.5 × 3.5–4.5 μ, often curved, microbasic amastigophors, partly 18.3–21.5 × 2.8–3 μ, basitrichs, those of the tentacles partly 24–29 × about 4.2 μ, microbasic amastigophors, partly (17) 24–28 × 2.8 μ, basitrichs, those of the actinopharynx partly 19–25 × 4.2–5 μ microbasic *p*-mastigophors, partly 24–35 × 3 μ, basitrichs, partly 14.5–18.3 × 4.2–5.6 μ microbasic amastigophors sparse, those of the filaments partly 20–25.4 × 4.2 μ microbasic *p*-mastigophors, partly 8–11 × 1.5 basitrichs, rare, those of the acontia, partly (39) 41–77 (80) × (4.5) 5–7 μ, microbasic amastigophors, partly (21) 24–41 × 2.8–4.2 μ, basitrichs. Spirocysts of the tentacles 19 × 2 – about 28 × 4.5 μ.

Colour of an individual from Bohuslän: Column brick-red with white suckers, at the base white longitudinal lines. Outer tentacles at the base orange-coloured, otherwise blackish violet with one white cross-band and white to yellowish-white apex, inner tentacles brownish-grey with two white bands and yellowish-white apex, at the base a rather distinct B mark, inwards on the oral disc a white zone and over the stronger endocoels a ring of white spots about in the middle of the disc. Actinopharynx shading in orange. Another specimen from Bohuslän had the column brownish-yellow but at the limbus flesh-coloured, the suckers were uncoloured, the tentacles coloured as the former specimen, but the orange colour very indistinct on the outer tentacles. An individual from Ulvesund had the column salmon red, in stronger contraction shading into orange with light suckers, the uppermost part of the column was violet-grey. The outer tentacles had at their base a small, indistinct yellowish-white zone (sometimes not present), the most part of them was orange coloured, the apex was greyish shading into violet. The inner tentacles were light grey shading into violet, in more contracted state blackish violet with 3 yellowish cross-band. At the base of the tentacles there was a violet-black, triangular spot, more distinct in contracted state (no distinct B mark present). The oral disc was flesh-coloured powdered with violet-grey to violet-black, sometimes with irregularly arranged small, white spots. The actinopharynx was flesh-coloured. The colour of this species is very variable, see GOSSE (1860), NAFILYAN (1912) and STEPHENSON (1935).

Dimensions at least up to 3.8 cm at the base and 1.5 cm at the margin (STEPHENSON 1935). All Scandinavian individuals were smaller.

Occurrence: Iceland: Vestmannaeyar at the beach. Rockall 185 m (*Sagartia rockalliensis*). Norway: Hjeltefjord; Ulvesund and Ösund, a few metres, on Laminaria (Carlgren); Gullöy, Solsvik, littoral (Dons); Skagerrak: mouth of Gullmarfjord, Smedjan 30 m (Carlgren); Kattegat: S.E. of Store Middelgrund 30 m "Akka" St. 153, N.W. of Hallands Väderö 30 m ("Akka" St. 164); S.W. of Hesselö 22 m ("Akka" St. 159); N.W. of Kullen 30 m ("Akka" St. 160); off Aalsgaarde (Kramp); off Hellebæk, 24 fms. (Mortensen). Helgoland (Carlgren).

Distribution: Kattegat, Skagerrak, the North Sea, the south west coast of Iceland, British Isles, Atlantic coast of France, the Mediterranean.

Exterior aspect: The column is conical or more cylindrical in connection with different state of contraction. The cinclides seem to vary from 1 up to 5 in the compartments, the former from the weakest endocoels, the latter from the strongest. The tentacles are shorter than those of *Sagartiogeton viduatus*, *undatus* and *anguicomus*. The oral disc is wide. There is often a single siphonoglyph, sometimes two. Moreover see the diagnosis.

Anatomical description: The anatomy of this species is previously described by F. DIXON (1888) and by STEPHENSON (1920), wherefore I have not much to add. The suckers of the high ectoderm seem to be of the same structure as those of *S. troglodytes*, though they are weaker and seldom used for adherence. The sphincter is reticular in older individuals.

The mesenteries are in regular specimens arranged hexamerously and up to 192 in number. Often their arrangement is irregular. Characteristic of this species is that often only a single directive pair is present. As the asexual reproduction takes place here in the same manner as in *Metridium* viz. by "tearing" (STEPHENSON) of pieces from the limbus, the presence of a single directive pair is probably due to the persistence of old mesenteries in the lacerated pieces (see CARLGREN 1904, 1909). F. DIXON has examined in all 40 individuals, of which 8 were provided with a single siphonoglyph. Of 6 examples dissected by myself, 2 had two pairs of directives the others only one pair. An individual (from Ulvesund) was a double animal with more than 200 tentacles and with two mouths but only one oral disc showing uncommonly strong undulation for this species. The one mouth and the corresponding throat were smaller than the others. Only one directive pair joined the smaller throat, while 2 directive pairs were attached to the larger one. The perfect pairs vary in number, in regular individuals usually 3 cycles of mesenteries are perfect, in irregular ones there can be more or less than 24 perfect pairs. The retractors are band-like, diffuse, in the directives somewhat more concentrated, with richly branched folds. The parietal muscles are weak and not folded, the basilar muscles fairly well developed. The acontia are thick. I have examined the nematocysts of the acontia in 34 (33) individuals from different localities (Iceland, Helgoland, Norway, Sweden, and Denmark). The length of the microbasic amastigophors varied in 34 specimens between 47 and 77 µ, the average size of all was 57.54. STEPHENSON has examined 12 acontia, he found the average length of the amastigophors to be 53.93 µ. The basitrichs varied in 33 specimens between 26 and 44 µ, the average length of all was 33.3, in STEPHENSON's specimens 33.4, thus a good agreement.

Remarks: I think that *Sagartia rockaliensis* described by me 1924 is identical with *S. elegans*. I have (1935 p. 6) also described *elegans* from the Mediterranean (the gulf of Genoa). Possibly it belongs to another *Sagartia*-species though there was good agreement as to the size of the nematocysts of the acontia with those of *S. elegans*.

Genus **Kadosactis** Dan.

Diagnosis: Pedal disc well developed, with a cuticle. Column divisible into scapus and scapulus, the former with a cuticle, usually easily deciduous, and with tenaculi rarely very weak, usually strong with a stratified cuticle. Column with cinclides formed by the ecto- as well as by the endoderm and situated in various places, sometimes in reduction. Margin more or less distinct. Sphincter strong, mesogloeal. Tentacles of variable length, conical, hexamerously or irregularly arranged. Outer tentacles with or without basal thickenings on the outside. Number of tentacles usually fewer than that of the mesenteries. Longitudinal muscles of the tentacles ectodermal, at the base stronger on the inside than on the outside. Radial muscles of oral disc ectodermal. 1 or 2 up to 4 siphonoglyphs, 1–4 pairs of directives. Arrangement of the mesenteries hexamerous or irregular. At least 6 pairs of mesenteries, usually 12 or more perfect. Mesenteries growing from the limbus towards the margin. Perfect mesenteries and sometimes the strongest imperfect with strong diffuse retractors, extended over the whole surface and never concentrated, nor circumscript and provided with filaments and reproductive organs. Paritobasilar muscles not strong. The stronger mesenteries, not the directives, fertile. Acontia well developed, their nematocysts microbasic amastigophors and basitrichs, the former often very large. Cnidom: spirocysts, microbasic *p*-mastigophors, microbasic amastigophors, basitrichs.

As I have previously pointed out it is not necessary to set up a distinct family for this genus (compare STEPHENSON 1929 p. 194 and CARLGREN 1933 p. 21). The genus is related to *Phellia* but separated from it among other features by the presence of cinclides and a different structure of the tenaculi, which sometimes are very small and not rarely visible to the naked eye as in *K.* (*Sagartiogeton*) *antarcticus*. As to the subgenus *Kadosanthus*, proposed by me 1934 for *K. sulcatus*, differing from the typical *Kadosactis*-species in the presence of large tubercle-like formations, it is questionable, if the tenaculi are wholly reduced. As, however, the ectoderm of the column was wholly lost and the species was taken in very deep water, it is probable, that the rubbing of the clay against the animal during the dredging had removed every trace of the tenaculi, which at any rate may have been very small.

STEPHENSON (1935 p. 358) thinks that it may be necessary to unite the genera *Kadosactis* and *Actinothoe* because some species referred to *Actinothoe* are provided with tenaculi in conformity with *Kadosactis*. I think it is impossible to refer, for inst., the type of *Actinothoe*, *A. sphyrodeta*, a very delicate species, to the robust species of *Kadosactis* here named. Already the type of *Kadosactis*, *K. rosea*, is against such an opposition. For inst., the thin tentacles in *Actinothoe* are very different from the thick tentacles of *Kadosactis rosea*, which moreover are provided with thick mesogloeal swellings on their outside. The retractors of the mesenteries have also another appearance in the two genera. True, *Actinothoe undata* has more mesenteries at the base than at the margin in conformity with *Kadosactis* but there is, however, a real difference. In *Kadosactis* the mesenteries grow from the base towards the distal part of the column, in *undata* from the limbus as well from the margin, though the mesenteries originate earlier at the base than at the margin (see *Sagartiogeton undatus*). Therefore I think that these two species must be referred to two different genera. On the other hand it seems to me possible to unite *undata* with the type of genus *Sagartiogeton* proposed by me 1924 for *S. robustus* (see *Sagartiogeton*).

To the genus *Kadosactis* I refer the following species, *K. rosea* Dan., *K. abyssicola* Kor. & Dan., *K.* (*Sagartiogeton*) *antarctica* Carlgr., *K. spitzbergensis* (Dan.) and *K.* (*Sagartiogeton*) *sulcata* Carlgr., the last species being the type for a sub-genus, *Kadosanthus*.

Kadosactis rosea Dan.

Kadosactis rosea, n. sp. DANIELSSEN 1890 p. 8 Pl. 1 fig. 2, Pl. 7 fig. 11, Pl. 9 fig. 8. CARLGREN 1932 p. 264, 1933 p. 20 fig. 11.
Phellia bathybia n. sp. DANIELSSEN 1890 p. 64, Pl. 4 figs. 1–4, Pl. 13 figs. 7–9.
Phellia violacea n. sp. DANIELSSEN 1890 p. 70 Pl. 4 fig. 7, Pl. 13 fig. 10, Pl. 14 figs. 9–10.
Hormathia musculosa n. sp. GRAVIER 1918 p. 15, 1922 p. 69 Pl. 6 figs. 58, 59, Pl. 10 fig. 99.

Diagnosis: Tenaculi rather small, cuticle of the scapus easily deciduous. An annulus of cinclides at the limit between the scapus and scapulus, no cinclides at the limbus. Sphincter strong, reticular to somewhat alveolar, with large muscle meshes. Number of tentacles in large specimens 34–44. Outer tentacles with bulbous thickenings at the outside of the base, at least as long as the inner tentacles. 2 siphonoglyphs and 2 pairs of directives. Pairs of mesenteries normally 24 (6 + 6 + 12), of which not all reach the distal body-end. 12 pairs of perfect mesenteries with strong, diffuse retractors often forming humps. Stronger mesenteries of the third order without filaments and reproductive organs, but [illegible] towards the [illegible] 12 × 2.4 — about 2.5 μ, [illegible] 42 × 4.2.5 [illegible] probably micro- [illegible] tentacles 26–36 × [illegible] pharynx partly 41–65 [illegible] partly 38–45 × about 3 μ, [illegible] 42–56 × 4.2–5.5 μ micro- [illegible] 15.5 × 2–2.5 μ basitrichs, those [illegible] partly 91–118 × 5.5–7 μ, [illegible] 50–65 × 3.5–4.5 μ, basitrichs, [illegible] 5.5–6, resp. (36?) 48–55 × [illegible] 2–60 × 6–7 μ.

[illegible] white with a faint rosy tinge. [illegible] Outer tentacles coloured as the column. [illegible] brown coloured than the oral [illegible] brown with a darker annulus [illegible] (*Kadosactis rosea* teste DANIELSSEN). Scapus [illegible] coloured. Inner tentacles and oral [illegible] Outer tentacles at the base and on the [illegible] coloured as the scapulus but otherwise quite [illegible] (*Phellia bathybia* teste DANIELSSEN). Scapulus light violet, [illegible] colour with a white annulus round the [illegible] point. Oral disc pale-violet with yellowish- [illegible] Actinopharynx chestnut brown (*Phellia violacea* teste DANIELSSEN). The body is colourless in preserved state, the [illegible] and the oral disc are sometimes dark brown, the actinopharynx brown, the siphonoglyphs yellowish.

[illegible] in preserved state 1.5 cm high and broad (or [illegible] broad and 1 cm high).

[illegible] Baffin Bay 69°50' N. 61°37' W. 1880 m. Bottom temp. [illegible] 0.4 (Godthaab exp. St. 51) 25 specimens; 67°18' N. [illegible] 0.4 (Godthaab exp. St. 162) [illegible] N. 5°40' E. 1865 m. (Monaco exp. [illegible] 75°36' N. 12°10' E. 1750 m. [illegible] N. 13°03' E. 2354 m. Bottom [illegible] N. Atl. exp. St. 295, *Phellia violacea*); 69°31' N. 7°06' W. 2465 m. Bottom temp. ÷1 (Ingolf exp. St. 113) several specimens; 69°13' N. 8°23' W. 1889 m. Bottom temp. ÷1 (Ingolf exp. St. 117) several specimens; 70°51' N. 13°03' E. 2354 m. Bottom temp. ÷1.2; 69°02' N. 11°26' W. 1836 m. Bottom temp. ÷1.1 (Norw. N. Atl. exp. 205, St. 240, *Phellia violacea*); 68°27' N. 8°20' W. 1996 m. Bottom temp. ÷1 (Ingolf exp. St. 118) 2 specimens; 67°53' N. 10°19' W. 1902 m. Bottom temp. ÷1 (Ingolf exp. St. 119) 1 specimen; 67°29' N. 11°32' W. 1666 m. Bottom temp. ÷1 (Ingolf exp. St. 120) 4 specimens; 66°23' N. 7°25' W. 1802 m. Bottom temp. ÷1.1 (Ingolf exp. St. 104) 17 specimens; 67°14' N. 8°48' W. 1649 m. Bottomtemp. ÷0.9 (Ingolf exp. St. 111) 3 specimens; 65°53' N. 7°18' W. 2127 m. Bottom temp. ÷1.1 (Norw. N. Atl. exp. St. 51, *Phellia bathybia*); 63°53' N. 6°22' W. 1960 m. Bottom temp. ÷1 (Michael Sars exp. 1900) numerous specimens; 63°22' N. 5°29' W. 2222 m. Bottom temp. ÷1.2 (Norw. N. Atl. exp. St. 10, *Kadosactis rosea*).


Fig. 6. *Kadosactis rosea*. Sphincter.

Exterior aspect: The wide pedal disc is commonly attached to the mud, and then the investment of the pedal disc agrees with that of the scapus. Often the investment is lost, so that the insertions of the mesenteries are clearly visible. 2 specimens (from the Ingolf expedition St. 104) were attached to dead shells of *Pecten frigidus* and also in a bottle from the Norwegian Atlantic expedition a shell of this species was present together with the holotype of *Kadosactis*. Often the limbus is not distinct in the specimens attached to the mud. The column is usually cylindrical and more or less high according to the stronger or weaker contraction (compare DANIELSSEN's figures 1–4 Pl. 4 of *Phellia bathybia*, which probably are good). If low, the diameter of the pedal disc is considerably larger than the height of the column, especially in the specimens fastened to shells. The scapus is provided with a rather weak cuticle, often richly incrusted with a thick layer of mud. The cuticle is easily deciduous. If removed, the surface of the scapus often shows irregularly arranged, low papillae of various appearance. A nearer examination of their investment indicates, that they are weak tenaculi (compare below). The scapulus is not high, smooth and longitudinally sulcated, at least in contracted specimens. The species is provided with cnidae. In a small, well preserved specimen from the

Godthaab expedition the cinclides were distinct and visible under a lens. They were situated at the limit between scapus and scapulus and placed in an annulus round the body. To judge from a section of a piece containing three pairs of mesenteries, it seems to be a cinclis from each endocoel in the upper part of the body. On the other hand I have not found any cinclides in a sectioned piece with 5 mesenteries of the limbus. The margin is not distinct.

The number of the tentacles is always fewer than that of the mesenteries. 7 specimens examined had 27, 28, 31, 36, 38, 43, and 44 tentacles. DANIELSSEN stated, that *Phellia bathybia* had 18 + 18 and *Kadosactis rosea* 36 + 36 tentacles. As to the latter I have not been able to count all tentacles of the type-specimen, but judging from the remaining tentacles, there were certainly considerably fewer tentacles than DANIELSSEN states. Also DANIELSSEN's statement of the number of mesenteries in *Kadosactis* is certainly incorrect. Also the tentacle cycles are more than 2 and probably 3. Moreover, it is difficult to decide, whether the tentacles are strictly hexamerously arranged, probably not, as small displacements seem to have taken place in connection with the development of the strong basal swellings on the outer tentacles and the fact that not all mesenteries reach the margin. At the outside of the base the outer tentacles are provided with strong mesogloeal thickenings in the form of bridges connected with the mesogloea of the column. In sections of the inner tentacles the mesogloea was somewhat thickened on the corresponding places but these thickenings were visible only in sections. The distal part of the outermost tentacles was sometimes filamentously drawn out and according to DANIELSSEN in the living state almost as long as the column and warying. Also the middle tentacle cycle is often of the same appearance as the third as also sometimes some tentacles of the inner cycle. The tentacles of the latter cycle are, however, commonly shorter and not so much extended. Thus, the outer tentacles are longer or at least as long as the inner ones. The oral disc is wide, in the contracted state of the animal deeply excavated and provided with radial furrows corresponding to the insertions of the mesenteries. About the inner half of the oral disc is devoid of tentacles. The actinopharynx is rather long, and on each side provided with 10 longitudinal ridges corresponding to the insertions of the perfect mesenteries. The siphonoglyphs are broad and distinct.

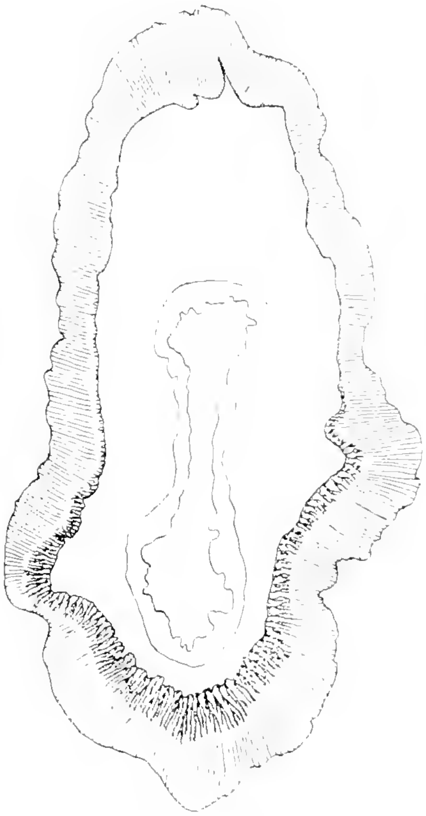

Fig. 7. *Kadosactis rosea.* Transverse section of tentacle.

Anatomical description: For the anatomical examination I have used 2 type-specimens af *Phellia bathybia* and 4 other specimens and also sectioned parts of several others as also of *Phellia bathybia, violacea* and *Kadosactis rosea.* The ectoderm of the scapus is rather high, in the tenaculi lower. The cells, probably chitinized, forming the connection between the mesogloea and the cuticle in the tenaculi, are rather few and separated from each other by rather larger parts of common cells; whether gland cells are present or not, I cannot decide, as the cells were badly preserved. Probably the fact that the cuticle is easily deciduous is in relation to the fact that these connections are few and weak. The sphincter (fig. 6) is strong and mostly reticular with tendency to become alveolar (especially in the type-specimen of *Kadosactis rosea*) and the muscle meshes are usually large especially in the upper half. It is separated from the endoderm by a rather thick mesogloeal lamella. In one sectioned specimen the distal part of the sphincter was situated close to the endoderm in a part of the column, in another part close to the ectoderm.

The ectoderm of the tentacles is rather high. Their longitudinal muscles are ectodermal, and at the base of the abaxial side very weak or absent (fig. 7), on the adaxial side very strong, especially on the ridges i. e. the tentacles are here longitudinally furrowed. Here the muscle lamella forms densely packed, high folds. In the distal part of the tentacles the longitudinal muscles are weaker and of the same strength on the outside as on the inside. The mesogloea is strongly thickened at the base of the abaxial side in the outer tentacles. Sometimes the mesogloea of the inner tentacles is somewhat thickened at the same place. The ectoderm of the tentacles, oral disc and actinopharynx is pigmented. The radial muscles of oral disc are ectodermal, weak in the vicinity of the actinopharynx, strong with high ramified folds in the outer parts. Only in the radial furrows the muscles are weak.

The ectoderm of the actinopharynx is rather high and provided with nematocysts of different size. In a large specimen they were partly 58–65 × 5–5.5 μ (numerous), partly 41–55 × 2.5 μ basitrichs, partly 13–17 × 1.5–2 μ basitrichs, in a smaller specimen 41–50 × 1.5 μ, 38–41 × 2.5 μ, 11–12 × 1.5 μ. In the types of *Phellia violacea* and *Kodosactis rosea* the large nematocysts were 43–53 × 1.5–5 μ resp. 43–50 × 1.5 μ. The larger capsules of the actinopharynx and filaments were often exploded, the length of the shaft and that of the capsule was about the same. They look like amastigophors but because I have seen several ones with a very short thread I think they are *p*-mastigophors the thread of which has usually been broken off. It may be possible that also amastigophors were present, but in such a case they are, as to their size, not different from the *p*-mastigophors. The mesogloea of the actinopharynx is strong in the ridges, in the furrows weak, in the siphonoglyphs thickened.

The mesenteries are generally arranged hexamerously in 3 cycles (6 + 6 + 12 = 24 pairs) 2 pairs of which are directives. Of 7 specimens examined in detail 5 were normally developed with the 24 pairs regularly arranged. Of these 12 pairs were perfect, the other 12 imperfect, though the strongest of the latter almost reach the actinopharynx. The pairs of the last cycle were not equally developed, some pairs were very weak and do not reach the distal body-end, others are considerably stronger and provided with developed retractors, especially in the distal part. In one specimen the weaker and the stronger pairs alternate, in the other specimens the arrangement was irregular. The different development of the mesenteries of the third cycle was connected with the above named, various number of tentacles. One specimen showed a somewhat irregular arrangement of the mesenteries in [illegible] peped [illegible] M [illegible] as retractors, [illegible] and reach only a little over the inner side of the column. The parietobasilar muscles as well as the basilar muscles are weak. All perfect mesenteries are provided with filaments and reproductive organs, which are lacking in the mesenteries of the third cycle. The size of the nematocysts of the acontia of 8 specimens was as follows:

	Amastigophors	Basitrichs
large specimen	106–118 × 5.5–6 μ	53–65 × 3.5–4(4.5)μ
	101–113 × 5.5–6	53–60 × 3.5–4.5
	91–106 × 6–6.5	53–61 × 3.5–4.5
[illegible]	101–110 × about 6.5	36?–53 × 3.5–4.5
	88–101 × 5.5–6	46?–55 × 4–4.5
small	86–98 × about 6	36?–48 × 3.5–4
[illegible]	86–103 × 6–7	41?–53 × 3.5–4.5
[illegible]	98–110 × about 6–7	48–55 × about 4.5

[illegible] pairs [illegible] inside of the di- [illegible] directives were situated [illegible] W [illegible] perfect pairs, 13 imperfect [illegible] *Phellia bathybia* and the type [illegible] *K* [illegible] developed. Of the me- [illegible] distal body-end during [illegible]

[illegible] mesenteries in the lowest part [illegible]

[illegible] the margin. The longitudinal [illegible] very well developed with [illegible] high folds (fig. 8) and often [illegible] the third cycle are provided [illegible] in their distal parts, [illegible] towards the exocoels [illegible] however lack pennons

The size of the basitrichs of the acontia of the specimens 1–7 is dubious as the maceration preparations of the acontia certainly contained also nematocysts of the filaments. As I have pointed out (1933 p. 21), I could not previously isolate perfectly the acontia from the filaments. In a well preserved specimen from the Godthaab expedition on the other hand the acontia were not stuck together with the filaments. I think that the smallest size of the basitrichs of the acontia may be about 48 μ. The ciliated tracts of the filaments are well developed and supported by large thickenings of the mesogloea. The intermediate streak seems to be structured as in *Halcampoides arctica* (CARLGREN 1921 p. 121–122 Pl. 2 figs. 11, 15). The species is dioecious.

Remarks: *Phellia bathybia* and *violacea* (DANIELSSEN 1890) are undoubtly nothing but *Kadosactis rosea*. The outer tentacles are in all three species provided with thickenings on the outside of their bases. Also their inner organization agrees very well. Identical with *K. rosea* is also GRAVIER's *Hormathia? musculosa* (CARLGREN 1934 p. 11). The species is a pronounced arctic deep-sea form always living in ÷ temperatures.

Kadosactis abyssicola (Dan. & Koren.).

Pl. III fig. 4. Pl. IV fig. 3.

Phellia abyssicola n. sp. DANIELSSEN and KOREN 1879 p. 78 Pl. 9 figs. 3–4. APPELLÖF 1891 p. 11. GRIEG 1897 p. 5, 11. 1913 p. 143. APPELLÖF 1905 p. 68.
non *Sagartia (Phellia) abyssicola* D & K. DANIELSSEN 1890 p. 30.
non *Sagartia abyssicola* n. sp. VERRILL 1882 p. 314.

Diagnosis: Tenaculi weak, numerous. Cinclides situated only close below the sphincter. Sphincter strong, reticular to somewhat alveolar, not stratified. Tentacles up to about 60, without distinct basal thickenings on their outside, considerably fewer than the mesenteries, the outer tentacles considerably shorter than the inner ones. Usually one siphonoglyph and one pair of directives, sometimes more than 2. More than 12 pairs of perfect mesenteries. Retractors of the mesenteries weaker than in *K. rosea* and their muscles more delicate. Reproduction also by fragmentation. Nematocysts of the column partly 43–58 × 5–6.5 μ, microbasic amastigophors, shaft with about 25 rows of barbs, partly 9.9–17.5 × 2–3 μ, basitrichs, those of the tentacles partly 52–70.5 × 7.5 μ, microbasic amastigophors, partly 21–31 × about 2.5–3 μ, basitrichs, common, those of the actinopharynx partly 41–63.5 × about 4.5–5 μ, microbasic amastigophors?, very numerous, partly 28–36 × 2.5–3 μ, basitrichs, those of the filaments partly 32.5–36 × about 4–2 μ microbasic p-amastigophors, partly 10.5–13.5 × 2 μ, basitrichs, those of the acontia partly 120–156 × 7–10.5 μ, microbasic amastigophors, partly 71–91 × 5–6(6.5) μ, basitrichs. Spirocysts of tentacles 17 × 1.5–43 × 6.5 μ.

Colour: Cuticle of the scapus greyish-brown, speckled with darker brown spots. When the cuticle is removed the scapus is pale flesh-coloured. Outer tentacles pale yellowish red, inner tentacles on their lower half and on all the inner surface brownish red, on the outer side considerably paler. Actinopharynx and oral disc dark brown-red, the latter with paler stripes proceeding from the mouth towards the inner tentacles (teste DANIELSSEN and KOREN). A preserved specimen from Hjeltefjord was olive-brown, its actinopharynx brown-red. The cuticle of another specimen from the same locality was dirty yellow, the inner tentacles on their inside and the oral disc brownish-red, other parts uncoloured.

Dimensions of the best preserved specimens from Hjeltefjord: 1) Height 1 cm, largest breadth 1.5 cm, length of the inner tentacles 0.5–0.6 cm. 2) Height 1.2 cm, largest breadth about 2 cm. Of a specimen from Trondheimfjord: Largest breadth 1.4 cm, largest height 1.2 cm, length of the inner extended tentacles about 1.4 cm and of the outer tentacles about 0.7–0.9 cm. A specimen from Hvidingsø was 2.7 cm broad and 1.5 cm high.

Occurrence: Norway: Trondheimfjord 70–450 m, clay ("Gunnerus" 1922), 2 specimens; Röberg 130–180 m ("Gunnerus" 1933) 1 spec.; Nordfjord: Vaagsfjord, Slaaken, and Stegene 188–377 m; off Skavöskallen, 188–226 m (teste GRIEG); Bergen: Hjeltefjord, deep water (APPELLÖF), 2 specimens; Korsfjord 471 m (teste KOREN and DANIELSSEN); Hardangerfjord 188–282 m (ASBJORNSEN); Hardangerfjord (teste GRIEG); Digerns Sound (ASBJORNSEN); Hvidingsöya 151–188 m (G. O. SARS); Oslofjord, Braendtangen S. of Hvidsten 151 m, 1 specimen; Norway without distinct locality, 3 specimens.

Exterior aspect: The pedal disc is well developed, wide, rather thick and provided with fragments of a cuticle. The column is somewhat conical, wider in the proximal than in the distal part. The scapus is invested with a wrinkled, rather thick but easily deciduous cuticle "interwowen with fine sand and clay" (DANIELSSEN). When the cuticle is removed, the scapus is very rugose, giving it an appearence as if it were provided with larger and smaller irregular tubercles, which, however, sometimes, as in specimens from Trondheimfjord, were inconspicuous to the naked eye. A closer examination of these imperforate tubercles, invested with cuticle, shows that we have to do with tenaculi. In the specimen from Röberg the tenaculi, forming irregular elevations, were present (fig. 3 Pl. I), fragments of such occurred also in the worst preserved specimens. Cinclides are also present here, they are, however, not situated on the tubercles, as DANIELSSEN and KOREN state, but situated close below the sphincter and seem to be at least 2 in certain compartments. In a sectioned piece with 3 pairs of mesenteries of a rather well preserved specimen I observed 2 in each endocoel of the outer pairs but no cinclis in the endocoel of the middle pair. The cinclides seem to be of the same structure as in *Sagartiogeton rugosus* (compare this species) but are very narrow in their middle parts, so that they can be easily over-looked in sections. Manifestly they are here in reduction, so that it is not probable that the acontia could be ejected through them. The margin was, in the best preserved specimens, crenulated. At the insertions of the mesenteries the uppermost part of the column, the scapulus, was longitudinally sulcated (Pl. III fig. 1).

Fig. 9. *Kadosactis abyssicola.* Sphincter.

Fig. 10. *Kadosactis abyssicola.* Section of three perfect mesenteries of the upper part of the body.

The tentacles are conical, in the contracted state rather thick, when extended considerably longer, the inner tentacles about twice as long as the outer ones and sometimes longitudinally and transversally furrowed. The number of tentacles is considerably fewer than that of the mesenteries. Four specimens had 40, 44, 51, and 58 tentacles, while the mesenteries were 72, 72, 80, and 90 at the limbus. The tentacles are devoid of basal thickenings. The oral disc is rather wide and its inner part without tentacles, it is radially sulcated. The actinopharynx is rather short and longitudinally [illegible] one siphonoglyph, in [illegible] In a specimen with two [illegible] each other.

[illegible] of the column was [illegible] of which was retained. [illegible] the outside of which was [illegible] especially in the scapular [illegible] of the column are weak, [illegible] and not stratified (3 speci[illegible] worse preserved specimen there were [illegible] and irregular balks in the sphincter. In [illegible] I have reproduced the sphincter of the best pre[illegible] Hjeltefjord. The sphincter is separated [illegible] of the column by a thin mesogloea-

[illegible] Section of a perfect mesentery in the [illegible] a mesentery of the last cycle.

[illegible] considerably higher than the [illegible] rather numerous nematocysts. [illegible] that of the oral disc and [illegible] The longitudinal muscles of the [illegible] weak on the outside of the base con[illegible] forming there palissade- [illegible] of the oral disc are ectodermal, [illegible] considerably stronger towards [illegible] of the mesenteries, at [illegible] of the actinopharynx is [illegible] only in the siphono- [illegible] nematocysts and sparse [illegible] The mesogloea is thin, provided with about 20 longitudinal folds, in the siphonoglyph and next to it thickened.

In the best preserved specimen from Hjeltefjord 38 mesenteries were perfect, of which 18 pairs and two single mesenteries. In addition to those 20 other imperfect mesenteries were present in the distal part of the body. Beginning with the single directive pair the following pairs were imperfect 4, 9, 11, 13, 17, 19, 21, 28, and 30, the pairs 15 and 24 consisted of one imperfect and one perfect mesentery. In the proximal part of the body I counted 45 pairs, thus about the half more than in the distal part. Also the other specimens examined had more than 12 perfect pairs. The arrangement of the mesenteries was most irregular in a specimen taken at Hvidingsoya and provided with 4 pairs of directives irregularly situated. The longitudinal muscles formed diffuse retractors in the perfect and strongest imperfect mesenteries. The retractors are very weak in their uppermost part, while the mesogloea is thickened here. The parietobasilar muscles were weak but formed in the proximal part of the stronger mesenteries a small shelf, their folds were, however, weak and low. Only the mesenteries having distinct retractors were provided with filaments. The acontia were well developed, long, and rather thick. The size of the nematocysts of the acontia was in 5 specimens as follows:

Occurrence	Amastigophors	Basitrichs
1. Norway without dist. loc.	130—156 × 10.5 μ	74—84 × 5 μ
2. - -	121—149 × 9—10 μ	72—86 × 5 μ
3. - -	139—149 × 7—8 μ	77—82 × 5 μ
4. Hvidingsoya ...	120—139 × 9—10	82—86 × 5—6 μ
5. Oslofjord.......	139—156 × 7—8 μ	71—86 × 5 μ
6. Roberg	123—146 × 9—10 (11) μ	72—83 × 6—6.5

All the stronger mesenteries inclusive the directives were fertile. The species propagates certainly asexually, probably by fragmentation, as the number of siphonoglyphs and directives varies. In the specimen taken in Oslofjord I have found a piece connected with the limbus of the parent by a small lamella. The nematocysts were not exploded.

Remarks: DANIELSSEN (1890 p. 53) identified *Phellia abyssicola* Dan. & Kor. with *Sagartia abyssicola* Verr. and included also some specimens dredged by the Norwegian Atlantic expedition, in the same species. As the description given below of *Sagartia abyssicola* Verr. shows, this species is not identical with that of DANIELSSEN and KOREN. The specimens taken by the expedition above named have also nothing to do either with the species of DANIELSSEN and KOREN nor with that of VERRILL. Many years ago I have examined these specimens. Those taken at station 326 were *Allantactis parasitica*, *Hormathia digitata*, *Actinostola spitsbergensis* and *Liponema (Bolocera) multicornis*. In the jar containing *abyssicola* from station 323 there were the two species first mentioned and some small specimens possibly belonging to another species than those enumerated. The figure 4 Pl. 10 is nothing but *Liponema multicornis* and their "acontia" squeezed out filaments, the figure 7 Pl. 10 is *Hormathia digitata*. As to the coloured figures 1 and 2 Pl. 3 it is difficult to decide to which species they belong.

Kadosactis(?) spitzbergensis (Dan.).

Phellia spitzbergensis n. sp. DANIELSSEN 1890 p. 74 Pl. 4 fig. 8, Pl. 15 figs. 1—3.
Kadosactis? spitzbergensis (Dan.). CARLGREN 1932 p. 261.

Diagnosis: Pedal disc well developed. Column divisible into scapus and scapulus, the former probably with tenaculi. Cinclides? Sphincter very strong, broad, alveolar with tendency to stratification and occupying a great part of the whole breadth of the mesogloea. Muscle meshes of the sphincter of ordinary size. Tentacles 48, fewer than the mesenteries. Pairs of mesenteries

18 arranged hexamerously, the last cycle only in the proximal part of the body. 6 (12?) pairs of perfect mesenteries. Longitudinal muscles of the mesenteries forming retractors only on the mesenteries of the first and second cycles. Retractors rather strong but their folds not, or only in their uppermost part sometimes a little concentrated. Parietobasilar muscles long but forming few folds. Nematocysts of the scapulus 17–19 × 2.5–3 μ, those of the tentacles 22.6–29.6 × (2.4) 2.8 μ, those of the actinopharynx partly 22.6–28.2 × 3–3.5 μ, partly 11–12 × 1.5 μ, the latter basitrichs, those of the acontia partly 38–47 × 5.5–6.5 μ?, microbasic amastigophors, partly 28.2–38 × 3.5–4.2 μ, basitrichs. Spirocysts of tentacles 21.2–36.6 μ.

Fig. 12. *Kadosactis spitzbergensis.* Sphincter.

Colour: Cuticle of the scapus greenish with a faint violet-coloured substratum, capitulum blue-violet, margin paler, tentacles intense blue-violet with reddish extremities. Oral disc blue-violet with lighter-coloured rays and a lighter-coloured annulus round the mouth (DANIELSSEN).

Dimensions in contracted state: Spec. 1) breadth of the pedal disc 1.1 × 1 cm, length of the body about 0.7 cm. Spec. 2) breadth of the pedal disc 1 × 0.8 cm, length of the body 0.3 cm.

Occurrence: 80°03′ N, 8°28′ E. 475 m. Temperature at the bottom 1.1° (Norw. N. Atl. Exped.) 2 specimens.

Exterior aspect: The pedal disc is well developed and covered with a cuticle. In the contracted state the body forms a low conus. The column is divisible into scapus and scapulus, the former provided with a cuticle, to which foreign bodies are attached. The scapus is probably provided with weak tenaculi, because the ectoderm was very low in several places. As the ectoderm was more incrusted here than in other parts, it is probable that the species has tenaculi, so much the more as the cells seem to be chitinized in the lower parts of the ectoderm. I have not observed any cinclides in my sections which, however, does not prove that such may be present. In the contracted state the scapulus is smooth and provided with longitudinal furrows. The margin is distinct.

The tentacles are short, conical, the outer tentacles considerably smaller than the inner ones. The number of tentacles was 48 (6 + 6 + 12 + 24) in both specimens. DANIELSSEN stated incorrectly that 3 cycles of tentacles, 24 in each, were present. The tentacles are not thickened on the outside of the base. The actinopharynx was transversally furrowed, probably there were 2 siphonoglyphs.

Anatomical description: The ectoderm of the scapus was of ordinary thickness but considerably thinner than the mesogloea, the sphincter (fig. 12) was very strong and broad, occupying a great part of the here thickened mesogloea and wholly separated from the endodermal muscles of the column. The muscle meshes are of ordinary size, often drawn out in a radial direction and showing a tendency to vertical stratification. The longitudinal muscles of the tentacles and radial muscles of the oral disc were ordinarily developed and ectodermal.

I have examined the mesenteries of the same specimen, which DANIELSSEN has dissected. They were hexamerously arranged and formed 48 pairs, the last cycle of 24 pairs only present in the lowest part of the body. As far I can see only 6 perfect pairs were present, while DANIELSSEN says that there were 12 pairs. It must, however, be remarked that the section figured in Pl. 15 fig. 3 has not cut through the actinopharynx but the oral disc, which I have discovered from the remains of the dissected specimen. The longitudinal muscles of the 2 first cycles form rather strong diffuse retractors (fig. 13) sometimes a little concentrated in their uppermost parts. In the main the retractors agree in their appearance fairly well with those of the species described above of *Kadosactis* but not with those of *Sagartiogeton*. They are somewhat weaker on the mesenteries of the second cycle than on those of the first. The longitudinal muscles of the other mesenteries are weak. The parietobasilar muscles form no or some very short folds but are extended rather far towards the distal body end. The basilar muscles are weak but distinct; the filaments of typical structure. The acontia

Fig. 13. *Kadosactis spitzbergensis.* Section of a perfect mesentery in the upper part of the body.

[illegible] perfectly [illegible] were [illegible] sections of [illegible] of the specimen [illegible] DANIELS [illegible] were sterile, [illegible] mesenteries of the [illegible] was a mistake of

[illegible] of this species is [illegible] expedition. Unfortun[illegible] somewhat uncertain [illegible] and difficult to [illegible] This year I have re[illegible] specimen. In the [illegible] and acontia it was [illegible] I could this time [illegible] but as the measures of the [illegible] agree with those previously [illegible] mistake about the presence [illegible] information about their length is, how[illegible] it was very difficult to decide the [illegible] were very opaque. Preliminarily [illegible] genus *Kadosactis*, though its systematic

Genus **Sagartiogeton** Carlgr.

[illegible] often provided with a cuticle. Column [illegible] of a scapulus, now not. Scapus usu[illegible] tenaculi which as a rule are weaker than *K*[illegible] with cinclides in the upper part of the [illegible] the limbus. Margin distinct. Sphincter [illegible] usually long, conical, hexamerously octo[illegible] or irregularly arranged, never thickened [illegible] Number of tentacles as a rule fewer than the [illegible] muscles of tentacles and radial muscles [illegible] Usually two siphonoglyphs, sometimes [illegible] 1–3 pairs of directives. Arrangement of the [illegible] tentacles. As a rule at least 6 pairs of [illegible] more. Mesenteries growing from the [illegible] margin but originating earlier at the [illegible] stronger imperfect mesenteries in the region [illegible] provided with fairly concentrated, often [illegible] retractors. Parietobasilar [illegible] The stronger mesenteries fertile. Acontia well [illegible] microbasic amastigophors and basi[illegible] microbasic amastigophors, microbasic [illegible]

[illegible] genus *Sagartiogeton* for a species [illegible] called *S. robustus*. Undoubtedly [illegible] *Actinothoe undata*. Both species [illegible] the mesenteries grow from [illegible] though the mesenteries [illegible] the mesenteries are more [illegible] if we may retain [illegible] of *Actinothoe*, [illegible] of the latter genus [illegible] 1935 refers also [illegible] seems, with some [illegible] 47 [illegible] a naturalist acquainted [illegible] be seen at first sight [illegible] between the two, and to me [illegible] way of referring them [illegible] however, of examining [illegible] *viduata* and this shows affinities with both the other forms, and constitutes an interesting link between them." I have examined a specimen of *sphyrodeta*, a very delicate species, and there was the same number of mesenteries at the base and at the margin, thus, as it seems, another arrangement than in *anguicoma*, *viduata*, *undata* and *S. robustus*. Although it could be desiderable to examine a rich material of *sphyrodeta* as to the mesenteries, because the species propagates asexually by longitudinal fission (see STEPHENSON 1935), it seems to me likely that there is a difference in the development of mesenteries between *sphyrodeta* and the other species, wherefore I propose to separate the latter species from *Actinothoe* and to refer them to *Sagartiogeton*. *S. robustus* and *A. undata* must certainly belong to same genus as also *lacerata*, having, though rarely, tenaculi. Moreover the question arises, if *anguicoma* and *viduata*, both having a smooth column, may be referred together with the forms having weak tenaculi. I think that it is necessary to do it, because *anguicoma* and *undata* are so nearly related to each other that it is likely that they are variations of same species. Thus I retain the genus *Actinothoe* for *sphyrodeta* while other British and northern forms may go to *Sagartiogeton*. As to the relation between the latter genus and *Kadosactis*, see this genus.

Sagartiogeton robustus Carlgr.

Pl. III fig. 8. Pl. V fig. 3.

Sagartiogeton robustus n. sp. CARLGREN 1924 p. 26.

Diagnosis: Tenaculi considerably shorter than those of *D. praelonga* (see p. 5), but with a strong multistratified and high cuticle. Cinclides situated at the limbus arranged in longitudinal rows, 6–2(1) cinclides in each row. Sphincter ordinarily developed, not occupying the whole scapulus, in its uppermost part reticular, in other parts with tendency to longitudinal stratification. Tentacles about 170–180 of ordinary length, considerably fewer than the mesenteries. One siphonoglyph or two. Perfect mesenteries more than 12. Retractors of the mesenteries high, diffuse and richly ramificated, in their upper part more concentrated. Parietobasilar muscles weak. Nematocysts of the scapus and scapulus 11.5–18.5 × 5–5.5 μ, those of the tentacles partly 18.5–23 × about 4.2–5 μ, partly 25.5–31 × 4.2–4.5 μ often a little curved, microbasic amastigophors (shaft almost 1 1/2 as long as the capsule), partly 15.5–21 × 1.5–2 μ, basitrichs, those of the actinopharynx partly 31–39.5 × about 4.2 μ amastigophors?, partly 21–25 × 4.5–5.5 μ microbasic *p*-mastigophors, partly 12.5–25 × about 1.5–2 μ, basitrichs, those of the filaments partly 11.3–13.5 × about 3.5 μ, partly 21–26.8 × 4.2–5 μ microbasic *p*-mastigophors, partly 28–35 × about 4.2 μ probably microbasic amastigophors, those of the acontia partly 43–57 × 4.2–5 μ microbasic amastigophors, partly 26–31 × about 2.8 μ, basitrichs. Spirocysts of tentacles up to about 36 × 5.5 μ.

Cnidom: spirocysts, microbasic amastigophors, microbasic *p*-mastigophors, basitrichs.

Colour in alcohol: Scapus grey, ectoderm of the tentacles, oral disc and actinopharynx greyish, endoderm of the tentacles, oral disc, actinopharynx and innermost part of the perfect mesenteries red brown shading into violet.

Dimensions: Spec. 1 (in strongly contracted state) largest breadth of the pedal disc 3 cm, largest height 2.5 cm. Spec. 2 largest height 2.2 cm, largest breadth at the limbus 1.5 cm, inner tentacles about 0.8 cm long, outer tentacles about half as long as the inner.

Occurrence: Rockall Bank 57°41′ N, 14°08′ W, 240 m. 2 specimens.

Exterior aspect: The pedal disc is wide and provided with a cuticle. The column is pillarlike in the uncontracted specimen, in the illustrated, strongly contracted specimen (fig. 8 Pl. III) conical. The scapus is rugose and provided with numerous tenaculi of the same structure as in *D. praelonga* but shorter. At the limbus the scapus seems to lack the papillae, at any rate they are very weak. Here cinclides, close situated and arranged in longitudinal rows, are present. The exact arrangement of the cinclides is difficult to determine but I have observed between 6 and 2 (seldom 1 cinclis) in each row. I have sectioned a piece just above the upper end of the scapus but not found any cinclides here: It is therefore probable that the cinclides occur only at the limbus of this species. The scapulus is devoid of a cuticle and irregularly wrinkled, the margin is rather distinct.

Fig. 14. *Sagartiogeton robustus.* Section of a cinclis in the lowest part of the body. On the right a part of another cinclis is visible.

Fig. 15. *Sagartiogeton robustus.* Sphincter.

The tentacles were 170–180 in the uncontracted specimen. They are conical to more cylindrical in the contracted state and rather long, the inner tentacles twice as long as the outer ones. They are close set and arranged in several cycles, but the arrangement is probably irregular as only one or two siphonoglyphs, the latter asymmetrically arranged, were present. More than half of the oral disc is occupied by tentacles. The oral disc is radially sulcated, the furrows correspond to the insertions of the mesenteries. The actinopharynx is longitudinally ridged. The sectioned specimen was provided with a well developed siphonoglyph.

Fig. 16. *Sagartiogeton robustus.* Section of a perfect mesentery in the region of lowest part of the actinopharynx.

Anatomical description: The ectoderm of the scapus is of ordinary thickness. The cinclides are partly invaginations from the ectoderm, partly evaginations from the endoderm, mostly the first (fig. 14). The tenaculi recall as to their structure those of *D. praelonga*, but the stratified cuticle forms not so many strata as those of these species (Pl. V fig. 3). The mesogloea of the column is very thick at least in the contracted state of the body and contains numerous cells poor in protoplasm. The circular muscles of the column are ordinarily developed as also is the sphincter. It is broad and extended over somewhat more than the half of the scapulus, ends rather abruptly and is wholly differentiated from the circular muscles of the column. Towards the tentacles it is reticular, in [illegible] in [illegible] among 15 [illegible] contains rather [illegible] and probably [illegible] tentacles and [illegible] and ordinarily [illegible] pharynx is of ordinary [illegible] interrupted by out shoots [illegible] the lowest part of the [illegible] of which probably are [illegible] actinopharynx is thin ex- [illegible] owing to the bad preserv- [illegible] I have not been able [illegible] In the more closely examined [illegible] mesenteries at the limbus, 60 pairs, [illegible] the aboral end of the actino- [illegible] 170–180 mesenteries, as there are so many [illegible] body. The specimen had only [illegible] the lowest part of the actinopharynx 12 [illegible] part also some of the third cycle. [illegible] seems to be perfect, its partner [illegible] 12 first pairs are unequally developed as to [illegible] other specimen (Pl. III fig. 8) about 60 pairs [illegible] of the actinopharynx-region, 23 pairs [illegible] consisting of one perfect and one im- [illegible] two directive pairs, asymmetrically situ- [illegible] Only 7 non-directive pairs were present [illegible] on the one side. Owing to bad preserv- [illegible] to give an exact statement of the [illegible] mesenteries and a part of the imperfect [illegible] well developed retractors occupying [illegible] In the uppermost part the retractors, [illegible] directives, were more concentrated and [illegible] The folds of the retractors were [illegible] text-fig. 16). The parietobasilar muscles [illegible] few, coarse folds, the acontia broad. [illegible] specimen had ovaries containing small [illegible] mesenteries, inclusive of the directives. The [illegible] of which is not named in the diagnosis, [illegible] it was impossible to decide their type. The [illegible] amastigophors of the acontia was almost [illegible]

Sagartiogeton verrilli nov. nom.

[illegible] Verrill 1882a p. 314, 1883–85 p. 45 [illegible] 1885 [illegible] Pl. 44 fig. 177.
[illegible] Verr. Carlgren 1928 p. 260, 301.

[illegible] scattered and not especially [illegible] Cinclides at [illegible] Sphincter long, alveolar [illegible] part of the mesogloea, [illegible] or irregularly arranged. [illegible] mesenteries more than [illegible] Mesenteries of the first, second and [illegible] concentrated in the middle [illegible] kidney-like, strong on [illegible] order. All, or almost all [illegible] Nematocysts of the [illegible] partly 24–35 [illegible] tentacles partly [illegible] 24–35 × 3.5–4.2 μ, micro- [illegible] partly 23.5–31 [illegible] 28–31 × 4.2 μ micro- [illegible] partly about [illegible] 4–4.5 μ, microbasic p-mastigophors, partly 11.5–12 × 3.5 μ, microbasic p-mastigophors? (only two capsules seen), those of the acontia partly 58–67 × 5.6–6.5 μ microbasic amastigophors, partly 34–38 × 2.8 μ, basitrichs. Spirocysts of the tentacles 17 × 1.5–35.5 × 5 μ.

Colour: Column dirty salmon or dull flesh-coloured. Tentacles sometimes pale flesh-coloured, sometimes orange or salmon, frequently dark purplish brown often with a darker streak on each side of the base in the paler specimens, flake-white patches often occur between the bases or at the margin between the outer tentacles, oral disc usually darker orange brown or purplish brown with pale and dark brown radii, acontia pink coloured (Verrill).

Fig. 17. *Sagartiogeton verrilli.* Sphincter (Ingolf, St. 95).

Dimensions in expanded state: 2.5–3.5 cm broad and 1 cm high (teste Verrill), in contracted state about 1.5 cm high and broad. The largest specimen taken at St. 95 was about 0.9 cm at the limbus and its scapus 0.8 cm long.

Occurrence: Danmark Strait 65°11′ N., 30°39′ W., 1116 m. Bottom temp. 2.4° (Ingolf expedition St. 95) 2 specimens; North America: Marthas Vineyard 40°02′ N., 70°11′ W., 130–150 fms. (U. S. Fish Comm. St. 1116), 40°05′ N., 68°18′ W. 174 fms. (U. S. Fish Comm. St. 1120), teste Verrill; Nantucket, Marthas Vineyard and Delaware Bay in many localities 76–640 fms; 39°59′46″ N. 70°18′30″ W. 260 fms; 38°21′50″ N. 73°32′ W. 193 fms. (Blake-exped.)

Exterior aspect: The pedal disc is broad, attached to pebbles or shells, often clasping the tubes of *Hyalinoecia artifex*. The column is elongated in extended state, the middle part narrower than the proximal and distal ones, in the contracted state it forms a broad, low cone, sometimes it is nearly flat. The scapus is provided with a cuticle and especially in the lower part of the body provided with tenaculi, which are very distinct when the cuticle is removed. According to Verrill the scapus of some specimens can be nearly naked, probably the cuticle of such specimens is lost. Cinclides are present below the sphincter and in the proximal part of the scapus. The scapulus is naked and longitudinally sulcated in introverted state of the distal body-end.

The tentacles are slender, acute, the inner considerably longer than the outer ones, in number up to about 96, in the "Ingolf"-specimens fewer and hexamerously arranged. More than half the oral disc is occupied by tentacles. The 2 siphonoglyphs are distinct.

Anatomical description: The ectoderm and mesogloea of the scapus are of ordinary thickness. The cinclides seem to be principally excavations of the endoderm. The endodermal muscles of the column are weak, the sphincter rather strong, not stratified, reticular in its upper part, more alveolar in its lower, long and usually not occupying half the breadth of the mesogloea and wholly separated from the endodermal muscles of the column. The sections of the sphincter of two specimens, the one taken by the U. S. Fish Commission, the other by the Ingolf expedition (fig. 17), show good agreement.

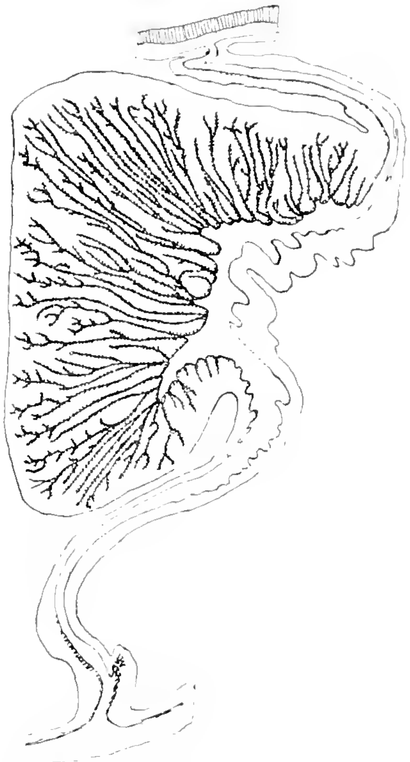

Fig. 18. *Sagartiogeton verrilli*. Section of a perfect mesentery of the first order about in the middle of actinopharynx (U.S. Fish Com.)

The longitudinal muscles of the tentacles are ectodermal, at the base about equally developed on the outside as on the inside, the folds like a palissade, are of about same height as the main part of the mesogloea. The radial muscles of the oral disc agree in their appearance with the longitudinal muscles of the tentacles, but are weaker at the insertions of the mesenteries. The ectoderm of the actinopharynx is rather high and contains numerous nematocysts, the mesogloea is of ordinary thickness, in expanded state of the actinopharynx thin, in the siphonoglyphs thickened.

A sectioned specimen showed the following arrangement of the mesenteries: 12 pairs of the first and second order and 6 of the third were perfect, the other 6 of the third order and those of the fourth imperfect. Counted from the one directive pair the pairs of mesenteries 1, 2 and 4 of the third order were imperfect in both halves of the body. The fourth cycle of mesenteries was almost complete the specimen had 92 tentacles. In another specimen there were also more than 12 perfect pairs. In a third individual I counted 74 tentacles but 124 mesenteries at the base. The longitudinal muscles of the mesenteries form retractors on the mesenteries of the first, second and third order. The retractors are strong in the mesenteries of the first and second order, especially in the former, and kidney-like in their upper part. Also in the middle of the mesenteries the folds of the retractors are high, in the lower part the retractors disappear. I have figured (figs. 18 and 19) the retractors of two specimens. The parietobasilar muscles reach to the upper part of the mesenteries and form a distinct offset on the stronger pairs, but their folds are few and low (figs. 18 and 19). The basilar muscles are weak, oral and marginal stomata present, acontia broad and well developed. All (or almost all?) mesenteries are provided with filaments and reproductive organs. The mesenteries of the last cycle are weak and have filaments and reproductive organs in their lowest part. The species is dioecious.

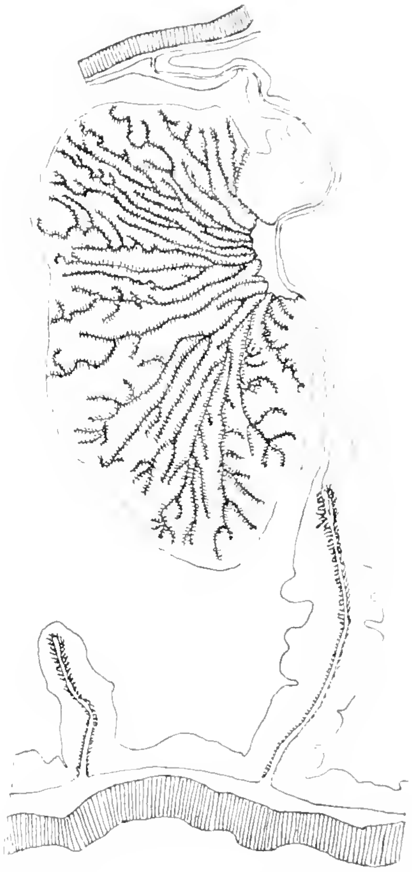

Fig. 19. *Sagartiogeton verrilli*. Section of a directive mesentery and of a mesentery of the third order at the lowest part of the actinopharynx (Ingolf St. 95).

Sagartiogeton ingolfi Carlgr.

Sagartiogeton ingolfi n. sp. Carlgren 1928 p. 259, 301.

Diagnosis: Scapus with a cuticle, probably weak and easily deciduous, with scattered weak papillae (tenaculi). Cinclides in [illegible] s. The sphincter [illegible] almost the [illegible] 80. Mesenteries [illegible] about 40. The [illegible] concentrated [illegible] are strong, and are [illegible] mesenteries are weak. [illegible] Parietobasilar muscles [illegible] 14–19.7 × 3.5 μ, [illegible] gophors, partly 9–12.7

[illegible] sphincter.

[illegible] of the tentacles partly [illegible] astigophors, partly 22–24 [illegible] those of the actinopharynx partly [illegible] stigophors, partly 25.4–28 [illegible] few, partly 24–38 [illegible] 13–17 × 2–2.5 μ basitrichs, [illegible] about 1.2 μ micro [illegible] about 3 μ basitrichs, [illegible] stigophors partly 16.2 [illegible] 60–88.8 × 7 [illegible] 18–62 × 3.5–4.2 μ basi [illegible] 14 × 5–5.5 μ

Size. [illegible] 1 extracted, length [illegible] 2 [illegible] height 1 cm [illegible] about 0.7 cm long.

[illegible] 14' N., 32°52' W., 1858 m [illegible] 7 specimens.

Exterior aspect. The examples were very badly preserved and strongly contracted so that I cannot give any good description of the species. The column, certainly divisible into scapus and scapulus as I have observed fragments of a cuticle incrusted with foreign bodies in a specimen, is according to the state of contraction conical or cylindrical. In the latter case, when the body is more expanded, the basal and distal ends are broader than the middle. Moreover, the column is irregularly wrinkled and forms small papillae, certainly tenaculi, below the sphincter. On sections I have found cinclides in the proximal part of the body as well as below the sphincter. The margin is rather distinct.

The tentacles are about 80 in number (2 specimens examined). Especially the outer tentacles are thin in the expanded state and not provided with thickenings at the base. The inner tentacles are more than twice as long as the outer ones. The oral disc is rather wide and radially sulcated, about half the disc is devoid of tentacles. The actinopharynx is well developed and sulcated. 2 well developed siphonoglyphs, running out in aboral prolongations, are present.

Anatomical description: The ectoderm of the column is high, the endodermal circular muscles are rather well developed. The sphincter is rather strong and not stratified. It occupies a great part of the mesogloea. The muscle meshes are fairly large and uniformly distributed and separated from each other by thin mesogloea-balks (fig. 20).

The amastigophors of the tentacles are few. The longitudinal muscles of the tentacles are ectodermal, fairly strong and arranged like a palissade. The radial muscles of the oral disc are stronger and also ectodermal. Their folds are high between the insertions of the mesenteries and often once branched, at the insertions of the mesenteries weak. The ectoderm of the actinopharynx is rather high and thicker than the mesogloea, also in the ridges than; only in the siphonoglyphs the mesogloea is somewhat thickened.

Fig. 21. *Sagartiogeton ingolfi*. Section of a directive mesentery in the uppermost part of the body.

The mesenteries were irregularly developed in the sectioned specimen. In the distal part 38 pairs of mesenteries were present, in the middle region of the body only 25 pairs and in the lower part 37 pairs (the mesenteries at the limbus, however, not examined). On the one side of the two pairs of directives there were 4 perfect pairs, on the other side 3½, all with strong muscle pennons. Marking the perfect mesenteries with P, the other mesenteries provided with retractors with M, the weaker with W and the weakest with w the arrangement of the mesenteries was as follows (dm: directive mesenteries).

$\overset{\text{dm}}{\text{PP}}$, ww. WW, ww, PP, *ww*, WM, *ww*, PP, *ww*, WW, *ww*, PP, ww, PP, ww, WW, ww, $\overset{\text{dm}}{\text{PP}}$, ww, PM, ww, WW, ww, PP, ww, MM, ww, WM, ww, PP, ww, MM, ww, PP, ww, WW, ww.

Fig. 22. *Sagartiogeton ingolfi.* Section of a directive mesentery and of some other mesenteries in the lower part of the body.

In the middle of the body all ww, except those marked with spaced-out figures, seem to be absent. Also the mesenteries in one and the same pair are often not equally developed. Another individual had about 88 mesenteries at the limbus. The longitudinal muscles of the mesenteries are, especially in the perfect mesenteries, very strong and form concentrated retractors showing in their distal part a characteristic appearance with a large fold directed outwards and separated from the main lamella of the mesentery. In textfigures 21 and 22, I have figured mesenteries sectioned through the distal and proximal parts of the body. The longitudinal muscles are weak inside and outside the retractors as also in the mesenteries marked with W and w. These latter mesenteries are fertile, seemingly devoid of filaments and reach only a short way into the coelenteron. The parietobasilar muscles are distinct, situated on a fold of the mesogloea in the proximal part of the body, in the middle they begin to disappear. Oral and aboral stomata are present. All stronger mesenteries, inclusive the directives, are fertile, in the sectioned specimen with ovaries.

Several nematocysts were exploded but the exploded shaft broken into pieces so that it was difficult to clear up the types of nematocysts. I think, however, that I am right when I interpret the broader and longer nematocysts, having a long shaft, as amastigophors, the other broader with a short shaft as *p*-mastigophors. The amastigophors as well as the basitrichs of the acontia varied. In an individual the former were 71.7–88 × 7–7.5 μ, the latter 55–62 × 3.7–4.2 μ in two individuals 60 (63) 66 × 7 μ resp. 48–53.6 × 3.5–4.2 μ.

Sagartiogeton flexibilis (Dan.).

Phellia flexibilis n. sp. Danielssen 1890 p. 51, Pl. 3 figs. 5–6, Pl. 12 figs. 1–5.

Diagnosis: Pedal disc wide. Scapus with a cuticle incrusted and well developed, provided with tenaculi. Scapulus with cinclides. Sphincter very strong, alveolar-reticular with tendency to stratification and occupying about two thirds of the breadth of the mesogloea. Tentacles about 36. Pairs of mesenteries 24 (6 + 6 + 12). Perfect pairs of mesenteries probably 6, with very strong, strongly concentrated, sometimes kidney-shaped retractors. Folds of the retractors few but rather much branched. Longitudinal muscles of the other mesenteries weak. Parietobasilar muscles weak. Filaments on the mesenteries of the first and second orders.

The nematocysts of the scapus were 12.7–15.5 × 2.8–3.5 μ, often a little curved, probably microbasic amastigophors, those of the tentacles partly 26–29 × 3.5–4 μ, microbasic amastigophors, partly 17–24 × 2.8 μ, basitrichs, those of the actinopharynx partly 26.8–28.2 × 3.5–4 μ microbasic *p*-mastigophors?, partly 26–27 × 2.5–2.8 μ, basitrichs, those of the acontia partly (42?) 53–66 × 5.6–7 μ microbasic amastigophors, partly 34–44 × 2.8–3.5 μ, basitrichs. Spirocysts of tentacles up to about 27 × 4.5 μ.

Colour: Scapus yellowish-brown, scapulus either almost white or pale rose-red. Outer tentacles pale red, inner tentacles brown, at their bases dark chestnut brown. Oral disc strong brown with a white annulus round the mouth, from which white stripes issue to the tentacles (teste Danielssen).

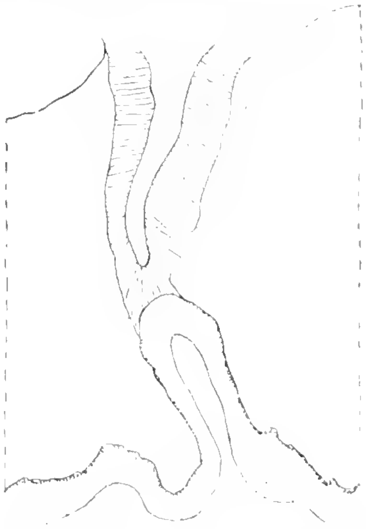

Fig. 23. *Sagartiogeton flexibilis.* Cinclis.

Dimensions of the specimen taken at station 8 in contracted state: Largest breadth of the pedal disc 0.7 cm, height of the column 0.4 cm. — In expanded state 2 cm high (Danielssen).

Occurrence: Sognefjord, 61° 13′ N, 6° 36′ E. 1189 m. Temperature at the bottom 6.6° (Norw. N. Atl. Exped. St. 1) 1 specimen. 61° 00′ N, 4° 49′ E. 366 m. Temperature at the bottom 6.6° (Norw. N. Atl. Exped. St. 8) 1 specimen.

[illegible] Pl. 12 fig. 2 in [illegible] The pedal

[illegible] sphincter.

[illegible] distal body end. The scapus [illegible] cuticle, incrusted with foreign [illegible] conspicuous only when the [illegible] had been removed. Then they appeared [illegible] The scapulus is rather high and prox- [illegible] section as the sphincter I have [illegible]

[illegible] are about 50 in number as far I can see. [illegible] were 48 tentacles but this number [illegible] The tentacles are arranged in more than 2 [illegible] of DANIELSSEN probably 6 + 6 [illegible] The oral disc is not broad, [illegible] longitudinally sulcated. Prob- [illegible]

[illegible] The rather thick ectoderm of [illegible] The mesogloea of the [illegible] the ectoderm. The ecto- [illegible] and contains nema- [illegible] the formation of cnidules [illegible] to the same [illegible] very strong with [illegible] two thirds of the [illegible] lower. [illegible] The longitudinal muscles of the tentacles are ectodermal. The ectoderm of the actinopharynx is higher than the mesogloea and pigmented.

The perfect pairs of mesenteries were probably 6, as far I can see (in conformity with DANIELSSEN). In a section of about $^{1}/_{6}$ of the middle part of the body I counted 3 perfect mesenteries and between those, one pair and a single mesentery, 1 pair of the second and 2 pairs of the third order. Of the latter one pair seems to be weaker than the other and probably does not reach the distal body end. The 6 perfect pairs are provided with very strong, high and often kidney shaped retractors, the folds of which are rather much branched (fig. 25). It is probable that also some of the mesenteries of the second order form distinct retractors although weaker than those of the perfect pairs. In another sectioned part (see above), containing one pair of directives, one pair of the second and two pairs of the third order, the one mesentery of the second cycle was provided with weak but distinct retractors of the same appearence as those of the first cycle. As also filaments and reproductive organs are present in the mesenteries of the first as well as of the second order, there is practically no distinct difference between these mesenteries here. The muscles of mesenteries of the third order are longitudinal and weak, the parieto-basilar and basilar muscles weak. DANIELSSEN stated that the 6 perfect pairs of mesenteries were sterile. I cannot confirm this observation, the perfect mesenteries inclusive the directives were undoubtedly provided with testes, which, however, were little developed. At least certain mesenteries of the second order were also fertile. The specimen was apparently not full-grown.

The nematocysts were usually not well preserved, only in the acontia they were good. Especially it was difficult to distinguish the microbasic *p*-mastigophors from the amastigophors. In maceration preparations of the ectoderm of the actinopharynx as well as of the filaments with adjacent parts of the mesenteries I have found oval nematocysts recalling holotrichs and a very large spirocysts 52 × 7 μ undoubtedly foreign capsules, residues of the food taken (compare CARLGREN 1940 p. 50).

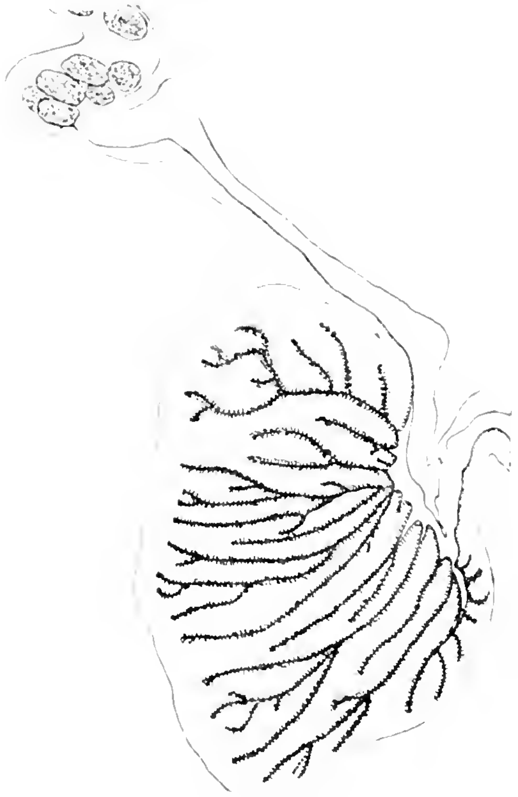

Fig. 25. *Sagartiogeton flexilis.* Part of a directive mesentery in the fertile region.

Sagartiogeton abyssorum n. sp.

Diagnosis: Pedal disc wide. Column smooth, possibly without cinclides. Margin distinct. Sphincter in its upper part reticular, in its lower alveolar, occupying only half of the thickness of the mesogloea. Tentacles between 90 and 100, conical, fairly long, fewer than the mesenteries at the base, their longitudinal muscles ectodermal. Actinopharynx longitudinally sulcated. More than 12 pairs of perfect mesenteries. 2 pairs of directives. Retractors of the mesenteries band-like but often more or less separated from the mesenteries, in extreme cases forming a band-like transversal circumscript formation. Parietobasilar muscles weak but forming a little shelf. Nematocysts of the column partly 30–36 × 5 μ, microbasic amastigophors, partly 19.7–26.8 × 2.8 over 3 μ, basitrichs, those of the tentacles partly 41–50 × about 5.5 μ, often a little curved, microbasic amastigophors, partly 22–26 × 2.8 μ, basitrichs, those of the actinopharynx partly 35–41 × 5.5 (6) μ, microbasic *p*-mastigophors, partly 31–38 × about 3.5 (4) μ, common, basitrichs, those of the filaments partly 28.2–41 × 4.2–5 μ, microbasic *p*-mastigophors, partly 11.3–15.5 × 1.5–2 μ, basitrichs, those of the acontia partly 72–86 × 6.5–7 μ, microbasic amastigophors, partly 31–55 × 3–3.5 μ, partly 15.5–19.7 × 2 μ, both basitrichs. Spirocysts of tentacles up to about 46 × 5 μ.

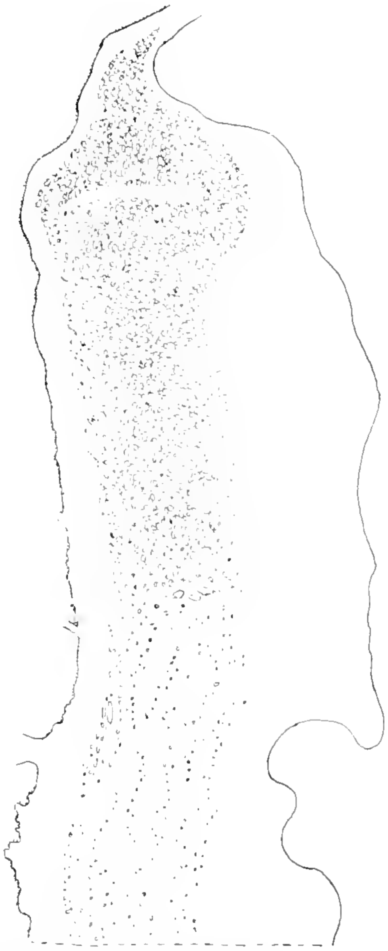

Fig. 26. *Sagartiogeton abyssorum.* Sphincter.

Colour unknown.

Size of the best preserved specimen: breadth of pedal disc 1.5 × 1.3 cm, height of the body about 1 cm.

Occurrence: 62°06′ N, 19°00′ W, 1960 m. Bottom temp. 3.4 (Ingolf exped. St. 64) 2 specimens.

Exterior aspect: Both specimens were strongly contracted, the one very damaged in its upper part. The pedal disc was broad and irregularly folded, that of the damaged specimen drawn out in two portions, the one considerably longer than the other. The column was irregularly wrinkled. I cannot decide if cinclides were present, considering the thickness of the mesogloea they were possibly absent.

Anatomical description: The textfigure 26 shows the structure of the sphincter. The mesenteries were more numerous at the base than at the margin. Owing to the strong and irregular contraction of the pedal disc it was very difficult to decide the exact number of the mesenteries at the base without demolishing the specimen. In about three fourth of the limbus I counted, however, about 100 mesenteries, wherefore the number of them may have been at least 130. The best preserved specimen had 2 pairs of directives, on the one side of the directive pairs there were 8 perfect pairs, on the other 7½; thus in all 17 pairs and a single mesentery perfect. The retractors of the perfect mesenteries were very strong and band-like, their folds high and close set and partly richly branched. The muscles issued now directly from the mesenteries (textfig. 27 *a*), now only the inner parts of the retractor were fastened at the mesenteries while the outer, larger part formed a special lobe, now the retractor were joined with the mesentery only with a mesogloeal lamella giving the retractor appearance of a circumscript sphincter drawn out in transversal direction (textfig. 27 *b*).

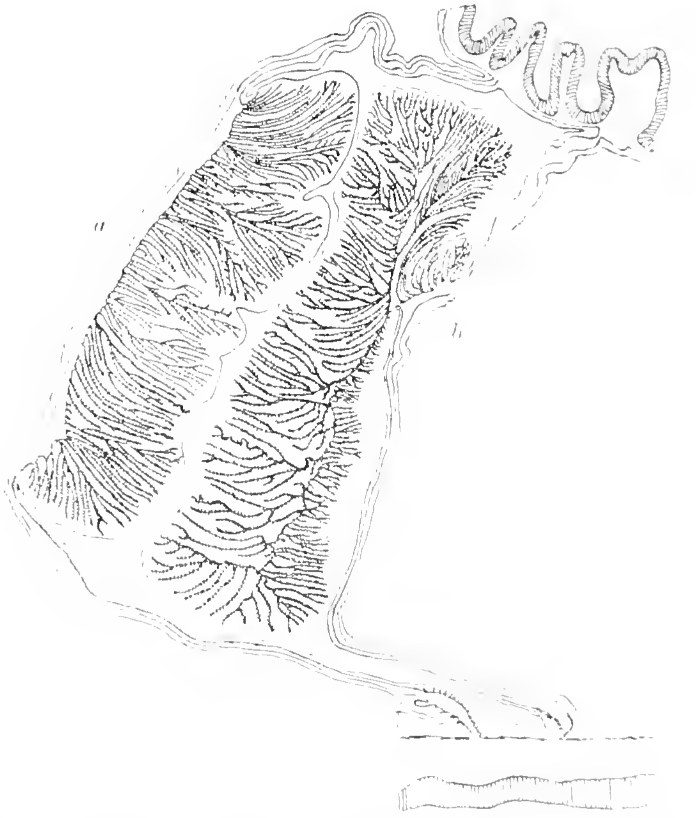

Fig. 27. *Sagartiogeton abyssorum.* Transverse section of a perfect mesenterial pair, the third from the one directive, in the region of the actinopharynx.

Remarks: The species is certainly nearly related to *S. ingolfi* but may be a distinct species because the retractors and the sphincter show different appearance, and the sizes of the nematocysts are different.

Sagartiogeton (Actinothoe) undatus (O. F. Müll.).

[illegible] O. F. Mü[illegible] 1788 II p. 50 Pl. 63 figs. 4, 5.
[illegible]
[illegible] Edwards 1857 p. 250
[illegible] 1883 p. 154
[illegible] Carlgren 1893 p. 94 figs. 27–31.
[illegible] 1902 p. 59
[illegible] 1935 p. 357, Carlgren 1940
[illegible] XIII
[illegible] Pax [illegible] p. 115
[illegible] Oersted 1844 p. 74? Lütken 1861 p. 194,
[illegible] 1865 p. 390; [illegible] 1914 p. 87

D[illegible] Pedal disc wide. Column provided with cinclides [illegible] as well as at the base, and usually (always?) [illegible] from a region below the margin. Margin [illegible] sphincter strong, alveolar with a little tendency to be [illegible] in some places, separated from the endodermal muscles [illegible] band of the mesogloea. Tentacles long, [illegible] 170–192?, at least originally hexamerously [illegible] longitudinal muscles of tentacles and radial muscles [illegible] Actinopharynx with longitudinal ridges [illegible] corresponding to the number of perfect mesenteries. [illegible] 2 siphonoglyphs, rarely 1 or 3, aborally a little prolonged. Mesenteries hexamerously arranged, but the arrangement in the [illegible] actinopharynx usually disturbed by retarding of certain mesenteries in their growth. As a rule 2 pairs of directives, [illegible] 1. Perfect pairs in varying number up to at least 18 [illegible] some single mesenteries. More mesenteries at the base than [illegible] margin. Retractors of the mesenteries band-like, more or less concentrated, rarely circumscript, those of the directives [illegible] concentrated to circumscript. Parietobasilar muscles [illegible] weak, not forming a shelf, basilar muscles well developed. [illegible] stronger mesenteries incl. the directives fertile. Dioecious. [illegible] Nematocysts of the column partly 11–22 × 3.5–5 μ, [illegible] astigophors, partly 8.5–17 × 1.5–3 μ basitrichs, those of the tentacles partly 19–27.5 × 3.5–4.5 μ microbasic amastigophors, partly 8.5–17 × 1.5–2.5 μ basitrichs, those of the actinopharynx partly 24–29 × 3.5–4.2 μ, microbasic *p*-mastigophors, partly 19.7–24 × 2.5–2.8 μ, basitrichs, those of the filaments partly 12–14.5 × 4.2–5.5 (6) μ, partly 18.3–29 × 4–5 μ, both microbasic [illegible]stigophors, partly 9.5–17 × 1.5–3 μ basitrichs, those of [illegible] partly 31–58 × 5–6.5 (7) μ, microbasic amastigophors, partly 22–31 × 2–2.5 2.8 μ, basitrichs. Spirocysts of tentacles [illegible] 21 × 4.2 μ.

Colour: Pedal disc flesh coloured. Column flesh- or salmon-[illegible] greyish when contracted. The parts which [illegible] the endocoels are coloured by red or olive-brown [illegible] forming longitudinal bands. Upper cinclides [illegible] brown annulus, at the limbus light olive-brown [illegible] cinclides as in *[illegible]*. Tentacles light grey to [illegible] at each side provided with an olive green, rarely [illegible] thickened at the base of the tentacles and [illegible] darker mark. Inside those on the disc at the [illegible] 2 darker marks which, together with [illegible] distinct B mark when the tentacles [illegible] contracted. Oral disc black-brown, [illegible] orange coloured. The parts of the oral disc [illegible] stronger endocoels are often provided [illegible] white almost square spots situated [illegible] disc. Insertions of the mesenteries on [illegible] or orange. Sometimes the directive [illegible] the other part of the disc and [illegible] the oral disc is crossed by a black [illegible] angles to the directive plane (see [illegible] 1935 Pl. XXI fig. 2).

Sizes of two well preserved, large specimens 1) length 2.5 cm, breadth at the base about 2 cm 2) length 1.5 cm, breadth at the base 3 cm. The longest individual seen by myself was, when living and well expanded, 4 cm long, at the limbus and margin 3 cm broad, in the middle of the body 2 cm; the inner tentacles were about 3 cm long (Carlgren 1893).

Occurrence: Norway: Trondheimfjord, Bergenfjord 32 m; Oslofjord, Hallandspollen. Skagerak: Bohuslän, Kosterfjord between Rumnö och Storsholm 4–7 m. (Oldevig & Eliasson); between Saltö bank and Gulskär (scapus incrusted with sand) 40 m (Wahrberg & Eliasson); between the mainland and Tjernö (Wahrberg & Eliasson); Kornö Brandskären 30 m; Gullmaren Björkholm 26 m, Strömmarne, Skatholmen 7 m (Carlgren).

Kattegat: Stigfjord 12–16 m (Carlgren, Gustafson, Molander); Koön, Marstrand 38–20 m (Lagerberg); mouth of Göta river (Wahrberg & Oldevig); Frederikshavn (Feddersen, Carlgren); E. S. E. of Frederikshavn 23–26 m; N. of Borrebjerg bank 8 m (Kramp); 3 miles E. to N. of Sæby 14 m (Thor expd.); Limfjord, Livo Bredning N. of Fur (Spärck); Kungsbackafjord 15 m ("Akka" St. 3); off Kungsbackafjord 16 m ("Akka" St. 37); S.S.W. of Nordsto ("Akka" St. 17); W. of Middelgrund 25 m ("Akka" St. 166); S. of Anholt 26 m ("Akka" St. 163); N.W. of Hallands Väderö ("Akka" St. 153); Väderö–Bastad 13.5 fms; Väderö, Sandhamn 10 fms (Lönnberg); Lysegrund (Mortensen); N.N.W. of Lysegrund ("Akka" St. 161); S.W. of Hesselö ("Akka" St. 159); off Aalsgaarde 10–15 fms (Kramp); Hellebæk; the Sound, Snekkersten 17–21 m; Samsö (Jacobsen); Store Belt (Winther); Fenö, Middelfart (Lütken); Koldingfjord 22 m (Carlgren); [Bay of Kiel (Möbius)? I have not seen any specimens from this locality.]

Exterior aspect: As far as I can remember all individuals from Bohuslän I have seen in living state were provided with tenaculi. Thus, the column was divisible into scapus and scapulus. Many preserved specimens from different localities had also tenaculi, only a few, badly preserved individuals seemed to lack them, but sections of some of them showed that there were at least traces of such formations present. Therefore I think that the presence of tenaculi is characteristic of the typical *undata*. Usually the scapus is covered with mud, if the mud is partly removed the tenaculi show an appearance of rounded spots covered with a cuticle (figs. 15, 16 Pl. III). When the scapus is wholly deprived of its investment the tenaculi project in form of papillae on the scapus. Rarely other objects than mud are stuck to the scapus. I have, however, seen two individuals, the investment of which consisted of only small grains of sand. Sections of the tenaculi show another appearance than that in other parts of the scapus ectoderm (Pl. VI fig. 6). Two tenaculi are visible in the figure, their ectoderm is probably at least partly chitinized as seen more distinctly in sections of other individuals. In the figured ectoderm that of the tenaculi is fairly high, in sections of tenaculi of other individuals considerably thinner than the other ectoderm. In the ectoderm of the scapus parasites similar to those mentioned in *S. viduatus* (see below) have often been found. The cinclides seem to be sometimes ectodermal but more usually endodermal. Of 8 cinclides examined in three specimens 6 were evaginations of the endoderm, in one cinclis the ectoderm and endoderm took part to about same extent, the 8th cinclis was almost wholly lined by ectoderm.

The number of tentacles seem never (or rarely?) to reach 192. One large specimen had 170 tentacles but 192 mesenteries at the base, another 122 tentacles and 96 pairs of mesenteries at the limbus. 96 mesenteries were present in the whole animal but as the tentacles were 122 it is clear that the younger mesenteries grow from the margin as well as from the limbus, though the latter develop earlier than the former. The mesenteries are certainly arranged after a hexamerous plan, but as of the youngest, stronger mesenteries the one mesentery is often perfect, its partner imperfect and some of them are retarded in their development the arrangement seems irregular. Usually there are 2 pairs of directives, rarely 1 or 3. Of 27 examined individuals from Stigfjord and Gullmaren 25 had 2 pairs of directives and 2 only 1 pair. Of 6 individuals of a collection attached to a shell of *Ostrea*, 3 had 2 pairs of directives, 2 1 pair and 1 individual 3 pairs of directives. The number of perfect mesenteries varies. I have dissected 6 specimens with 2 pairs of directives. The number and arrangement of the perfect mesenteries were in 1) 18 pairs and 2 single mesenteries – d (directive pair) $8^1/_2$ in d $8^1/_2$ – 2) 18 pairs and 1 single mesentery – d 8 d $8^1/_2$ – in 3) 15 pairs and 1 single mesentery – d 7 d $6^1/_2$ – in 4) 13 pairs and 2 single mesenteries – d $6^1/_2$ d $5^1/_2$ – in 5) 16 pairs perfect – d 7 d 7 – in 6) 13 pairs and 2 single mesenteries – d $6^1/_2$ d $5^1/_2$. A specimen from Gullmaren with 1 pair of directives had 16 pairs and 2 single mesenteries perfect. Three specimens from the shell of *Ostrea* had the following number of perfect mesenteries 1) 15 pairs and 2 single mesenteries – d $3^1/_2$ d $3^1/_2$ d 6 – 2) 6 pairs and 1 single mesenteries – d $2^2/_2$ d $2^2/_2$ – 3) 6 pairs and 3 single mesenteries d $5^3/_2$. The specimens 2 and 3 were small and, however, not sectioned in the uppermost part of the actinopharynx wherefore the statement of the number of perfect mesenteries is somewhat uncertain.

I have examined the nematocysts of the acontia in 46 specimens almost all from Stigfjord in Bohuslän, in 15 specimens the length of some amastigophors were more than 50 μ, in a single acontia up to 58 μ, the average length of all was 46.38 μ. The basitrichs of the acontia have been measured in 32 specimens, the average length was 25.9 μ.

var. *anguicomus* (Price).

For literature and synonyms see STEPHENSON 1935 p. 355. Also *Actinothoë anguicoma* Price PAX 1936 p. 111 fig. 139.

STEPHENSON has (1935) given a summary of this form which he regards as a distinct species, however admitting that it may be identical with *undata*. Of course it is very difficult to decide if the one is a variety of the other or whether both are distinct species. I have seen living *anguicomus* in Helgoland and in Denmark (S. of Esbjerg and Hirtshals) and have also examined a specimen from Plymouth. The small differences between the two forms are to my mind 1) *undatus* is provided with tenaculi on the column, *anguicomus* has a smooth column 2) *anguicomus* grows larger than *undatus* 3) the colour of *anguicomus* varies more than that of *undatus*. I have seen *anguicomus* in Helgoland the colour of which recalls that of *viduatus*. On the other hand both forms have sometimes the same black transverse band on the disc. The acontia too seem to have same colour in both 4) *undatus* has, though rarely, 3 directive pairs or only 1. In *anguicomus* I have found only 2 directive pairs. Too few specimens of *anguicomus*, however, have been examined to decide whether this is a real difference. Of these differences only the first seems to me important. But as I have shown that the usually smooth *laceratus* sometimes has tenaculi, and the anatomy of *undatus* and *anguicomus* agree well, it is to my mind best to regard *anguicomus* as a variety of *undatus* or vice versa but as the latter is the older name the species must be called so.

I have examined some individuals as to their anatomy which is imperfectly known. The sphincter of two large specimens sectioned (from Helgoland and Plymouth) showed same appearance. It was principally reticular and separated from the endodermal muscles of the column by a thin stripe of the mesogloea. 10 specimens (7 from Helgoland, 1 from Plymouth and 2 from Hirtshals) had 2 pairs of directives. The number of perfect pairs of mesenteries seems always to be more than 12. One individual from Plymouth had 18 pairs and 2 single mesenteries perfect – d (directives) $9^1/_2$ d $7^1/_2$. Four specimens from Helgoland had the following number of perfect pairs 1) 20 pairs and 2 single mesenteries d $9^1/_2$ d $9^1/_2$ – 2) 20 pairs – d 9 d 9 – 3) 18 pairs and 3 single mesenteries – d $9^1/_2$ d $7^2/_2$ – 4) 14 pairs and 1 single mesentery – d 6 d $6^1/_2$, this specimen was small and not fertile. All stronger mesenteries incl. the directives are fertile. The retractors and the parietobasilar muscles showed the same appearance as those of the typical *undatus*. The nematocysts of the column were partly 17–19 × 3.5 μ, microbasic amastigophors, partly 8.5–15.5 × 1.5–2.8 μ, basitrichs, those of the tentacles partly 17–22.6 × about 3.5–4 μ, microbasic amastigophors, partly 12.7–17 × 1.5–2.8 μ, basitrichs, those of the actinopharynx partly 22.6–25.5 × 4.2 (5) μ, microbasic *p*-mastigophors, partly 19.7–22.6 × 2.5–2.8 μ, basitrichs, those of the filaments partly 12–14 × 3.5–5 μ, partly 22.6–26.8 × 3.5–4.2 μ, both microbasic *p*-mastigophors, partly 11.3–13 × 2 μ, few, basitrichs, those of the acontia partly 39.5–50.8 × 5–5.5 μ, microbasic amastigophors, partly 22–26.8 × 2.5–2.8 μ, basitrichs (all information of the nematocysts from a large specimen from Plymouth, the nematocysts of the tentacles, however, measured in a large specimen from Helgoland). The microbasic amastigophors of the acontia varied between 34 and 51 μ (average size of all 40.65 μ) in 18 specimens, the basitrichs between 21 and 29 μ (average size of all 24.6 μ) in 16 specimens. The average size of the nematocysts of the acontia was somewhat smaller than in the typical *undatus*. Is is to be noted, however, that a large proportion of the *anguicomus* examined were small.

Sagartiogeton (Actinothoë) viduatus (O. F. Müll.).

Actinia viduata n. sp. O. F. MÜLLER 1776 p. 231, 1788 p. 31 Pl. 63 figs. 6–8; RATHKE 1843 p. 146; SARS 1857 p. 141. ? Lütken 1861 p. 191.
A. Isacmaea viduata EHRENBERG 1834 p. 34. ? Örsted 1844 p. 74.
Paractis ? viduata Müll. p. p. MILNE-EDWARDS 1857 p. 250.
Cylista viduata Müll. p. p. ANDRES 1883 p. 359.
Sagartia viduata O. F. Müll. PETERSEN 1892 p. 172, 176; CARLGREN 1893 p. 88 Pl. 4 fig. 2, Pl. 6 figs. 7, 8, textfig. 26; GRIEG 1913 p. 143; BLEGVAD 1914 p. 86 p. p.; BROCH 1927 p. 6.
Actinothoe viduata Müll. STEPHENSON 1935 p. 342; PAX 1936 p. 115 fig. 138; CARLGREN 1940 p. 41 fig. XIII 6–14.
? *A. filiformis* n. sp. RAPP 1829 p. 57 Pl. III figs. 2, 3; SARS 1835 p. 3.

Diagnosis: Pedal disc wide. Column smooth, always without tenaculi, with cinclides in its upper part as well as at the limbus. Upper cinclides (ectodermal invaginations) irregularly arranged in number 0–3 from each endocoel of the three oldest cycles. At the limbus 1–3 cinclides from the oldest endocoels. Sphincter ordinarily developed, extended, filling up about half of the mesogloea, reticular to alveolar, wholly separated from the endodermal muscles of the column. Tentacles conical, thin, long, in extended state considerably longer than the column, regularly hexamerously arranged in number up to 192. Actinopharynx with numerous longitudinal ridges. Always 2 siphonoglyphs without aboral prolongations. Pairs of mesenteries up to 192, hexamerously arranged, 2–3 cycles perfect. 2 pairs of directives. The youngest cycle only in the distal and proximal parts. Retractors of the mesenteries diffuse with ordinary high folds, in the region of the actinopharynx situated in the middle of the mesenteries. Retractors of the directives stronger than those of the other mesenteries and situated especially in their upper part close to the actinopharynx. Parietobasilar muscles fairly weak, basilar muscles distinct. At least the three first cycles of mesenteries with filaments, acontia, and gonads. Acontia thick. Never asexual reproduction. Nematocysts of the column partly (22) 24–27 × 4–4.5 μ, microbasic amastigophors, partly 10–19 × 1.5 over 2.5 μ, basitrichs, those of the tentacles partly (20) 22–26 (29) × about 3.5 μ, microbasic amastigophors, partly 15.5–19 × about 2.8 μ, those of the actinopharynx partly 22–24 × 4–4.5 μ, microbasic *p*-mastigophors, partly 14–26 × 2–2.5 μ, basitrichs, those of the filaments partly 17–20 × 4 μ, partly 21–27 × 4–5 μ, both microbasic *p*-mastigophors, partly 13–15 × almost 2 μ, basitrichs, those of the acontia partly 54–62 × 5.5–6.5 μ microbasic amastigophors, partly 22–29 × about 2.5 μ, basitrichs. Spirocysts of tentacles up to about 23 μ.

[illegible] station. [illegible] according to the [illegible] insertions of the [illegible] olive [illegible] provided [illegible] somewhat broadened [illegible] grey with the [illegible] coloured. Within the base [illegible] spot of same colour as the [illegible] of 12–24 opaque grey, [illegible] corresponding to the endocoels [illegible] tentacles and the actino- [illegible] stronger coloured than [illegible] greyish or yellowish white. Gonads [illegible]

[illegible] Column 5 cm long and 1.5 cm [illegible] Tentacles at least as long as [illegible]

[illegible] Norway: Trondheimsfjord, Eidsbotn on *Zostera*; [illegible] *Zostera* [illegible] Manger (teste Sars). Hjelte- [illegible] *Zostera* [illegible] Hardangerfjord on *Zostera* (teste Grieg); [illegible] *Zostera* (teste Broch). Drøbak on *Zostera* [illegible] Sweden: Gullmaren, Vadetoar on *Zostera* [illegible] Kosterfjord, Rasso on *Zostera* [illegible] Denmark: Limfjord: Nykobing; Livø [illegible] *Zostera* [illegible] off Glyngøre 23 m (Kramp). Hol- [illegible] *Zostera* [illegible] Petersen; Kattegat without distinct locality [illegible] Mortensen. The species lives usually on *Zostera* [illegible] occur on other objects in the vicinity [illegible] *Zostera* [illegible] it can be found on floating *Zostera* [illegible]

[illegible] The exterior of the species has been de- [illegible] 1893. The always smooth column is usually [illegible] *Zostera*, rarely pillarlike. As to the [illegible] principally invaginations of the ecto- [illegible] In a large specimen I have [illegible] of the cinclides from the three oldest [illegible] 0, 2, 2, 2, 3, 1, 2, 3, 3, 2, 3, 1, 1, 2, 2, 0, 2, 1, 3, [illegible] endocoels. At the base one cinclis, some- [illegible] older endocoels.

[illegible] description see CARLGREN 1893. As to the [illegible] base they seem principally to be invagina-

[illegible] the limbus.

[illegible] from the endoderm [illegible] I cannot decide with [illegible] the endodermal [illegible] sections (textfig. 28). At any rate we have to do at least with praeformed cinclides. In the ectoderm of the column sometimes encysted parasites, probably gregarines, occur (textfig. 29). They were situated about in the middle of the ectoderm or somewhat approached to the mesogloea. As in other species of *Sagartiogeton* the younger mesenteries grow from the base upwards as well as from the margin downward, but the mesenteries at the base seem to arise a little earlier than those at the margin. The retractors of the non-directives are band-like, in the directives concentrated and in the region of the actinopharynx situated close to it. The acontia are thick. The species is dioecious, the male and female gonads are ripe at the end of June in Bohuslän. The species never propagates asexually, but pieces of the basal part regenerate easily (see CARLGREN 1904, 1909).

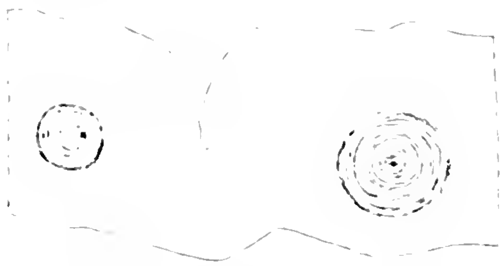

Fig. 29. *Sagartiogeton viduatus*. Encysted Gregarines in the ectoderm of the column.

Remarks: The species is not identical with *Sagartia viduata* of GOSSE (see also STEPHENSON 1935 p. 357). Also the species mentioned by SCHULZE (1875), HARTLAUB (1894) and PAX (1928) from Helgoland is not our species but *anguicomus*. The *viduata* too from Bulk (MÖBIUS 1873) and from other coasts of Germany is probably not this species. This is also the case with the species mentioned by ÖRSTED 1844 and LÜTKEN 1861 from the Sound. It is, however, possible that *viduatus* at these times was present there because we must always take into account that the fauna has changed from time to time in such an area as the Sound. Also the individuals enumerated by LEVINSEN 1893 from Danish waters were not *viduatus*. It is likely that the species shortly described by RAPP 1829 as *A. filiformis* n. sp. and noted by SARS 1835, is this species although the figures are not good; but the species undoubtly had cinclides.

Sagartiogeton (Actinothoë) laceratus (Dal.).

Pl. III fig. 13.

For literature and synonyms see STEPHENSON 1935 p. 347. Also *Sagartia undata* (O. F. M.) LÖNNBERG 1898 p. 55, 1902 p. 59 p. p. *Actinothoe lacerata* Dal. PAX 1935 p. 124 fig. 118; CARLGREN 1940 p. 41 fig. XIV 1–5.

Diagnosis. A relatively small species. Pedal disc broad and undulated in connection with the asexual reproduction. Column usually smooth but sometimes with weak tenaculi distributed over the most part of the column. Cinclides in the upper part of the column not numerous, absent at the limbus, principally endodermal evaginations. Sphincter strong, alveolar to reticular, separated from the endodermal muscles of the column by a thin band of the mesogloea, at its proximal end not pointed. Tentacles fairly long but shorter than those of *viduatus* and *undatus*, conical, in number up to about 140–150, usually considerably fewer, hexamerously, sometimes octomerously or decamerously arranged. 2, rarely 3 siphonoglyphs. Perfect pairs of mesenteries typically 12 with concentrated diffuse retractors. Parietobasilar muscles weak, basilar muscles distinct. Asexual reproduction by laceration (constriction?). Development of the mesenteries in the lacerated pieces biradial. Acontia well developed, thick. Nematocysts of the column partly 19–25 × about 3.5 μ, often curved, microbasic amastigophors, partly 11–18 × (2) 2.5 μ, basitrichs, those of the tentacles partly 22-29 × 4-4.5 (5) μ, microbasic amastigophors, partly (14) 19-22 (28) × 2.5 μ, basitrichs, those of the actinopharynx partly 26-29 × 3.5-4.5 μ microbasic *p*-mastigophors, partly (22) 23-27 × 2.5-3 μ, basitrichs, those of the filaments partly 10-13 × 4-4.5 μ, partly 22-26 × 4-4.5 μ, both microbasic *p*-mastigophors, partly 11-15 × 1.5 μ, basitrichs, those of the acontia partly 36-60 × 4-5.4 μ microbasic amastigophors, partly 21-31 × 2-2.6 μ basitrichs. Spirocysts of tentacles up to about 21 × 4 μ.

Colour: I have noted the following colours in some specimens: Column white with pale brown-red longitudinal bands. Cinclides white. Tentacles in expanded state greyish with 5 grey to yellowish-white cross-bands. On the inside of the tentacles a brown longitudinal line and a more or less distinct dark brown B spot at the base. Oral disc dark brown with yellowish radial lines or yellowish-white with dark brown radial stripes. One individual with a brown annulus around the mouth (specimens from Rotwold bay, Trondheimfjord).—Column pale salmon red with brick-red longitudinal band sometimes appearing as spots, tentacles greyish with 2 or 3 white or yellowish-white transverse bands, between these an area of lilac especially distinct in contracted state. B spots distinct at the base of the inner tentacles, brown, on the outer tentacles at same place a brown band. Oral disc paler or darker with yellowish, in the outer parts orange-coloured insertions of the mesenteries. Often 6 more or less marked, orange-coloured radial bands. Actinopharynx pale, little shading in orange (specimens from Gullmaren). See further GOSSE (1860 *Sagartia coccinea*) and STEPHENSON (1935).

Dimensions: Diameter of base up to 1.5 cm. Largest well preserved specimen length 2.2 cm, oral disc about 2 cm. According to STEPHENSON the disc and the tentacles can reach 3 cm, and the hight of expanded animal 2.2 cm or more. The Scandinavian individuals are usually smaller.

Occurrence: Norway: Foldenfjord 9-27 m (Sot-Ryen); Trondheimfjord, Rotvolds Bay 100-10 m (Carlgren); Ile Bay 50 m (Petersen); Elandwaagen 6-15 m; Fosenwaagen 25-30 m; Sodenes 100 m (Mortensen); Bjugnbotn 5-10 m; Rissen 15-13 m (Östergren). Dröbak, Skibkalla 30 m (Broch). Sweden: Bohuslän Strömstadfjord 8-15 m; N.W. of Nord Koster 30 m; Kosterfjord between Flatskär and Danielkummel 25-50 m; ½ mile S.W. of Klövskär, 35 m (Wahrberg & Eliasson); between Gaveskär and Knippelholmen 11 m (Wahrberg & Oldevig); Styrsö 35 fms. Andsöholmen (Olsson); Kornö Brandskär 30 m; Gullmaren off Langegap 35 m; off Lysekil 60 m; Björkholmen (Carlgren); Bonden Tova; Stigfjord (Carlgren & Gustafsson, Molander); Kattegat: Frederikshavn S.E. of Hirtsholm 11 fms (Carlgren); 6 miles E.S.E. of Frederikshavn 23 m (Kramp); west coast of Laesö Channel 36 m (Kramp); Laesö Channel 35-45 m (Carlgren); Kungsbackafjord 27 m, 25 m ("Akka" St. 6, 7); W. off Traslov 54 m ("Akka" St. 71); W. of Morup 46 m ("Akka" St. 103); S.W. of Galtaback 30 m ("Akka" St. 131); S.W. of Store Middelgrund 33 m ("Akka" St. 178); S.W. of Lysegrund 35 fms (Mortensen). Hellebaek (Kramp). The Sound: S.W. of Sofiero 26-32 m (Lonnberg). Raa 16 fms (Lonnberg).

Exterior aspect: The pedal disc is wide and typically strongly undulated (fig. 13 Pl. III) in connection with the asexual reproduction by constriction. MARY STEPHENSON (1925 p. 891) characterises the species (*coccinea*) "among other things by its lacerate basal outline and constant habit of asexual reproduction by basal fragmentation". Whether this habit is constant is questionable though as a rule it is so. The column is as a rule smooth, sometimes, however, provided with weak tenaculi in most part of it. I have seen several individuals from different localities in Bohuslän and at Frederikshavn having such formations. STEPHENSON (1929 p. 128 and 1935) has referred *Phellia picta* Gosse to *A. lacerata*. According to GOSSE (1860) this species was provided "with a very thin membranous epidermis" extending about half-way up the column. Perhaps it was a *lacerata* furnished with tenaculi. STEPHENSON (1935) mentions, however, that he never has observed any tenaculi in the British individuals of *lacerata*.

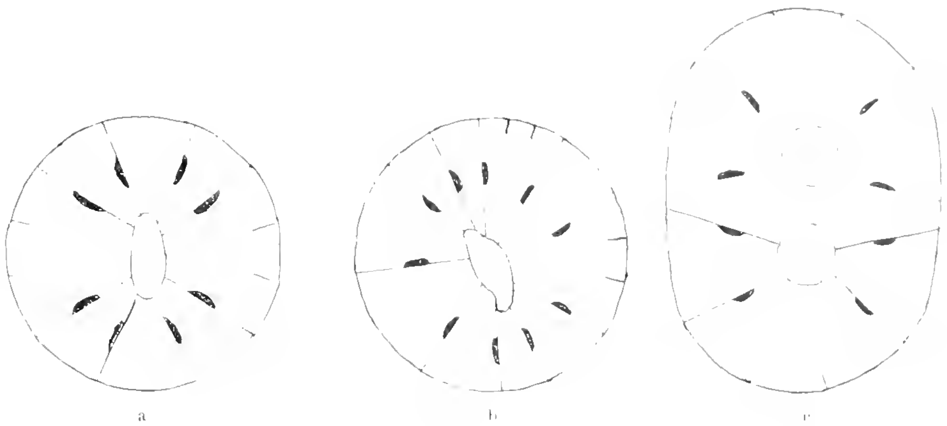

Fig. 30. *Sagartiogeton laceratus*. Schematical arrangement of mesenteries in lacerated pieces.

In the upper part of the column there are few cinclides present, usually only one, sometimes two communicating with the older endocoels. At the base cinclides seem to be absent. The tentacles are usually hexamerously, sometimes octomerously, decamerously or irregularly arranged. Their number varies considerably but seems never to reach 192. In a very large individual I counted 75 tentacles in about the half of the animal. Usually they are fewer than 100. They are considerably shorter than those of *viduatus* and *undatus* also in extended state. The actinopharynx is longitudinally ridged, the siphonoglyphs, usually 2 rarely 3, are well developed. The size of the species is smaller than that of *viduatus* and *undatus*.

Anatomical description: The arrangement of the mesenteries is as a rule hexamerous but sometimes octomerous or decamerous. The arrangement varies so much that it seems as if never a single directive pair should be present in this species. Of 26 specimens examined from different localities 21 had 2 pairs of directives symmetrically or almost symmetrically situated, 2 individuals were also provided with 2 such pairs but separated from each other only by a perfect common pair, 3 specimens had 3 pairs of directives, in 2 of these two pairs of directives were situated as in the latter specimens, the third pair was about opposite the two others, in the third specimen the three directive pairs were more symmetrically arranged. The difference in this respect between *laceratus* and *Sagartia elegans*, which latter species often has only a single directive pair, is certainly correlated with the different mode of asexual reproduction in the two species. In *elegans* new [illegible] *Metr-* [illegible] *...atus* [illegible] mesenteries pass [illegible] complete development [illegible] On the other hand, in [illegible] complete destruction of [illegible] it separates from [illegible] 1904 by which [illegible] I have sectioned [illegible] Fig. 30 shows the arrange- [illegible] the level of the actinopha- [illegible] 12 mesenteries were pre- [illegible] radially arranged. In a fourth [illegible] has gone a little further [illegible] symmetrically arranged directives. [illegible] fig. 30 b). A fifth piece was a [illegible] common directives (fig. 30 c) [illegible] of a tentacle in the directive plane [illegible] 1904 [illegible] Pl. 1. 3 other pairs had fewer mesen- [illegible] fig. 30 a but even these pieces showed [illegible] that the one development zone was [illegible] between the development zones in- [illegible] retarded in its development I think that [illegible] from the hexamerous type can be ex- [illegible] perfect pairs varies a little, typically [illegible] they are fewer, sometimes more [illegible] however not found more than 14 perfect pairs [illegible] The retractors of the perfect [illegible] usually high folds but fairly concentrated, [illegible] in the region of the actinopharynx. [illegible] are weak, the basilar muscles distinct. [illegible] of the acontia is summed up from 15 [illegible] the nematocysts of which have been [illegible] the size of the other nematocysts only [illegible]

Sagartiogeton tubicolus (Dan. & Koren.).

[illegible]

[illegible] Koren and Danielssen 1877 Pl. 9 figs. 1, 2.

Pedal disc very broad. Column cylindrical or [illegible] less distinctly divisible into scapus and sca- [illegible] with an easily deciduous cuticle and with very [illegible] Cinclides in the scapulus below the [illegible] part of the body. Sphincter long, [illegible] its upper part reticular. Tentacles [illegible] length, the inner longer than the [illegible] the mesenteries and irregularly [illegible] of tentacles and radial muscles [illegible] well developed siphonoglyph. [illegible] Mesenteries generally more [illegible] the distal part of the body. [illegible] mesenteries. Commonly one pair of [illegible] mesenteries diffuse but more [illegible] Parietobasilar muscles [illegible] mesogloea. Stronger mesenteries. [illegible] Nematocysts of the column partly [illegible] partly 10–22.6 [illegible] partly 24–41 × 4.2 [illegible] 19.7–24 × 2.5–2.8 μ, basi- [illegible] partly 28.2–42 × 4.2–5.6 μ, [illegible] 19–27 × 4.2–5 μ micro- [illegible] 32 × 2.5–2.8 μ basitrichs, those [illegible] 4.2 [illegible] μ microbasic p-masti- [illegible] 4.2–5 μ microbasic p-masti- [illegible] those of the acontia [illegible] mastigophors, partly [illegible] of tentacles up to 35 × 5 μ.

Colour according to Koren and Danielssen: Column carnation red, oral disc rosy red with lighter radial stripes, tentacles rosy red. The actinopharynx of some specimens from Stjernøysund and Rognsund was light red brown in alcohol.

Size of the well preserved specimen from Hjeltefjord. Pedal disc 1 × 0.7 cm, oral disc 0.7 cm, height of the column 1.8 cm. The largest specimen from Stjernøysund was 1.8 cm high and broad, the smallest one 0.4 cm high and its pedal disc 0.6 cm, the largest specimen from Rognsund was about 1.4 cm high (introverted) and its pedal disc 1.8 × 1 cm, the smallest one 0.35 cm high and its pedal disc 0.7 × 0.5 cm.

Occurrence: Norway: Korsfjord at Bergen about 397 m (teste Danielssen and Koren); Hjeltefjord at Bergen, Bratt-holmen, depth unknown, 1 specimen on an Ascidian; Finmarken, Skarvskjaer, Stjernøysund 300–350 m (Gunnerus exp. 1929), some specimens; Rognsund, N.E.-point of Stjernøy, 200–350 m, on shells of *Balanus hameri* (Gunnerus exp. 1929), some specimens.

Description of the specimen from Hjeltefjord.

Exterior aspect: The column was broader at the base than in the distal part. The lower part formed a scapus provided with scattered tenaculi and a cuticle easily deciduous and incrusted with foreign bodies. The tentacles were short, the inner longer than the outer and 72 in number. Danielssen and Koren (1877) noted that their species had 48 tentacles, but on the figure 2 Pl. 9, there were 58 tentacles figured. The oral disc was fairly broad, the actinopharynx very long and provided with numerous longitudinal ridges and furrows.

Anatomical description: The ectoderm of the scapus had numerous gland cells. In the tenaculi the ectoderm was considerably lower but the cuticle stronger than in the interjacent parts. Owing to imperfect preservation I cannot describe the structure of the tenaculi, but there is no doubt that we have to do with such formations. The ectoderm of the scapulus showed the same structure as that of the scapus but was devoid of a cuticle. The numerous cinclides, being, as it seems, concentrated in an annulus between the scapus and the sphincter, were principally evaginations from the endoderm, sometimes also the ectoderm took part a little in the formation of the cinclides. Also in the lowest part of the scapus where tenaculi seem to be absent (this part was not incrusted) there were cinclides, principally invaginations of the ectoderm. The mesogloea of the column was fairly thick, in the uppermost part of the body, however, attenuated. The sphincter

Fig. 31. *Sagartiogeton tubicolus*. Section of sphincter in its aboral part.

was long and occupied the most part of the scapulus. It seems to be somewhat reticular in its upper part (the preservation of the sphincter was bad here), in its lower part, where the mesogloea was thick, it were alveolar (textfig. 31). The ectodermal muscles of the tentacles show coarse folds, the radial muscle folds of the oral disc were closer set. The actinopharynx was of the usual structure, the longitudinal ridges of the ectoderm pass over into the cnidoglandular tract of the filaments. The figure 32 shows a section of the actinopharynx with the single siphonoglyph.

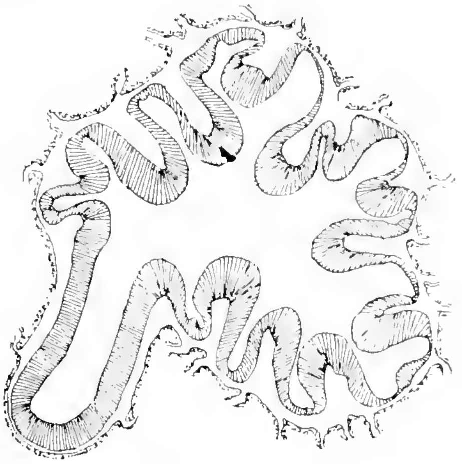

Fig. 32. *Sagartiogeton tubicolus*. Transverse section of the actinopharynx.

Fig. 33. *Sagartiogeton tubicolus*. Section of a perfect mesentery at the end of the actinopharynx.

The mesenteries were irregularly arranged in correspondence with the presence of only one pair of directives. There were 23 mesenteries perfect and several imperfect in almost the whole region of the actinopharynx, I have, however, not examined the uppermost part of the body, possibly some more mesenteries were perfect there. Of the perfect mesenteries 10 formed pairs, three mesenteries were single. At the limbus I counted 120–130 mesenteries, at the margin the mesenteries may have been 72 as the specimen had 72 tentacles. In the middle part of the body the mesenteries seemed to be fewer. Thus, the mesenteries grow from the margin as well as from the limbus but certainly more rapidly from the latter. The retractors of the perfect mesenteries were concentrated in their upper part and provided with high folds (fig. 33). The mesogloea of the mesenteries was thickened, especially in the lower part of the specimen, and the parietobasilar muscles situated on a distinct fold of the mesogloea (fig. 33). The nematocysts of the scapulus were partly 25.4–29 × 4.5–5.5 μ, microb. amastig., partly about 14 × 2.8 μ, basitrichs, rare, those of the tentacles partly 28.2–32.4 × 4–5.6 μ, microb. amastig., partly 19.7–22.6 × 2.8 μ, basitrichs, those of the actinopharynx partly 31–33.8 × 4.2–5 μ microb. *p*-mastig.?, partly 25.4–28.2 × 2.8 μ, basitrichs, partly 11.3–14 × 2 μ, basitrichs, those of the filaments partly 24–29.6 × 4.2–5.6, microb. *p*-mastig., partly 11.3–14 × 4.2 μ, microb. *p*-mastig., partly 11.3–13.4 × (1.5) 2, basitrichs, those of the acontia partly 44–60 × 5.6 μ microb. amastig., partly 40.2–45.1 × 4.2 μ, basitrichs. Spirocysts up to about 33 × 5 μ.

Fig. 34. *Sagartiogeton tubicolus*. Section of the column with a tenaculum (specimen from Stjernoysund).

Since I have examined the specimen described above I have had the opportunity to examine several specimens taken at two localities, Stjernoysund and Rognsund, situated not far from each other in the Finmark. The specimens from Stjernoysund agree in their exterior and anatomy and also in the size of the nematocysts fairly well with those taken in Hjeltefjord, so that they may belong to one and the same species. Also the specimens from Rognsund resemble the named specimens so much that I am inclined to place them together but as the microbasic amastigophors and *p*-mastigophors were considerably larger here, it may be possible that it is a distinct species. I have, however, at present referred them together, the specimens from Rognsund as a variety *major*.

The exterior of the Stjernoysund and Rognsund specimens agrees. The pedal disc was very wide, the column in contracted specimens conical or in more expanded state more or less cylindrical, though the base was considerably broader than the distal part. The column seemed to be quite smooth also by examination with a lens, but microscopic examination of one Stjernoysund specimen sectioned completely showed that there were small tenaculi here (fig. 34). Probably there had been a very thin cuticle also in other specimens though it had been torn off during the dredging. The tentacles were in 3 specimens from Stjernoysund 66, 80 and 118, in 4 specimens from Rognsund 60, 62, 84 and 96, the mesenteries at the base 180, 156 and 220 resp. 92, 128 and 96 [illegible] tacles were not [illegible] with several [illegible] Stjernøysund had [illegible] Rognsund likewise, [illegible] situated. The [illegible] I have sectioned the [illegible] locality it seems [illegible] Hjeltefjord. The retractors [illegible] of the specimen from [illegible] those of the specimens.

[illegible] Section of a perfect mesentery at the [illegible] specimen from Stjernøysund).

[illegible] were the folds of the mesogloea were more [illegible] shows a section of a perfect mesentery of a [illegible] Stjernøysund. The stronger mesenteries, incl. the [illegible]

[illegible] comparison of the size of the nematocysts [illegible] Stjernøysund and Rognsund. The nemato[illegible] the Stjernøysund specimen were partly [illegible] amastig., partly 18.3–22.6 × 3(3.5) μ [illegible] those of the tentacles partly 24–33 × 1.5 μ, [illegible] exam.), partly 22.6–24 × 2.5–2.8 μ (1 [illegible] actinopharynx partly 24–31 × 4–5.6 μ, [illegible] partly 19–24 × 4–2.5 μ, microb. [illegible] partly 22–29.6 × 2.5–2.8, basitrichs [illegible] filaments partly 26–32 × 4.5–5 μ, [illegible] partly 12.7–14.1 × 3.5–4.2. [illegible] those of the acontia partly [illegible] microb. amastig., partly 38–48 × 3 [illegible]

[illegible] from Rognsund were: those [illegible] microb. amastig. (1 spec. [illegible] basitrichs (1 spec. [illegible] partly 31–41 × 4.5–5 μ, microb. [illegible] 19.7–24 × 2.8 μ (1 spec. exam.), [illegible] 33–42 × 5–5.6 μ, microb. *p*-mastig.? (1 spec. exam.), partly 21–27 × 4.2–5 μ, microb. *p*-mastig. (1 spec. exam.), partly 21–32 × 2.5–2.8 μ, basitrichs (1 spec. exam.), those of the filaments partly 31–43 × 5 μ, microb. *p*-mastig. (3 spec. exam.), partly 14.4–19.7 × 3.5–4.2 (5) μ, microb. *p*-mastig. (2 spec. exam.), partly 11.3–14 × 1.5 μ (1 spec. exam.) those of the acontia partly 62–82 × 5.6–almost 7 μ, microb. amastig. (6 spec. exam.), partly 44–53 × 3.5–4.2 μ basitrichs (6 spec. exam.). As we see the microbasic amastigophors and the microbasic *p*-mastigophors were considerably longer in the specimens from Rognsund than those from the other localities as the following comparison of the average length shows:

	Acontia micr. am.	Filament m*p*m.	Tentacles micr. am.	Actinopharynx m*p*-m?
Hjeltefjord	50.5 μ	26.3 μ	30.3 μ	32.9 μ
Stjernøysund . .	57.5 μ	28.4 μ	28.8 μ	28.5 μ
Rognsund	71.8 μ	38.3 μ	37.75 μ	38.1 μ

The average size of the basitrichs of the acontia was 12.8, 12.97 and 16.75 thus, a fairly little difference. It is to be noted that the smallest specimen from Rognsund (see above: size) had larger nematocysts than those of the largest specimen from Stjernøysund.

The occurrence of a single siphonoglyph in so many specimens indicates that asexual reproduction, probably by laceration, is prevalent in this species.

Remarks: I have with some hesitation identified the specimens with *Phellia tubicola*, Kor. & Dan.

Genus **Phellia** Gosse.

Sagartiid with broad pedal disc. Column without cinclides, divisible into scapus and scapulus, the former with a cuticle and with somewhat modified tenaculi forming distinct wart-like papillae covered with a very thick cuticle. Sphincter fairly well developed, long, mesogloeal, wholly separated from the endodermal muscles of the column. Tentacles at least in younger individuals fewer than the mesenteries, the inner tentacles longer than the outer ones. Longitudinal muscles of tentacles and radial muscles of oral disc ectodermal or meso-ectodermal. Siphonoglyphs varying, as also the pairs of directives (1–4). Younger mesenteries growing from the base upwards. Arrangement of the mesenteries often irregular owing to asexual reproduction (laceration or longitudinal fission?). Perfect pairs of mesenteries usually more than 6, sometimes fewer, with strongly concentrated to almost circumscript retractors and well developed parietobasilar muscles forming a distinct strong fold. The stronger imperfect mesenteries with or (in younger individuals) without retractors. Basilar muscles distinct. Filaments, acontia and gonads from the first cycle of mesenteries (incl. the directives) onwards. Acontia well developed provided with microbasic amastigophors and basitrichs. Cnidom: spirocysts, basitrichs, microbasic amastigophors and microbasic *p*-mastigophors.

The recovery of GOSSES' *Phellia gausapata* by STEPHENSON and the examination of this species by STEPHENSON as well as by myself — I have examined a specimen from Skluma, Norway and lately an individual from Iceland — have disturbed our previous idea about the genus *Phellia*. The anatomy of this species, which STEPHENSON (after stating that the first named *Phellia*, *P. murocincta*, is identical with *Sagartia troglodytes*) regards as type of the genus, agrees more with the genus *Sagartia* than one previously has suggested, so that it is not necessary to retain the family Phelliidae. Numerous species placed in the genus *Phellia* have been described but belong to the genus *Telmatactis* or to several other genera. In my paper on the Actiniaria of the German Deep-Sea expedition (p. 236, note) I have stated that *Sagaphellia* and *Phellia* are synonyms. In fact, at present we can refer only *Sagaphellia aucklandica* Carlgr., *Hormathia exlex* McMurr., and possibly *Syphellia dubia* Carlgr. to the genus *Phellia*. All these species live in northern boreal or subantarctic waters.

The genus, I think, is nearly related to *Kadosactis*. Both genera are characterized by irregularity in the mesenteries and the number of siphonoglyphs, though *Phellia* is more aberrant in these respects, with sometimes 4 pairs of directives and 4 siphonoglyphs. There are, however, some differences, the tenaculi are of different structure in the two genera and *Kadosactis* is provided with cinclides which are lacking in *Phellia*.

Phellia gausapata Gosse.

Pl. V fig. 2.

Literature and synonyms see STEPHENSON 1935 p. 371 Pl. XXI fig. 5, Pl. XXII fig. 4, textfigs. 75, 76, 99 D, 106. Also CARLGREN 1930 p. 7; PAX 1936 p. 111.

Diagnosis: Pedal disc fairly broad, at least in younger individuals broader than the oral disc. Tenaculi with a very strong cuticle. Sphincter thin but long, at least half of it situated in the scapus. Tentacles in variable number, often irregularly arranged. Actinopharynx with 1–3 not strong siphonoglyphs, 1–3 pairs of directives. Perfect pairs of mesenteries varying from 4 to 8, sometimes one mesentery perfect, its partner imperfect. Mesenteries, at least in younger examples, more numerous than the tentacles, arranged in 4 or 5 (6) cycles. Retractors of the stronger mesenteries varying from concentrated diffuse to more circumscript. In older individuals also the mesenteries of second and third orders, are provided with retractors, in younger ones not. Filaments at least on all older mesenteries. Gonads from the oldest mesenteries onwards, in younger individuals on the first and second cycles. Acontia well developed. Their basitrichs somewhat larger than the amastigophors. Nematocysts of the scapus partly 14.3–20 × 3.5–4 μ, microbasic amastigophors, partly 14–17.6 × 3.2–4.2, those of the scapulus 14–18 × 3.5–4 μ, those of the tentacles partly 14–18 × 3.2–4 μ, microbasic amastigophors, partly 16.6–22.6 × 2–2.5 μ, basitrichs, those of the actinopharynx partly 21.2–25 × 3.8–4.6 μ, microbasic amastigophors?, partly 24.6–29.2 × 2–2.6 μ, basitrichs, those of the filaments partly 10–14 × 2.8–3.5 μ, microbasic *p*-mastigophors, partly 14.3–17.6 × 1.5–2 (2.5) μ, basitrichs, those of the acontia partly 27.5–37 × 3–3.5 μ, microbasic amastigophors, partly 30–43 × 3.5–4.6 μ, basitrichs. Spirocysts of tentacles up to 31 × 4 μ.

Colour: "Lowest part of scapus cream coloured, highest part greenish grey. Scapulus pale flesh-colour tinged with purple, longitudinally streaked with dull purple, the streaks irregular. Tentacles translucent, grey, marked with opaque cream and dull brick-red. Primary tentacles with a transverse cream bar halfway up, interrupted in the middle and with red areas above and below it, secondary tentacles similar to the primaries but with an additional cream bar at the base. Tertiary tentacles with two cream bars. Oral disc purplish grey with a soft pattern. A pale zone round the mouth imperfectly outlined by a scalloped ring of opaque cream. Primary and secondary radii dark, the latter with a pale orange triangle, tertiary radii pale orange with a little V at the tentacle base. Actinopharynx cream." (STEPHENSON 1935).

Size: According to STEPHENSON up to 2–3 cm in length and 1.5–2 cm in breadth at the oral disc, when expanded. The individual marked with (1) was in contracted state 1.2 cm long and 1.5–0.7 cm broad at the base, 0.3 cm at the distal part. The size of the example marked with (2) was: length 1.6 cm, breadth at the base 0.7 cm, at the margin 0.3 cm.

Occurrence: Norway: Sklinna, low-water (DONS 1927), 1 specimen (1). Iceland: Vestmannaeyar low-water (SÆMUNDSSON 1899), 1 specimen (2).

Further distribution: North-east coast of Scotland, Wick (Gosse, Stephenson).

Exterior aspect: The single individual from Norway was contracted, conical with broad base, narrow in its upper part. The scapus was provided with a firmly adherent cuticle, very thick in the strong, wart-like tenaculi. The scapulus was smooth, the margin tentaculate. The tentacles were 32 in number and considerably fewer than the mesenteries at the base, the inner tentacles considerably larger than the outer ones. The actinopharynx had few but high longitudinal ridges. There were 2 siphonoglyphs symmetrically situated. STEPHENSON has noted 1–3 siphonoglyphs.

Fig. 36. *Phellia gausapata*. Section of a perfect mesentery in the region of the actinopharynx.

Fig. 37. *Phellia gausapata*. Section of a mesentery of the second order in the region of the ciliated tracts.

Anatomical description: The ectoderm of the scapus was fairly low, in the tenaculi thinner, on the other hand the cuticle of the tenaculi was very thick (fig. 2 Pl. V), in other parts fairly thin. In distinction from the cuticle of the tenaculi in *Kadosactis* it shows a very compact structure, at any rate it is not so lamellar as in this genus. The structure of the ectoderm in the tenaculi seems

H[illegible] the state [illegible] present between [illegible]. The mesogloea of [illegible] it contained [illegible] in the mesen[illegible] parts. Probably [illegible] of the column [illegible] strong [illegible] of the sphincter [illegible] muscles of the ten[illegible] were considerably [illegible] pharynx. [illegible] distal part [illegible] was present [illegible] part of the body as well as [illegible] pairs at the limbus. I cannot, [illegible] of the fourth cycle were devel[illegible] at the base but probably [illegible]. Thus it is clear that the [illegible] from the base upwards. In a large [illegible] 1935 p. 37) found the same number of [illegible] the youngest mesen[illegible] up to the margin. A smaller example [illegible], however, more mesenteries at [illegible]. He has observed specimens with [illegible] 7 [illegible] perfect pairs and in a large individual [illegible] mesenteries [illegible] 29 and 31 [illegible] were in his specimens 1 or 3. Fur[illegible] of the first to third cycles [illegible] retractors. As the specimen from Skhinna was rather young, only the first cycle of mesenteries had well developed retractors, though the mesenteries of the second and third cycles were well developed. The retractors show sometimes a tendency to be circumscript in their upper part, usually they are diffuse but concentrated with high folds. The figures 36 and 37 show sections of a directive mesentery and a mesentery of the second order in the region of the actinopharynx (fig. 36) and of the ciliated tract (fig. 37). The inner part of the latter mesentery, not figured, had undeveloped ovaries but no retractor. The parietobasilar muscles were very distinct in the perfect mesenteries and form high folds, the basilar muscles distinct. The mesenteries of the three first cycles were provided with filaments, those of the first and second order with gonads, though only a little developed. STEPHENSON has stated that also the younger mesenteries are fertile in larger specimens. According to this author the species reproduces itself by basal fragmentation.

Remarks. The description of the individual from Norway I have principally made in 1928. Lately I have examined a single specimen from Iceland. Unfortunately it was not well preserved, so that I cannot give any information about the arrangement of the mesenteries and the number of siphonoglyphs. I have only measured its nematocysts. In the diagnosis I have summed up the size of the nematocysts as far as known up to now. Though the nematocysts of the acontia in the individual from Norway were somewhat larger, those in the individual from Iceland a little smaller than those in STEPHENSON's specimen. I think it is no doubt that all three examples belong to same species. For further information see STEPHENSON's paper 1929 and 1935.

Family Hormathiidae Carlgr.

A[illegible] sphincter carrying only basitrichs. Mesenteries [illegible] and [illegible]. Sphincter mesogloeal. [illegible] 1952 p. 262) that the family must be called H[illegible] genus *Chondractinia* is a synonym of *Hor*[illegible] genus *Metridium* should go to an especial family, M[illegible]

Genus Chondrophellia Carlgr.

[illegible] divisible into scapus and [illegible], the former with a cuticle and tubercles [illegible] part, where 12 short rows of a few [illegible] conspicuous. Scapulus longitudinally sul[illegible] mesogloeal. Tentacles hexamerously [illegible] the mesenteries. Longitudinal [illegible] muscles of oral disc ectodermal. [illegible] arranged, only the first 6 pairs of [illegible]. M[illegible] in the distal and especially [illegible] of the body. Perfect mesen[illegible] ones with diffuse retractors [illegible]. Below the actinopha[illegible] mesenteries are curved [illegible] muscles weak. Mesenteries [illegible] fertile and provided [illegible] sterile and without [illegible] provided only with basitrichs, [illegible] microbasic *p* mastigophors.

Chondrophellia coronata (Verr.).

[illegible] VERRILL 1883 p. 53 Pl. 6 [illegible]

[illegible] 1893 p. 187 Pl. 31 figs. [illegible]

Actinauge fastigata McMurr. STEPHENSON 1920 p. 536.

Chondrophellia coronata (Verr.) CARLGREN 1928 p. 259, 289, 1928 b p. 216.

Hormathia elongata n. sp. GRAVIER 1918 p. 11, 1922 p. 67 Pl. 5 figs. 52, 53, Pl. 6 figs. 54–57.

Diagnosis: Scapus checkered, in its upper part tuberculated, in its summit 12 rows of 2–3 high tubercles not sharply defined from each other. Cuticle, especially on the tubercles, thick. Sphincter alveolar. Tentacles up to about 96, the last cycle often (always?) incomplete. 2 siphonoglyphs without aboral prolongations. Pairs of mesenteries 48, the last cycle apparently complete only at the limbus. Longitudinal muscle pennons of the mesenteries of the first and second cycle well developed, in their lowermost parts weak. Nematocysts of the scapulus 18–23 × about 2.8 μ, basitrichs, those of the tentacles 22–32 × about 2.8 μ, those of the actinopharynx partly 22–34 × 2.8–3.5 μ basitrichs, common partly 25.5–28.5 × 4.2 μ, microbasic *p* mastigophors, few, those of the filaments partly 15.5–17.5 × 2–2.5 μ, basitrichs, those of the acontia 30–53 × about 2.8–4.2 μ. Spirocysts of the tentacles 19 × 2–50 × 7.5 μ.

Colour in preserved state: Scapus yellowish-brown or greyish.

Dimensions in preserved state: length 1.9 cm, breadth of the distal part 1 cm and of the pedal disc 1.5 cm, inner tentacles 0.4 cm long and 0.1 cm broad at the base (spec. from St. 78); length 2 cm breadth of the distal part 1.5 cm and at the pedal disc 1.2 cm (spec. from St. 90); length 3 cm, breadth 1.2 cm (spec. from St. 11), length 0.8 cm breadth of the pedal disc 1.25 × 1 cm (spec. from St. 166); length 1.4 cm breadth 2 cm (spec. from Blake exp.).

Occurrence: 66°35′ N., 56°38′ W., 599 m. Temp. at the bottom 3.9° (Ingolf exp. St. 32) 1 specimen; 61°15′ N., 29°06′ W., 1070 m. Bottom temp. 4.1° (Ingolf exp. St. 90) 1 specimen; 61°31′ N., 31°12′

W. 2418 m. Bottom temp. 1.6° (Ingolf exp. St. 11) 2 specimens; 62°57′ N. 19°58′ W. 957 m. (Thor exp. 1903. St. 166) 1 specimen; 61°33′ N. 19° W. 2051 m. Bottom temp. 3° (Ingolf exp. St. 65) 1 specimen; 60°37′ N. 27°52′ W. 1505 m. Bottom temp. 4.5° (Ingolf exp. St. 78) 1 specimen; 49°25′ N. 12°20′ W. 1275–1180 m. (Thor exp. 1905 St. 93) 3 specimens.

Figure 95 shows the distribution of the species.

Further distribution: East coast of U. States 300–980 fms, Marthas Vineyard 41°29′45″ N. 65°47′10″ W. 980 fms (Blake exp. St. 307 teste VERRILL). East Atlantic 38°26′ N. 26°30′45″ W. 1165 m, 31°43′30″ N. 10°46′45″ W. 2165 m (Monaco exp.). ?coast of Chile 38°08′ S. 75°53′ W. 677 fms. (Albatross exp. St. 2791).

Exterior aspect: The pedal disc is thin, commonly not or slightly broader than the cylindrical column and provided with a thin cuticle. The column is firm and its scapus provided with an adherent cuticle, which is thick and hard especially in the tuberculated area. The most part of the scapus shows longitudinal and transversal furrows giving the scapus a checkered appearance. Distally the squares have a more tuberculated facies. In the summit of the scapus there are 12 tuberculated ridges drawn out longitudinally, each divisible by shallow incisures into 2 or mostly 3 tubercles giving the ridges a characteristic, denticulate aspect (Pl. I fig. 10). The scapulus is short and longitudinally sulcated. The tentacles in the contracted state are rather thick and conical, the inner tentacles of ordinary length, the outer ones about half as long as the inner ones. They are hexamerously arranged in 5 cycles, but the last cycle was incomplete in the specimens examined (from St. 78). I counted here 39 tentacles in the one half, possibly there were a few more as some tentacles were very small. About half of the oral disc is devoid of tentacles. The oral disc is radially furrowed at the insertions of the mesenteries, the actinopharynx is of ordinary length and provided with 2 distinct siphonoglyphs symmetrically situated and devoid of aboral prolongations.

Fig. 38. *Chondrophellia coronata.* Lower half of the sphincter.

Anatomical description: The ectoderm of the pedal disc and column is rather thin, that of the scapulus contains numerous nematocysts. The mesogloea of the column is thick and provided with rather numerous cells poor in protoplasm. The circular muscles of the column are weak, on the other hand the mesogloeal sphincter (fig. 38) is very well developed and alveolar, in the middle region with a little tendency to be reticular. The muscle meshes are large, especially in the upper part of the sphincter.

The ectoderm of the tentacles is higher than the mesogloea and contains numerous spirocysts but more sparse nematocysts, especially in the specimens from St. 78 and 90. In the specimens from St. 11 they were more numerous in the apex of the tentacles. The longitudinal muscles of the tentacles are ectodermal with high folds arranged like a palisade and often somewhat ramified. The radial muscles of the oral disc are also ectodermal, sometimes, but not always, they are weaker at the insertions of the mesenteries. The ectoderm of the actinopharynx is somewhat thicker than that of the scapus and provided with numerous nematocysts. The mesogloea of the actinopharynx is of ordinary thickness. The sizes of the nematocysts (n) and spirocysts in the different regions of the body were the following:

Habitat.	scapulus	tentacles		actinopharynx	acontia
	n.	n.	sp.	n.	n.
St. 78	....	24–27	19 × 1.5–43 × 7 μ	22–29	31–41 × about 2.8 μ
St. 90	18–23 × 2.5 μ	26–32	19 × 1.5–50 × 7.5 μ	.....	....
St. 11	....	26–31	22 × 2–50 × 7 μ	26–34	38–53 × 2.8–4 μ
St. 93	....	(20) 22–26	19 × 1.5–46 × 7.5 μ	.....	33–41 × 2.8 μ
St. 32	....	....	....	.....	30–42 × 2.8–3 μ
St. 166 (small spec.).........	....	....	....	.....	30–36 × 2.8 μ
St. 2791 (Albatross exp.).....	....	....	....	26–34	34–42 × 2.8–4 μ

The pairs of mesenteries were 48 in the sectioned specimens from St. 78, of these only 24 were present in the most part of the body, i. e. the fourth cycle was developed in the uppermost and lowermost parts of the column. At the limbus there were 24 pairs present, at the margin fewer. Only 6 pairs of mesenteries are perfect. The mesenteries of the second order are also well developed, those of the third order weaker and those of the fourth very weak. In the region of the actinopharynx the perfect mesenteries are thin in the inner half, in the outer thickened; the mesenteries of the second and third orders weaker here than below the actinopharynx. The mesenteries of the 3 first orders form diffuse retractors the folds of which are high, especially in the middle part of the retractors, and often rather much branched. Textfigure 39 shows a transverse section of 4 mesenteries of the 3 first cycles below the actinopharynx. The inner parts of the non-directives are here curved towards the exocoels, those of the directives towards the endocoels. The retractors do not reach the basal disc but are continued in a weaker muscle lamella in the proximal parts of the mesenteries (textfig. 40). The parietobasilar muscles are rather weak and form few and low folds, in the mesenteries of the third order they are in contact with the retractors. The basilar muscles are weak, with few but distinct folds. The mesenteries of the first and second order incl. the directives are provided with filaments and reproductive organs, either ovaries or testes. The acontia are very well developed.

Remarks: The anatomy of this species is described by McMURRICH (1893 p. 188), in several points, however, the description is incomplete. In contradistinction to McMURRICH I have found [illegible] are fertile in 2 [illegible] a specimen from the [illegible] M. M[illegible] specimens. Thus, it is

[illegible] Section of the scapus with a directive [illegible] of the second and third order.

[illegible] does not belong to the genus *Actinauge* but [illegible] a new genus, for which I have already proposed [illegible] *Chondrophellia*. Concerning the species [illegible] M. M[illegible] substituted the name *coronata* for *fastigiata* in order to obviate confusion with *Hormathia* (*Chitonactis*) *coronata*. As the species must be placed in another genus than *H. coronata* it is not necessary to give the species a new name. The name *fastigiata* must be dropped.

[illegible] a directive mesentery in [illegible]

As far as I can see the Albatross specimens, dredged off the coast of Chile, belong to the same species as the Atlantic specimens; of the former I have examined one specimen, considerably larger than the Atlantic specimens. Also *Hormathia elongata* described by GRAVIER (1918, 1922) is certainly this species or at least a species belonging to the genus *Chondrophellia*. The figures of this species agree very well with *Chondrophellia* as also GRAVIER's description of its exterior and of its imperfectly described anatomy. GRAVIER's statement that the parietobasilar muscles are well developed, while the retractors are weak, is certainly due to a confusion of these muscles. It is opposite to remark that the retractors of *Chondrophellia* are situated close to the column.

Genus **Allantactis** Dan.

Hormathiidae with smooth, fairly thick column which is devoid of tubercles, cuticle and cinclides. Margin distinct. Sphincter very strong, mesogloeal. Tentacles fairly short, the inner longer than the outer ones, without basal bulbs, 96 in number, hexamerously arranged. Longitudinal muscles of the tentacles ectodermal, radial muscles of oral disc meso-ectodermal. 2 well developed, broad siphonoglyphs. 6 pairs of perfect and sterile mesenteries, 2 pairs of directives. Not more mesenteries than tentacles. Retractors of the mesenteries diffuse. Parietobasilar and basilar muscles fairly weak. Cnidom: spirocysts, basitrichs, microbasic *p*-mastigophors.

Allantactis parasitica Dan.

Pl. III fig. 11. Pl. IV fig. 9.

Allantactis parasitica n. gen. n. sp. DANIELSSEN 1890 p. 20 Pl. 2 fig. 3, Pl. 9 figs. 1–4.

Allantactis parasitica Dan. KWIETNIEWSKI 1898 Pl. 11 figs. 1–3; CARLGREN 1902 p. 50, 1912 p. 5; PAX 1915, 1922 p. 250; CARLGREN 1928 p. 293, 1932 p. 263, 1939 p. 11; CARLGREN in KRAMP 1933 p. 17; CARLGREN in BROCH 1936 p. 1.

Calliactis kroyeri n. sp. DANIELSSEN 1890 p. 36 Pl. 2 fig. 2, Pl. 8 figs. 6, 13, 14.

Pedal disc fairly wide embraicing shells of *Sipho*, *Neptunea* or other gastropods. Column smooth. Sphincter very strong separated from the endodermal muscles of the column by a rather thin stripe of the mesogloea, mesogloeal, distinctly transversally stratified. Tentacles, at least in preserved state, more or less longitudinally furrowed, their longitudinal muscles well developed. Radial muscles of oral disc principally ectodermal, strong in the outer part, weaker in the inner one. Actinopharynx with longitudinal ridges. Siphonoglyphs with well developed gonidial tubercles and aboral prolongations. Retractors of the perfect mesenteries band-like, in the region of the actinopharynx forming fairly low folds, in the directives stronger, below the actinopharynx the folds of the retractors are strongest inwards. Parietobasilar muscles forming no shelf. Mesenteries of the second cycle may sometimes be sterile. Nematocysts of the column 23.5–30 (31) × 3.5–4.2 μ, basitrichs, those of the tentacles (25.5) 28–39.5 × 3.5–4.2, basitrichs, those of the actinopharynx (26) 28–42 × 3–4.2 (4.9), basitrichs, those of the filaments partly (21) 24–33.8 × 4.2 (4.9) μ, microbasic *p*-mastigophors, partly 12.7–17 × 1.5–2 μ basitrichs, those of the acontia partly 31–43.7 × 3–3.5 μ, partly 15.5–22.6 × almost 2 μ, both basitrichs. Spirocysts up to between 50–60 × 7–7.5 μ.

Colour. Column yellow, shading a little to brown, distal part near the tentacles rose-red. Tentacles pale violet. Oral disc rose-red, around the mouth a purple-red oblong annulus (*Allantactis parasitica*, DANIELSSEN); Column carmine-red with light-red longitudinal stripes, tentacles and oral disc pale buff colour. The colour varies, however, somewhat in the different individuals, from scarlet to carmine (*Calliactis kroyeri*, DANIELSSEN); reddish with deeper coloured stripes, distal part of the body reddish (specimen from Hurry Inlet); colour white to brown-yellow upwards reddish (specimen from Franz Joseph fjord); yellow-red with yellow-grey tentacles (specimen from Fame Islands).

Sizes in preserved state up to 10 cm long and 4 cm broad.

Occurrence: Jones Sound, Gaasefjord 76°18′ N. 88°10′ W. (Fram Exp. 1900) 75°51′ N. 81°01′ W. 610 m. Bottom temp. ÷ 0.6°.

West Greenland: Baffin Bay and Davis Strait: 77°28.5′ N. 68°16′ W. 875 m. Bottom temp. ÷ 0.4°, 77°17′ N. 69°59′ W. 930 m. Bottom temp. ÷ 0.4°, 77°05′5 N. 71°13′ W. 790 m. Bottom temp. ÷ 0.4°, 76°36′ N. 68°51′ W. 180–80 m. Bottom temp. ÷ 1.3°, 75°35′ N. 65°41′ W. 490 m. Bottom temp. 0.7°, 75°26′ N. 62°26′ W. 820 m. Bottom temp. 0.7° (Godthaab Exp.), 75°26′ N. 67°27′ W. 260 fms. (Sofia Exp.), 74°52.5′ N. 62°12′ W. 150 m. Bottom temp. 0.7°, 73°12′ N. 58°08′ W. 850 m. Bottom temp. 0.5° (Godthaab Exp.). Upernavik (Drosvad 1929), 72°08′ W. 74°20′ W. 30–80 fms. (Nilsson), 70°53′ N. 54°03′ W. about 700 m. Bottom temp. 1.05°, 70°51′ N. 52°01′ W. 733 m. Bottom temp. 1.1° (Godthaab Exp.). Umanak 260 fms. (Tjalfe Exp. 1908), 250 fms. (Hansen). Ikerasak, inner part of Umanakfjord 70°36′ N. 51° W. 80–120 fms. (Olrik), 69°16′ N. 51°35′ W. (Tjalfe Exp. 1908 St. 146), 69°44′ N. 51°38′ W. 350 fms. (Sofia Exp.), North part of Disco fjord 171–227 fms., 69°17′ N. 52°50′ W. 225 fms. 69°17′ N. 52°11′ W. 227–231 fms., 69°15′ N. 53°18′ W. 111–161 fms. (Tjalfe Exp. 1908 St. 115, 117–18, 122, 182), 68°17′ N. 58°14′ W. 410 m. Bottom temp. 2.55°, Totness Road, Exeter Sound 75–200 m (Godthaab Exp.). Tunugdliarfik 280–300 m. Bottom temp. 2.1° (Rink Exp. 1912 St. 139). Greenland without distinct locality (Olrik).

East Greenland: Tirolerfjord near the head 122–126 m. Bottom temp. ÷ 1.10°, near Young Sound 320 m. Bottom temp. ÷ 1.73 (Norwegian Exp. 1932). Clavering fjord 338–100 m. Between Jackson Isl. and Cape Mary 250–230 m. Bottom temp. ÷ 1.05°, 4 quarter-miles S. of Hold with Hope 340–260 m. Bottom temp. 0.3° (Norwegian Exp. 1931) Mackenzie Bay N. of Franz Joseph fjord 12–35 m, entrance of Franz Joseph fjord 200–300 m. Inner part of Mosknsoxefjord 100 m, outer part 220 m (Kolthoff Exp. 1900). Between Bontekoe and Cape Bennett 290 m. Franz Joseph fjord 502 m. Temp. 1.3°, Dusén fjord 185–75 m. Bottom temp. ÷ 1.2° (Norwegian Exp. 1930, 1931), Geologfjord near head 650–625 m. Bottom temp. ÷ 1.61°, Grantaffjord 82 m. Bottom temp. ÷ 1.56° (Norwegian Exp. 1932), 73°20′ N. 21°30′ W. 70 m, 73°15′ N. 25°42′ W. 760 m, 72°45′ N. 22°56′ W. 35–60 m, 72°43′ N. 26°38′ W. 35–60 m (Sw. Greenland Exp. 1899), Sofia Sound 200 m, entrance of Kempe fjord 100–55 m. Vega sound 250 m, 30 m, 250–190 m, Alpe fjord 70 m, Antarctic harbour (Norwegian Exp. 1930), Forsblad fjord 14–3 fms. (Danish E. Greenland Exp. 1900), Scoresbysound, Fame Isl. 70°50′ N. 22°33′ W. 23–25 m. Hurry Inlet 70°43′ N. 22°29′ W. 70 m. (Sw. Greenland Exp. 1899), 7–0 fms. (Danish E. Greenland Exp. 1900). Kangerdlugssuak 175 m (2nd East Greenland Exp. 1932).

41

42

Figs. 41, 42. *Allantactis parasitica*. Section of 2 sphincters in their middle part. The outer part of the sphincter figured in 42 is somewhat schematic.

N. E. and E. of Iceland: 67°40′ N. 15°40′ W. 495 fms. Bottom temp. ÷ 0.6° (Ingolf St. 121) 66°14′ N. 11°33 W. 781 fms. Bottom temp. ÷ 0.8° (Ingolf Exp. St. 110), 66°32′ N. 18°50′ W. 192 m (Heegaard), 64°53′ N. 10°0′ W. 630 m. Temp. 600 m ÷ 0.69° (Michael Sars Exp. 1900), 65°21′ N. 10°42′ W. 650 m (Monaco Exp.) 63°05′ N. 3°00′ E. 960 m. Bottom temp. ÷ 1.1° (Norw. N. Atl. Exp.), 63°06′ N. 2°46′ E. 915 m. Temp. at 910 m ÷ 1.07° (Michael Sars Exp. 1900), 63°07′ N. 1°38′ E. 1450 m, 62°58′ N. 1°56′ E. 1100 m. 62°13′ N. 1°26′ E. 775 m (Michael Sars Exp. 1902, all stations from the cold area).

West Spitzbergen: 80°01′ N. 10°51′ E. 430 m (Monaco Exp.) Kings Bay 60–160 fms. (Sw. Spitzb. Exp. 1861) Prince Charles Forland 78°57′ N. 11°80′ E. 115 m (Olga Exp.). 78°18′ N. 8°47′ E. 199 m. Bottom temp. 1.1° (Norw. N. Atl. Exp.) 78°22′ N. 17°10′ E. 102 m (Monaco Exp.). Safe Bay 118–127 m. Temp. at 108 m 0.65°, entrance Tundra Bay 71–68 m. Bottom temp. ÷ 0.93°, off Tundra Bay 117–111 m. Temp. at 110 m ÷ 0.62°, off Cape Erdmann 263–256 m. Bottom temp. 2–2.6°, off Alkhorn 406–395 m. Temp. at 382 m 2.61°, Advent Bay 70–12 m. Temp. at 11 m 1.85°, entrance East fjord 199–226 m. Temp. at 210 m 1.27°, Temple Bay, Biona Harbour 30 m. Bottom temp. 3.78°, Green Bay 90–80 m, Billen Bay 37–35 m. Bottom temp. 1.5°, 150–140 m ÷ 1.67°, Northfjord [illegible] Bay 70–95 m. [illegible] at 95 m [illegible] about 0 (Sw. [illegible] N. 210–240 m. (Helgoland [illegible] 1.1 (Michael Sars Exp. [illegible] 1864). Sassen Bay [illegible] Exp.). Advent Bay 78 16′ N. [illegible] N. [illegible] (Exp. Recherche [illegible]

[illegible] Treurenberg Bay, Foster Isl. 40 fms. [illegible] 1861. Bastian Isl. 40–50 fms. (Kükenthal & Walter [illegible] Wahlbergs Point (Sw. Spitzberg Exp. [illegible] N. E. [illegible] Cape Melchers 13 fms. (Kükenthal & Walter [illegible] 30–40 fms. (Malmgren 1864), 2 miles [illegible] (Kükenthal & Walter). King Charles [illegible] 78 [illegible] N. 27 [illegible] E. Bottom temp. 0.2, 78 50′ N. 29 30′ E. [illegible] Exp. 1898.

[illegible] 75 05′ N. 18 30′ E. Bottom temp. 2 [illegible] Exp. 1898), 75 31′ N. 17 50′ E. 225 m. Bottom [illegible] 72 [illegible] N. 21 51′ E. 408 m. Bottom temp. 1.5 (Norweg. N. Atl. Exp. [illegible]).

[illegible] Murman Coast: Kola fjord (Awerinzeff, Derjugin), [illegible] 20–110 m. (teste Pax), about 72 N. 38 E. 274 m. [illegible] 1.1 (Poseidon Exp. teste Pax), 72 19′ N. 17 45′ E. [illegible] Exp.).

Kara Sea (Dijmphna Exp.), 73 37′ N. 80 35′ E. 23 fms. (Nor[illegible] Exp. 1876).

[illegible] Siberia: Taimyr Isl. 76 15′ N. 95 30′ E. [illegible] 5–10 fms. Bottom temp. [illegible] 1.1, Cape [illegible] 77 [illegible] N. 103 25′ E. 5–10 fms., 76 40′ N. 115 30′ E. [illegible] 1.6, 76 52′ N. 116 0′ E. 36 fms. Bottom [illegible] Stolbovoj and Blischni 73 53′ N. 138 E. [illegible] N. of the mouth of Indigirka 72 20′ N. [illegible] Bottom temp. [illegible] 0.6 (Vega Exp.), 75 29′ N. [illegible] 75 21′ N. 164 18′ E. 58 m. 75 30′ N. 164 28′ E. [illegible] N. [illegible] E. 56 m., 73 15′ N. 175 30′ E. 45 m. [illegible] 2–4 [illegible] the bottom between [illegible] 1.12 [illegible]

[illegible] 1898 has described the anatomy of this species [illegible] nematocysts. In the main my examination of [illegible] Kwietniewski, who, however, says [illegible] oral disc are ectodermal. In fact it [illegible] muscles as meso-ectodermal, as here [illegible] which the muscles are situated [illegible] figures 11 and 12 I have drawn the middle [illegible] two specimens. I have examined the [illegible] 5 specimens, those of the tentacles [illegible] 10, those of the filaments in [illegible] 18 specimens.

[illegible] *Urticina crassicornis* and *Calliactis* [illegible] The sizes of the nematocysts [illegible]

Actinauge Verr.

[illegible] often ex[illegible] divisible into scapus [illegible] more or less strong, [illegible] upper part. More or less [illegible] with longitudinal [illegible] with the coronal [illegible] with more or [illegible] more than 96 or [illegible] Radial muscles [illegible] weak over the [illegible] Actinopharynx well developed with 2 broad siphonoglyphs. Pairs of mesenteries 48, rarely a few more, 2 pairs of directives, 6 pairs perfect and sterile, at least the most other fertile. Tentacles and mesenteries in same number. Retractors diffuse, rather weak, parietobasilar and basilar muscles weak. Acontia well developed containing only basitrichs. Cnidom: spirocysts, basitrichs, microbasic *p*-mastigophors.

Actinauge longicornis Verr.

Urticina longicornis n. sp. Verrill 1882 p. 222.
Actinauge longicornis Verr., Verrill 1883 p. 53 Pl. 5 figs. 1–2, 1885 p. 511, 531, Pl. 7 fig. 21; McMurrich 1898 p. 211.
Hormathia longicornis (Verr.) Stephenson 1920 p. 535.
Chitonactis? longicornis (Verr.) Haddon 1889 p. 315.

Diagnosis. Pedal disc deeply excavated. Scapus always with small tubercles. Tentacles 96, acute, in expanded state long (teste Verrill). Swellings on the abaxial side of tentacles especially distinct on the inner tentacles. Sphincter transversally stratified with small meshes collected mostly in larger groups. Mesenteries 96. Nematocysts of the scapulus 15.5–21 × 2.8–3.5 μ, basitrichs, those of the tentacles 19–27 × 2.8–3.5 μ basitrichs, those of the actinopharynx partly 19–31 × 2.8–4 μ, basitrichs, partly about 21 × 3 μ microbasic *p*-mastigophors, rare, those of the filaments partly 17–19.7 × 2.8–3.5 μ, microbasic *p*-mastigophors, partly about 11.3 × 1–1.5 μ basitrichs, those of the acontia 28–35 × about 3–4 μ, spirocysts of the tentacles up to about 36 × 6 μ.

Colour: Column whitish or pale pink, scapulus usually with darker and lighter stripes of orange-brown or purplish-brown colour. Tentacles translucent, usually delicate pink or rose-colour, sometimes light purplish brown, usually with an ill-defined whitish ring at the base and pale tips. Oral disc usually whitish or pale rosy pink with broad radii of deep rose-red or sometimes dark purplish-brown. Lips orange-brown or reddish with deeper brown stripes on the large lateral folds, gonidial grooves paler (Verrill).

Dimensions: 10–12.5 cm high and 8–9 cm broad, tentacles 4.5–6.5 cm long (Verrill). The largest specimen examined by me was 6.5 cm high and 5 cm broad in the preserved state.

Fig. 13. *Actinauge longicornis*. Section of the sphincter in its middle part.

Occurrence: 39 57′15″ N. 70 56′30″ W. 195 fms. (U. S. Fish Comm., Albatross Exp. St. 2183) 2 specimens. — Marthas Vineyard 100–325 fms., Delaware bay 130 fms., Beaufort N. Carolina 34 0′30″ N. 76 10′30″ W. 178 fms. (teste Verrill).

Exterior aspect. The pedal disc is deeply excavated enclosing mass of mud or sand as the pedal disc of *A. verrillii* and *richardi*. The column is higher than broad and divisible into scapus and scapulus. The former is in its lowermost part almost smooth, in its upper part provided with more or less numerous, but always small tubercles arranged in vertical rows. In the contracted state the column is transversally furrowed, and shows in the tuberculated area a checkered appearance. There are no distinct, coronial tubercles. As the ectoderm of the scapus is lost, I cannot confirm, whether the scapus is provided with a cuticle. At any rate the cuticle, if present, is weak. In the contracted state of the animal the scapulus is furnished with numerous longitudinal furrows and alternately broader and smaller ridges, the number of the ridges seems to correspond to the number of tentacles, as each ridge ends at the base of a tentacle. Thus the margin is not distinct. The tentacles are acute, and in the expanded state long (teste VERRILL), in the contracted state of ordinary length, the inner are longer and broader than the outer ones. The capitular ridges, especially the larger ones, end with thickenings at the base of the tentacles, the latter are bulbous swollen at the outside of the base. These swellings are most distinct in the inner tentacles. The number of tentacles seems to correspond to that of the mesenteries, and is 96. In VERRILL's figure 1 Pl. 5 (1883) the last cycle is not indicated. They are probably hexamerously arranged. The inner half of the oral disc is radially furrowed and lacks tentacles. According to VERRILL the oral disc "can expand very broadly". The actinopharynx is long and provided with several longitudinal furrows and ridges, in the contracted state also transversally furrowed. The 2 siphonoglyphs, symmetrically situated, are broad and aborally prolongated.

Figs. 44, 45. *Actinauge longicornis*. Transverse sections of a tentacle (fig. 44) and a perfect mesentery (fig. 45) in the region of the actinopharynx. Inner part of the mesentery not figured.

Anatomical description: The mesogloea of the column is thick and contains cells poor in protoplasm, the sphincter very strong and separated from the weak endodermal muscles by a considerable mesogloea-layer. The muscle meshes are arranged in groups, elongated transversally and separated from each other by thicker balks of mesogloea. Therefore the sphincter is distinctly transversally stratified. In its lowest part the muscle meshes are more scattered and separated by thicker mesogloea-balks and curved (fig. 43).

The ectoderm of the tentacles is thick apart from that of the basal swellings. The longitudinal muscles of the tentacles are ectodermal, in their proximal parts weaker on the outside than on the inside, in the basal swellings probably absent (fig. 44). In the outer parts of the swellings I have found some muscle meshes in the mesogloea in transverse sections, but probably these muscle meshes belong to the sphincter. The mesogloea of the tentacles is thick in their basal parts especially in the swellings. The radial muscles of the oral disc are meso-ectodermal and well developed, at the insertions of the mesenteries not weaker than between the mesenteries.

The mesenteries are typically arranged in 4 cycles (6 + 6 + 12 + 24 + 48 pairs). Only the mesenteries of the first cycle are perfect. The longitudinal muscles form weak diffuse retractors in the stronger mesenteries (fig. 45). In the region of the actinopharynx the retractors are situated in the middle of the mesenteries, or somewhat more outwards, and show large folds seen with the naked eye. The parietobasilar muscles are weak, as are also, probably, the not well preserved basilar muscles. The mesenteries of the first cycle are sterile, the other fertile. In maceration preparations of the filaments with adjacent parts of the mesenteries there were fairly numerous nematocysts of different size and appearance, one part certainly holotrichs, the other atrichs or holotrichs all evidently residues of the food taken (see CARLGREN 1940 note 2 p. 50).

Remarks: HADDON (1889 p. 315) has referred the species to the genus *Chitonactis*, and HADDON (1898 p. 459) and STEPHENSON (1920 p. 535) to the genus *Hormathia*. As the genus *Actinauge* may be maintained, the species *longicornis* undoubtedly belongs to this genus. It agrees as well in appearance as in organisation much with *Actinauge verrilli* and *richardi*.

Actinauge richardi (Marion).

Pl. III fig. 7. Pl. IV fig. 1.

For literature and synonyms see STEPHENSON 1935, moreover
Chitonactis richardi (Mar.) FISCHER 1889 p. 269 Pl. 6 figs. 3, 4.
Actinauge richardi (Mar.) CARLGREN 1934 b p. 16; PAX 1936 p. 111.

Diagnosis: Pedal disc thin, usually deeply excavated, forming a cup-shaped concavity filled with mud or sand which serves as an anchor for the animal, sometimes, however, attached to other objects and then flattened. Column divisible into scapus and scapulus, the former covered with a cuticle which sometimes is thin, sometimes strong and provided with tubercles showing a tendency to be arranged in longitudinal and vertical rows. The tubercles are of very variable appearance, now low, now large, rounded or more acuminate. At the uppermost part of the scapus usually 12 stronger tubercles. Scapulus with ridges which sometimes are broken up by transverse interruptions into tubercles, and which communicate with the swellings of the tentacles of at least the fourth cycle. Sphincter separated from the very weak endodermal muscles of the column by a fairly thick stripe of the mesogloea, fairly long, not much broader in its upper part than in its lower, usually alveolar with a tendency to longitudinal and transverse stratification or forming a net of coarse meshes in which smaller [illegible] reduced to bundles [illegible] hexamerously in 5 cycles, [illegible] of the 5th cycle, [illegible] swellings on their outside [illegible] fairly weak on the [illegible]. Radial muscles of oral disc meso- [illegible] with about 24 longi- [illegible] prolonged aborally. [illegible] 6 pairs of perfect and [illegible]. Retractors of the mesen- [illegible] concentrated, forming [illegible] weak, not forming a shelf, a little [illegible] mesenteries. Nematocysts of the [illegible] 18.3–26.8 × 2.5–2.8 μ, partly about 11.3 × 1.5–2 μ, [illegible] of the actinopharynx partly 22–36 × [illegible] 19.7 × 3 μ, very rare, microbasic [illegible] filaments partly 10–11.3 × 1.5–2, [illegible] 16.2–20 × 3–4.2 μ microbasic p-mastig- [illegible] partly 24–34 × 3–3.5 μ, partly 8.5– [illegible] basitrichs. Spirocysts of tentacles up to [illegible]

[illegible] white tinged with green, tubercles dull- [illegible] of tentacles whitish. Tentacles white [illegible] with brown longitudinal bands, or blood-red to [illegible] longitudinal bands of red and white. Oral disc [illegible] streaked with brown, muddy brown, [illegible] colour (HADDON, DURÈGNE).

[illegible] broad and 12 cm high.

[illegible] Shetland 60°36′ N. 0°37′ W. 115 m (Jäger- [illegible] Hebrides 58°31′ N. 8°03′ W. 300 m (Jägerskiöld); [illegible] N. 5°11′ E. 400 m. Temperature at the bottom 6.31° [illegible] Sars exped. St. 51 1902); 61°14′ N. 2°13′ E. 115 m. Temperature at the bottom 6.78° (Michael Sars exped. St. 50 1902); [illegible] (teste STEPHENSON); great fishing banks N.W. [illegible] S.W. of Bergen 130–180 fms., N.W. of Egersund, Jederen, [illegible] (Swedish fishermen). North Atlantic: 50°22′ N. 11°44′ W. 184 m; 49°27′ N. 8°36′ W. 146 m. Temperature at [illegible] 9.78° (Michael Sars exped. 1910); 36°07′ N. 8°03′ W. [illegible] exped. St. 1096 determined by GRAVIER as [illegible]; 35°32′ N. 7°07′ W. 1215 m, temperature at [illegible] 1910); 35°31′ N. 6°35′ W. 535 m, temperature at 157 m [illegible] Michael Sars exped. 1910); 26°35′ N. 15°05′ W. 189 m, temperature at the bottom 14.2° (German Deep Sea exped.), locality? [illegible] St. 14 determined by MARION as *Chondractinia* [illegible] Mediterranean: Naples, Palanghesari, Bochicella.

[illegible] distribution: Several localities S.W. of Ireland [illegible] Bay of Biscay, coast of Portugal, west [illegible] as far as Senegal (teste FISCHER) according to [illegible] from 70 to 2000 m.

[illegible] species has been described by HADDON [illegible] 1918 [illegible] (1928). Finally STEPHEN- [illegible] good summary of the exterior and the [illegible] made by him in other re- [illegible] is summed up from 10 speci- [illegible] of the filaments only from 3.

Actinauge verrilli (Hadd.) McMurr.

[illegible] CARLGREN 1928 p. 292 and 1933

[illegible] of *A. richardi*. Column divisible [illegible] with a cuticle rarely deciduous [illegible] tubercles arranged in longi- [illegible] very variable in their [illegible] large and more flattened and formed by growing together of smaller tubercles. Lower part of the scapus not tuberculated or with indistinct tubercles. Scapulus agreeing with that of *richardi*, the ridges however more numerous. Sphincter elongated, occupying only a part of the thick mesogloea, only in its upper part somewhat below its apex stronger, alveolar with distinct tendency to transverse stratification. Tentacles 96, rarely a few more, short, especially in comparison with the length of the animal, conical, at least in the preserved state longitudinally furrowed, at their outside provided with sometimes very strong, sometimes weaker swellings of the mesogloea. The longitudinal muscles of tentacles ectodermal, not strong, very weak in the bulbs. Radial muscles of the oral disc ectodermal or meso-ectodermal, well developed. Actinopharynx long, longitudinally furrowed. Two distinct but not very broad siphonoglyphs aborally prolonged. Mesenteries 96 or rarely a few more, hexamerously arranged, 6 pairs of perfect and sterile mesenteries. The mesenteries of the second order also seem to be sterile. Retractors of mesenteries diffuse with low folds. Nematocysts of the scapus 10.6–13.4 × 2 μ, basitrichs, those of the scapulus partly 11.3–18.3 × 2–2.8 μ, basitrichs, partly 21–28.2 × 4.2 μ microbasic p-mastigophors, those of the tentacles 22.6–36 × 2.8–3 (3.5) μ, basitrichs, those of the actinopharynx partly 26–42.2 × 2.8–3.5 μ, partly 14–19 × about 2 μ both basitrichs, partly 21–36 × 4–4.5 μ microbasic p-mastigophors, those of the filaments partly 12.7–18.3 × 2 μ, basitrichs, partly 24 × 31 × 4.2 (4.5) μ, microbasic p-mastigophors, those of the acontia partly 31–43 × 3–4 μ, partly 14–21.5 × 2 μ, both basitrichs. Spirocysts of tentacles up to 60 × 7 μ.

Colour: Scapus dull pale red, flesh colour or salmon, warts pink or whitish. Scapulus red, orange or chocolate-brown often present in stripes of darker or lighter tints. Tentacles usually dark pink, salmon, orange or orange-brown varying to dull red and chocolate-brown. Oral disc usually orange or reddish brown or chocolate, with lighter and darker radii (teste VERRILL 1922 p. G. 95).

Size: up to 10–15 high and 8–10 cm broad, larger tentacles up to 1.5–2 cm long. (VERRILL 1922).

Occurrence: Baffin Bay, Davis Strait and West Greenland: 77°28′5 N. 68°46′ W. 875 m, bottom temp. ÷ 0.1; 77°05′5 N. 71°73′ W. 790 m, bottom temp. ÷ 0.1; Melville Bay 75°26′ N. 62°26′ W. 820 m, bottom temp. 0.7; 74°52′5 N. 62°12′ W. 450 m, bottom temp. 0.7; off Lancaster Sound 74°12′ N. 77°00′ W. 680 m, bottom temp. 0.1; 73°12′ N. 58°08′ W. 850 m, bottom temp. 0.5 (Godthaab exp. 1928); Upernavik (Drosvad); 70°53′ N. 54°03′ W., about 400 m, bottom temp. 4.05; 70°51′ N. 52°01′ W. 733 m (Godthaab exp. 1928); Umanakfjord 260 fms. (Tjalfe exp. 1908), Umanak 397 fms. (Ingegerd and Gladan exp. 1871); 250 fms. (Amundsen); Discofjord 130 fms. (Holm); Discofjord, Nipisite harbour 10–20 fms. (Ingegerd and Gladan exp. 1871); 68°24′ N. 54°05′ W. 220–280 fms. (Tjalfe exp. 1908); 66°19′ N. 56°28′ W. 235 fms. (Wandel 1889); 66°14′ N. 56°08′ W. 175 fms. (Tjalfe exp. 1908); 66°42′ N. 56°42′ W. (Tjalfe exp. 1909); 66°35′ N. 56°38′ W. 318 fms. bottom temp. 3.9 (Ingolf exp. St. 32) 65°36′ N. 56°24′ W. 349 fms. (Wandel); 65°34′ N. 54°31′ W. 68 fms., bottom temp. 0.2 (Ingolf exp. St. 29); 65°30′ N. 55°26′ W. 289 fms. (Wandel 1889); 65°14′ N. 55°42′ W. 420 fms., bottom temp. 3.5 (Ingolf exp. St. 28); 63°30′ N. 54°25′ W. 582 fms., bottom temp. 3.3 (Ingolf exp. St. 25); Kvanefjord 420 m, 300–500 m, 200–440 m (Rink exp. St. 5, 11, 23).

N. of New Foundland 54°20′ N. 52°25′ W. 232 fms. (Ingegerd and Gladan exp. 1871); St. Lawrence estuary 50–330 m (Préfontaine); 80 miles S. of Marthas Vineyard (U. S. Fish. Com.); 40°03′ N. 70°28′ W. 135–160 fms. (U. S. Fish Commission).

Iceland. Hali of Isafjarðardjup 170–235 m); Reyðarfjörður 226 m.

Further distribution: East coast of N. America from Chesapeake Bay to west of New Foundland 50–1098 fms. (teste

Verrill 1922). West coasts of N. and S. America? (teste McMurrich; probably, as he remarks, another species).

Exterior aspect: The exterior of this species varies considerably in the distribution and size of the warts of the column. In the specimen from U. S. Fish Commission (Pl. II fig. 9) the warts are small and rounded and the arrangement in rows very distinct, the specimens from the Godthaab expedition (Pl. II figs. 6, 8, 10) agree with the former, but the warts are fewer and sometimes very indistinct. In an individual from the Tjalfe expedition (Pl. II fig. 7) the upper warts have begun to grow together in the upper part of the scapus at the same time as they have become larger. Much larger warts are meet with in a specimen from the Ingolf expedition (Pl. II fig. 4). Three other individuals, all from same locality, show a different appearance. The specimen figured in Pl. II fig. 2 has the warts of about ordinary size but the arrangement is more irregular. Figs. 1 and 3 Pl. II show individuals provided in their upper parts with very large warts (the lower part of the scapus is not visible) evidently arisen from growing together of smaller warts. When I first examined these specimens I suggested that they possibly belonged to *Phelliactis*, but a closer examination of the oral disc of the specimens figured in Pl. II figs. 2, 3 and 4 showed that the characteristic arrangement of the muscles in this genus were absent here, wherefore these specimens must be referred to *Actinauge verrillii*, all the more as all other characters, also the size of the nematocysts, agreed with this species. The ridges of the scapulus and the coronial tubercles, often not distinct, seem to vary in number.

Fig. 46. *Actinauge richardi*. Section of the sphincter in its middle part.

Anatomical description: McMurrich has 1893 given a good description of the anatomy of this species. The sphincter is, in comparison to the size of the specimens, fairly weak, strongest in the upper part apart from the uppermost. It shows a tendency to transverse stratification though not so distinctly as in *A. longicornis*. A portion of the sphincter has been drawn in figure 46. The basitrichs of the acontia have been measured in 25 specimens, their average length was 36.2 μ resp. 17.6 μ, those of the tentacles in 18 individuals, their average length was 28.2 μ. The nematocysts of the actinopharynx were examined in 15 specimens, those of the filaments in 5. The average length of the microbasic *p*-mastigophors in the former was 28.18 μ, in the latter 28.1 μ. The average length of the basitrichs in the actinopharynx was 35.97 μ resp. 16 μ, in the filaments 15.58 μ. The nematocysts of the scapus and scapulus have been examined in only 1 specimen, because the ectoderm usually was disturbed or incrusted with mud and other objects.

Genus **Phelliactis** Simon.

Hormathiidae with well developed pedal disc. Column in its upper part sometimes more or less asymmetric, usually provided with large tubercles, especially in the distal region. Column divisible into scapus and scapulus, the former provided with a more or less developed cuticle. Tentacles always more than 96, not so numerous as the mesenteries, usually with distinct swellings at the base of their abaxial side, arranged at the margin in 2 (or more?) close cycles. Longitudinal muscles of the tentacles ectodermal. Oral disc wide, sometimes asymmetric, bilobed. Radial muscles of oral larger disc ectodermal or meso-ectodermal rather strongly folded, in the parts corresponding to the endocoels, however, unfolded. Two well developed siphonoglyphs. Pairs of perfect mesenteries commonly 6, sometimes 7–8 or 6–7 + some extra single mesenteries. 2 pairs of directives. Mesenteries more numerous at the limbus than at the margin, last cycle of mesenteries as a rule developing earlier at the mesenteries of the first and second order than at the third. Retractors of the mesenteries in the lower parts fairly weak, stronger in their uppermost part. Parietobasilar muscles weak, not forming a shelf. At least 6 perfect pairs sterile. Acontia well developed only with basitrichs. Cnidom: spirocysts, basitrichs, microbasic *p*-mastigophors.

As I have shown (1928 a p. 207) the genus *Chondrodactis* is synonymic with *Phelliactis*.

Phelliactis hertwigi Simon.

Pl. IV fig. 11.

Phelliactis hertwigi n. sp. Simon 1892 p. 75; Carlgren 1928 p. 289; 1928 a p. 207, 1931 p. 14 textfig. 9.

Chondrodactis duplicata n. sp. Stephenson 1918 p. 142 Pl. 14 fig. 6, Pl. 15 fig. 3, Pl. 18 figs. 19–21, Pl. 19 figs. 2–9; 1920 p. 491, 513, 539 fig. 25.

Diagnosis: Pedal disc well developed. Column with large, but not high, tubercles especially in the upper part of the scapus. No sharp difference between scapus and scapulus because the cuticle of the former is thin and easily deciduous (perhaps sometimes not present?). Uppermost part of the column distinctly asymmetric, bilobed. Sphincter well developed, broad distally, gradually diminishing downwards, alveolar with tendency to transverse and longitudinal stratification, separated from the endoderm by a rather broad mesogloea-lamella. Tentacles up to about 160, fewer than the mesenteries with distinct bulbs at the base of their abaxial sides. Longitudinal muscles of tentacles ectodermal, well developed at the adaxial side. Radial muscles of the bilobed oral disc, as also the siphonoglyphs, as in other *Phelliactis*-species. Mesenteries arranged in 5 cycles, the last cycle more or less incomplete. Always more than 6 perfect pairs; the extra perfect mesenteries forming now pairs, now consisting of one or more mesenteries the partner of which is imperfect, generally symmetrically arranged on both sides of the one directive pair. Nematocysts of the tentacles 32.4–46 × about 2.8 (3.5) μ, basitrichs, those of the actinopharynx partly 35.2–48 × 2.8 μ, basitrichs, partly 31–39.5 × 1.2 (1.5) μ, microbasic *p*-mastigophors, those of the filaments partly 32.1–38 × 2.8 μ, basitrichs, partly 26.8–31 × about 3.5 μ, microbasic *p*-mastigophors, those of the [illegible] 14–22 × about 1 µ, sparse. [illegible] 75 × 8–10 µ.

[illegible] Tentacles and oral [illegible] with brown flecks and [illegible] STEPHENSON).

[illegible] and smallest specimen from the [illegible] body 9.5–10 cm resp. 5 cm, [illegible] 2.7–3.5 cm. The largest specimen [illegible] cm high and 8.5 cm broad. All [illegible]

[illegible] 64° [illegible] N. [illegible] 20' W. (Davis Strait) 1100 m. [illegible] St. 67) 1 specimen; 62° 06' N. 19° 00' W. [illegible] 3.1 (Ingolf exped. St. 64) 1 specimen. [illegible] N. [illegible] W. [illegible] (Thor exped. 1904 St. 99) 1 specimen; [illegible] N. [illegible] W. 1000–1300 m. Temp. at 1000 m. 8°, 5 specimens; [illegible] N. 11° 55' W. 923 m. 18 specimens; 28° 08' N. [illegible] W. [illegible] specimens (Michael Sars exped. 1902 St. 76, [illegible]).

[illegible] East side of North Atlantic 52° 07' N. [illegible] W. [illegible]; 51° 54' N. 11° 57' W. 111 fms.; 51° 16' N. 12 [illegible] W. 750–800 fms.; 50° 37' N.; 50° 40' N. 11° 32' W. 250 [illegible] Fisheries, teste STEPHENSON) 59° 40' N. 7° 21' W. [illegible] 2' N. 8° 18' W. 570 fms. (Triton exped.).

[illegible] previously described by SIMON and more in [illegible] STEPHENSON. I have not much to add to STEPHENSON'S [illegible]. Sometimes the pedal disc was deeply excavated. The [illegible] is more or less large, but there are always [illegible] the upper part of the scapus. The tubercles are of [illegible] now smaller, now very large, usually rounded, sometimes [illegible] square. One of the most tuberculated and largest [illegible] contracted specimen I have figured in Pl. IV fig. 11. [illegible] asymmetric specimen I have seen is figured by [illegible]. As to the directive plane it was in 4 specimens [illegible] situated in the angles between the large and the small [illegible] parallel with these angles, in 5 specimens it stands more [illegible]. The tentacles are always fewer than the mesenteries, [illegible] there were 118 tentacles but 166 mesenteries at [illegible]

[illegible] of the last cycle of this species seem also to [illegible] at the mesenteries of the first and second order [illegible] of the third, at least it is more common to find [illegible] of the former than at the latter. I have in all examined [illegible] the arrangement of the perfect mesenteries. [illegible] the mesenteries arranged as in a (see below), [illegible] as in b, c and d (p: perfect mesenteries, [illegible] mesenteries forming pairs with the perfect, dd: [illegible]. Beginning from the one pair of directives the arrangement [illegible] follows:

	Number of perfect pairs	Single perfect mesenteries
[illegible]	6	2
[illegible]	8	0
[illegible]	7	1
[illegible]	6	4

[illegible] close to each other and were not [illegible] younger cycles. The arrangement [illegible] others from that of the other [illegible] perfect mesenteries were developed [illegible] STEPHENSON has examined in all [illegible] found that there was at least one [illegible] of the six primary pairs". Thus [illegible] 12 perfect mesenteries seems [illegible] probably, also of *Phelliactis* [illegible] 213) and *P. incerta* (CARLGREN [illegible] tentacles have been measured in 5 specimens, those of the actinopharynx in 1 and those of the acontia in 7, the spirocysts in 1 specimens.

Remarks: SIMON (1892 p. 83) notes that there are only 6 perfect pairs of mesenteries in the species. This statement is not correct. In the holotype which SIMON dissected there are 8 pairs of perfect mesenteries arranged as in b above.

Phelliactis robusta Carlgr.

Pl. I figs. 9, 12, Pl. IV fig. 8.

Phelliactis robusta n. sp. CARLGREN 1928 p. 290, 1934 p. 14 Pl. 1 fig. 7.

Diagnosis: Pedal disc wide. Body somewhat asymmetrical, more or less bilobate but not so strongly as in *P. hertwigi* and not so high as this species. Lower part of the scapus with small tubercles, distal part with very large ones. Cuticle of the scapus sometimes strong, especially on the tubercles, sometimes thinner. Scapulus with longitudinal ridges, more or less or not tuberculated. Sphincter alveolar, sometimes more reticular in its upper part but with thick mesogloea-meshes between the muscles, gradually diminishing downwards, lowest part thin, separated from the circular endodermal muscles by a thick band of mesogloea. Tentacles up to about 160, short, at the base of their outside with now large, now small, sometimes rather indistinct mesogloea-bulbs. Longitudinal muscles at the base stronger at the adaxial side than at the abaxial, ectodermal. Radial muscles of oral disc meso-ectodermal, stronger in the regions of the exocoels than in those of the larger endocoels. Actinopharynx long, with few longitudinal ridges and 2 broad siphonoglyphs. Mesenteries hexamerously arranged in 5 cycles, the last cycle usually incomplete. Only 6 pairs perfect, 2 pairs of directives. Retractors and parietobasilar muscles as in other *Phelliactis*-species. Nematocysts of the tentacles 35–46 × about 2.8 µ, basitrichs, those of the actinopharynx partly 26.8–43 × 2.8–3.5 µ, partly 17–22 × 2 µ, both basitrichs, partly 25.5–36 × 4 µ microbasic *p*-mastigophors, those of the filaments partly 18.3–21 × 2 µ, basitrichs, partly 23.3–28.2 × 3.5–4 µ microbasic *p*-mastigophors, those of the acontia partly 35–46 (49) × 2.8–3.5 µ, partly 19–22 × 2 µ, very rare, sometimes absent?, both basitrichs. Spirocysts of the tentacles up to about 60 × 7 µ.

Colour unknown.

Dimensions of one of the largest specimens (from St. 164): height 7.5 cm, largest breadth of the pedal disc 8 cm; of a small specimen (from St. 16): height 1.5 cm, breadth of the pedal disc 2.3 × 1.7 cm.

Occurrence: Davis Strait: 66° 35' N., 56° 38' W., 599 m. Bottom temp. 3.9 (Ingolf exped. St. 32) 12 specimens; 64° 54' N. 55° 10' W. 740 m. Bottom temp. 3.8 (Ingolf exped. St. 27) 5 specimens.

Danmark Strait 64° 34' N. 31° 12' W. 2148 m. Bottom temp. 1.6 (Ingolf exped. St. 11) 1 specimen; about 65° N. and 30° W. 1778 m (Swedish Sofia exped. 1883) 1 specimen; 64° 24' N. 28° 50' W. 1484 m. Bottom temp. 3.5 (Ingolf exped. St. 10) 1 specimen. S. of Iceland: 62° 40' N. 19° 36' W. 2150 m (Thor exped. 1903 St. 164) 1 specimen; 62° 06' N. 19° 00' W. 1960 m. Bottom temp. 3.1 (Ingolf exped. St. 64) 2 specimens; 62° N. 21° 36' W. 1591 m. Bottom temp. 3.3 (Ingolf exped. St. 40) 1 specimen; 61° 30' N. 22° 30' W. 1836 m. Bottom temp. 3 (Ingolf exped. St. 67) 1 specimen. W. of Faroe Islands: 61° 31' N. 11° 36' W. 1356 m. Bottom-temp. 2.4 (Ingolf exped. St. 46) 1 specimen. S.W. of Ireland: 50° 22' N. 11° 44' W. 1797 m. (Michael Sars exped. 1910 St. 95) 2 specimens.

Figure 94 shows the distribution of the species.

Exterior aspect. The pedal disc is well developed, the column not so elongated as in *P. hertwigi* perhaps owing to the strong contraction of the specimens. The distal part of the body is more or less asymmetric, at least in older specimens, but not so distinctly as in *P. hertwigii*. The column is divisible into scapus and scapulus, the former of which is covered by a cuticle, usually lost or only present between the tubercles. In some specimens, however, the cuticle is better preserved and sometimes, as in the specimens from the stations 27 and 40 (Pl. I figs. 9, 12) and from the Sofia expedition (Pl. IV fig. 8), the tubercles are provided with a thick cuticle. The lower part of the scapus has smaller tubercles, the upper part commonly very large ones. Most specimens show an appearance like that reproduced in Pl. I fig. 12. The scapulus is provided with high ridges which are tuberculated when the bulbous swellings of the tentacles are large.

The short tentacles are situated at the margin. Their number varies, but the tentacles are always fewer than the mesenteries at the limbus. One specimen examined had 192 mesenteries at the base but only about 160 tentacles, another 156 mesenteries at the lowest part of the actinopharynx but about 130 tentacles. At the base of the abaxial side the mesogloea forms more or less large bulbs, continuations of the ridges of the scapulus; sometimes the bulbs are small and rather indistinct but always present at least on several tentacles. The oral disc is wide with radial ridges, the actinopharynx long with few longitudinal ridges, the two siphonoglyphs are broad but aborally hardly prolonged.

Fig. 47. *Phelliactis robusta*. Sphincter of a small specimen.

Anatomical description: The ectoderm of the scapus is low, the mesogloea very thick, the endodermal circular muscles of the column are weak. The mesogloeal sphincter is, in comparison with the size of the specimens, not strong, especially on the higher side; that is to say, there is usually a little difference in the development of the sphincter in the lower and higher sides of the contracted animal. It is wholly separated from the endodermal circular muscles and rather broad in its upper part but gradually diminishing downwards. Its aboral end, forming only a thin muscle-lamella, is situated nearer the endoderm than the ectoderm, but separated from the former by a broad mesogloea. Its structure is alveolar (Fig. 17) showing a tendency to horizontal stratification in the middle part; sometimes the upper part of the sphincter is more reticular but with thick mesogloea-meshes (fig. 18).

Fig. 18. *Phelliactis robusta*. Uppermost part of the sphincter in a larger specimen.

The ectoderm of the tentacles is high, the longitudinal muscles are at the base considerably stronger at the adaxial side than at the abaxial. The meso-ectodermal radial muscles of the outer part of the oral disc agree with those in other *Phelliactis*-species viz. are weaker in the regions corresponding to the stronger endocoels than in other places, sometimes the difference is not so strongly marked as in *Phelliactis hertwigii*. In the endoderm there were small often exploded basitrichs.

The mesenteries are hexamerously arranged, at the limbus more numerous than at the margin. There are 5 cycles of mesenteries, usually those of the last cycle are not developed in all exocoels. I have dissected several specimens but in no case I have observed more than 6 perfect pairs, in contrast to the case of *hertwigii*, in which there always are more than 6 perfect pairs even in small individuals. As most specimens are considerably larger than the small specimen of *hertwigii* figured by CARLGREN (1934 b fig. 9), there is no reason to suppose that in *robusta* more mesenteries than 6 pairs would later grow together with the actinopharynx. In one specimen the mesenteries were 192 at the base, another specimen had 156 mesenteries at the end of the actinopharynx, a third about 131 mesenteries in the middle of the animal, at the limbus about 160. The number of mesenteries in the six sextants was more or less different. As in other *Phelliactis*-species the mesenteries of the last cycle show a tendency to develop earlier in the exocoels nearer the mesenteries of the first and second order than those of the third. The muscles of the mesenteries agree with those in other *Phelliactis*-species. The retractors are considerably stronger in the upper part of the body than in the lower part though weaker than in *Paraphelliactis*.

I have measured the nematocysts of the acontia in 10 specimens. They show good agreement in all. The small nematocysts of the acontia are rare and perhaps sometimes absent. The dimensions of the cnidae in other parts of the body are summed up from 3 specimens. The measures of the nematocysts of the filaments is, however, from a single specimen. In the smallest, not fertile specimen, the nematocysts were somewhat smaller. In a maceration preparation of the filaments – parts of the mesenteries I found several large holotrichs, evidently residues of the food taken.

Genus **Paraphelliactis** Carlgr.

Hormathiidae with well developed pedal disc. Column cylindrical, divisible into scapus and scapulus, the former strongly [illegible] Sphincter strong. [illegible] cycles, probably [illegible] without or [illegible] abaxial side. Radial [illegible] corresponding to the [illegible] 2 well developed siphono[illegible] ca. 48, 6 pairs perfect and [illegible] Retractors of the mesenteries strongest [illegible] Parietobasilar muscles weak. Acontia [illegible] only basitrichs. Cnidom: [illegible] mastigophors.

[illegible] *P.* [illegible] in appearance and structure [illegible] the different arrangement of [illegible] and by the development of [illegible] at the margin than at the limbus. To [illegible] the species named below. *P. spinosa* [illegible] Carlgren 1934 [illegible] p. 13

Paraphelliactis spinosa Carlgr.

[illegible] 4, 7.

[illegible] n. sp. CARLGREN 1928 p. 259, 291.

[illegible] somewhat asymmetric. Scapus with an ex[illegible] especially on the irregularly distrib[illegible] tubercles. No traces of distinct coronial [illegible] 160–170, rather short, cylindrical [illegible] without small thickenings of the mesogloea [illegible] abaxial side. Longitudinal muscles of the [illegible] radial muscles of oral disc meso-ectodermal. [illegible] the last cycle incomplete. Retrac[illegible] the distal part very strong, with numer[illegible] the proximal part considerably [illegible] of the scapulus partly 12.7–15.5 × 1.5–2 μ, [illegible] 21 [illegible] basitrichs, those of the tentacles 17 [illegible] very sparse, partly 29.6–36.7 × 2 [illegible] those of the actinopharynx partly [illegible] 29.6–37.2 × 2.5–3.5 μ, both basitrichs, [illegible] 28.2 × 2.5–3.5 μ, microbasic *p*-mastigophors, those of [illegible] 17–21 × 1.5 μ, basitrichs, partly 22.6–29.6 × [illegible] mastigophors, those of the acontia partly [illegible] numerous, partly 17–25.4 × about 2.5 μ, [illegible] Spirocysts of tentacles up to 60 × 7 μ.

[illegible] Scapus brown.

[illegible] (retracted) state (Spec. 1): length [illegible] Spec. 2: length 1.5 cm, largest

[illegible] the sphincter somewhat

[illegible] only 0.5 cm long and

[illegible] 44' N., 30°39' W., 1116 m. [illegible] 4 specimens (see fig. 95).

[illegible] was attached to a [illegible] was provided with a thick cuticle and irregularly wrinkled. The body was in the 2 large specimens somewhat asymmetric, the one side somewhat longer than the other. The column was divisible into scapus and scapulus, the former, showing a very robust appearance, was furnished with numerous larger and smaller tubercles, irregularly arranged. The tubercles were acuminated, rarely bispinous and covered with an extraordinarily thick cuticle, on which numerous Hydroids and Bryozoa had grown. Even the smallest, very young specimen had very strong acuminated tubercles in the upper part of the scapus. The scapulus was rather short, without a cuticle and longitudinally furrowed. The tentacles were, in a large specimen examined, 168, arranged hexamerously in several cycles on the outer part of the wide oral disc. They were conical or more cylindrical, sometimes, but not always, somewhat thickened at the base of the abaxial side. The actinopharynx was long with 2 siphonoglyphs, symmetrically situated, and with about 9 longitudinal ridges at each side of the siphonoglyphs.

Fig. 50, 51. *Paraphelliactis spinosa*. Fig. 50, Section of a perfect mesentery and the oral disc, fig. 51 transverse section of tentacle.

Anatomical description: The ectoderm of the scapus was rather low, its gland cells not numerous, wherefore it showed a rather compact structure. The mesogloea was very thick, especially in the tubercles. It sends out here and there thin sproutings at least sometimes communicating with the cuticle, perhaps they are chitinized ectoderm cells. The endodermal circular muscles were weak, on the other hand the mesogloeal sphincter was very strong. It was wholly separated from the endodermal circular muscles and occupied almost the whole mesogloea in its upper half, proximally it diminished in breadth. It was reticular-alveolar, but the mesogloea balks between the muscle meshes were rather thick (fig. 49). Sometimes irregular longitudinal bands of stronger balks were present.

The ectoderm of the tentacles was high at the adaxial side, at the abaxial thinner in the cases where the mesogloea was thickened there. Then the ectodermal longitudinal muscles formed a straight lamella on the outside, while they were folded on the inside (fig. 51). I have made several maceration-preparations of the tentacular ectoderm from the more closely examined specimen but have not observed any nematocysts. In the other large specimen some small tentacles were visible; maceration preparation from these showed the presence of several nematocysts 29.6–36.7 × 2.5 μ, but as acontia were ejected close to the tentacles it is possible that the capsules belonged to the acontia and only were stuck to the tentacles. On the other hand the spirocysts were extraordinarily numerous. The radial muscles of the oral disc were meso-ectodermal. The arrangement of these muscles agrees more with that in *Actinauge* than that in *Phelliactis*. True, the height of the muscle-lamella can be somewhat different in certain parts (fig. 50) but there was no such regular diminishing of the muscles in the middle of the parts corresponding to the larger endocoels.

Fig. 52. *Paraphelliactis spinosa*. Part of a mesentery in the region of the cnido-glandular tract.

The pairs of mesenteries were arranged in 5 cycles (6 + 6 + 12 + 24 + 48) in the specimen examined, but the last cycle was incomplete and also the mesenteries of this cycle present were very weak, especially in the lower part of the animal. As I counted 168 tentacles, the mesenteries at the margin may have been 168. I have observed 164, of which about 10 pairs were small. In the lower part of the body the mesenteries seemed to be fewer. Owing to the irregular contraction of the pedal disc I could not, however, count with any certainty, as the limbus was damaged, but I think that there were fewer mesenteries there. Somewhat higher up at most 150 mesenteries seemed to be present, but the mesenteries of the last cycle were also there very small. Only the mesenteries of the first cycle were perfect with 2 pairs of directives symmetrically situated. In the distal part the retractors of the mesenteries formed very strong but diffuse pennons on the stronger mesenteries (fig. 50), in the lower part they were weak (fig. 52) only the muscles of the mesenteries of the first order were here rather well developed. The parietobasilar muscles were weak, the ciliated tracts of the filaments strong. The mesenteries of the first cycle were sterile, the stronger of the other mesenteries fertile. The specimen examined was a female with small ova.

Remarks. Because remains of the ectoderm of the tentacles were stuck to the actinopharynx it was difficult to clear up the nematocysts there. I think, however, that the present information about them is more correct than that I gave in 1928. The size given there of the largest nematocysts was incorrect, caused probably by an error in measuring. In the maceration preparations of filaments with part of the mesenteries also large nematocysts similar to those of the acontia were present, probably belonging to these. The inner parts of the body, apart from the retractors, were not well preserved.

Genus **Adamsia** Forbes.

Hormathiidae with very wide base secreting a cuticle which may project beyond the mouth of the shell to which it is fastened. Column smooth, provided with cinclides sometimes situated on slight elevations. Sphincter well developed, mesogloeal. Tentacles in several cycles, never long. Two siphonoglyphs and 2 pairs of directives. 12 pairs of perfect and fertile mesenteries. Mesenteries more numerous at the margin than at the limbus. The species of this genus live in symbiosis with hermit crabs, in such a way that their mouths are always situated beneath that of the hermits. Cnidom: spirocysts, basitrichs, and microbasic *p*-mastigophors.

Adamsia palliata (Bohadsch).

Actinia palliata Boh. STRÖM 1762–1766 p. 164.
Medusa palliata Boh. STRÖM 1788 p. 250 figs. 1–5.
Adamsia palliata Boh. SARS 1853 p. 20, DANIELSSEN and KOREN 1856 p. 87; APPELLÖF 1891 a p. 7; ARNDT 1912 p. 121; GRIEG 1913 p. 111; PAX 1936 p. 110.
For further literature see ANDRES 1883 and STEPHENSON 1935.

Diagnosis: Cinclides endocoelic in the middle and lower part of the column, usually not more than one in each endocoel. Margin distinct. Sphincter well developed with fairly large muscle-meshes showing at least a tendency to transverse stratification. Tentacles hexamerously arranged in up to 7–8 cycles, in number between 100–500, fairly short. Retractors of the mesenteries weak, diffuse. The perfect mesenteries, and some of the older imperfect, sterile. Occurs in symbiosis with *Eupagurus prideauxi* Leach. Nematocysts of the column 17–19.7 × 2.2–2.5 μ, basitrichs, those of the tentacles 19.7–21 × 2.5–2.8 μ, basitrichs, those of the actinopharynx 21–26.8 × 2.8 μ, basitrichs, those of the filaments partly 19–22 × 2.8–3 (3.5) μ, microbasic *p*-mastigophors, partly 15.5–16 × 2–2.5 μ, basitrichs, very rare, those of the acontia 26.8–33.2 × 2.1–3.5 μ, basitrichs. Spirocysts of tentacles up to about 32.5 × 3.5 μ.

Colour: Column brownish, light orange or reddish-brown with more or less vivid magenta spots of variable size, the parts beneath the hermit crab white or pale. Oral disc and tentacles usually white or cream-coloured. Acontia usually rose or lilac, rarely white.

Size: Longitudinal diameter of the discs up to about 5–7 cm.

Occurrence: Norway: Trondheimfjord (teste ARNDT), the fjords at Bergen (teste APPELLÖF) Sondmor (teste STRÖM), Herdlafjord 20–30 m (Carlgren), Floro, Manger, Hardangerfjord, Bergenfjord (Sars), Flekkefjord (Esmark).

Further distribution: North Sea, British Isles, Atlantic coast of France, The Mediterranean.

Genus **Hormathia** Gosse.

Hormathiidae with well developed pedal disc often adherent to shells. Column divisible into scapus and scapulus. Scapus provided with tubercles showing at least a tendency to be arranged in rows, [illegible] and only a ring of [illegible] the uppermost part of the [illegible] are often small or absent. [illegible] developed cuticle, scapulus [illegible] mesogloeal, strong. Tentacles [illegible] their outside, not more than 96 [illegible]. Tentacles and mesenteries in same [illegible] of tentacles and radial muscles [illegible] latter sometimes meso-ectodermal. [illegible] glyphs, 6 pairs of perfect and sterile [illegible] Retractors diffuse. Cnidom: spirocysts, basitrichs, [illegible].

Hormathia digitata (O. F. Müll.).

[illegible] 5, 6, 8, 11. Pl. III figs. 9, 11, 12.

[illegible] digitata O. F. M. Grieg 1913 p. 141, 1923–24 p. 29; [illegible]

H[illegible] digitata O. F. M. Carlgren 1930 p. 3, 1932 p. 263, [illegible] 1933 p. 25 fig. 13, 1939 p. 9 fig. 2; 1940 p. 44 fig. XIV [illegible] 11. Pax 1936 p. 110.

[illegible] arcuatus n. sp. Gravier 1918 p. 11, 1922 p. 60 Pl. IV figs. 42, 43, Pl. IX fig. 97; Carlgren 1934 p. 13.

For further references see Carlgren 1893 p. 110, 1928 p. 296 and Stephenson 1935 p. 259.

Diagnosis. Pedal disc wide. Scapus usually provided with tubercles, the uppermost of which, forming 12 coronal tubercles, [illegible] are stronger than the other and sometimes alone present. In younger individuals the scapus may be not tuberculated or the tubercles are small. Scapulus sometimes with ridges issuing from the coronal tubercles. Sphincter very strong, wholly separated [illegible] ectodermal circular muscles of the column showing at [illegible] tendency to transverse stratification, alveolar to more [illegible] especially in its upper part. Tentacles 96, long, conical. Actinopharynx of moderate length. Siphonoglyphs broad, aborally [illegible]. Mesenteries 96, hexamerously arranged. Retractors of [illegible] mesenteries well developed, diffuse, parietobasilar muscles [illegible] muscles fairly well developed. Viviparous. Nematocysts of the scapus partly 17–22 × about 2.5 μ, basitrichs, partly 7–12 × 1 μ probably basitrichs, those of the scapulus 17–29 × [illegible] 2.5 μ basitrichs, those of the tentacles 23–31 × 2.5–3.5 μ, [illegible] of the actinopharynx partly 26–36 × about [illegible] p-mastigophors, partly 26–31 × 3.5–4 (4.5) μ, [illegible] those of the filaments partly 19–24 × 4–5 μ, microbasic [illegible] partly small basitrichs, sparse, those of the [illegible] 26–38–40 × 3.5–4 (4.5) μ, partly about 14 μ, both [illegible]. Spirocysts of tentacles up to about 43 × 7 μ.

[illegible] Scapus more or less whitish, flesh-coloured, [illegible] orange. Scapulus often of same colour as the tentacles [illegible] except the ridges. Tentacles reddish-yellow, dull [illegible] purple brown, sometimes almost flesh-coloured. [illegible] pinkish-white sometimes with a pattern. [illegible] pinkish buff or with alternate stripes of [illegible] Stephenson (1935 p. 260) notes that the oral [illegible] in dark pigment on a paler ground [illegible] pale pigment on a darker ground as *H[illegible]* [illegible] *Cataphellia*. As far I can remember [illegible] pattern. See further Carlgren 1893 [illegible] 1935.

[illegible] to about 8 [illegible] broad.

[illegible] 72 05′ N., 52 19′ W., 164 fms. (Ingegerd [illegible] 1871). [illegible] district (Ryder 1887), 68 20′ N. [illegible] exp. 1908 St. 117). Egedesminde [illegible] 47′ N., 58 14′ W., 140 m. Bottom temp. 2.55 [illegible] 66 45′ N., 56 23′ W., 175 fms. (Tjalfe [illegible] Hellefiskebanke 66 44′ N., 56 08′ W., 330 m (Tjalfe exp. St. 100); 66 37′ N., 56 37′ W., 450 m (Dana exp. 1925); 66 35′ N., 55 54′ W., 88 fms., bottom temp. 1.6 (Ingolf exp. St. 31), 65 34′5 N., 4 31′ W., 68 fms., bottom temp. 0.2 (Ingolf exp. St. 29); 63 56′ N., 53 12′ W., 130 fms. (Wandel 1889); Fiskenaes, Bredefjord 220–310 m, 245–440 m, 230 m, 250–280 m, 140–180 m, 115 m (Rink exp. 1962, St. 66, 77, 87, 97, 91, 111); Kvanefjord 135 m (Rink exp. 1912 St. 25); Tunugdliartik 125–177 m (Rink exp. 1912 St. 140); Skovfjord 70–140 m (Rink exp. 1912 St. 156), Julianehaab 4–10 fms. (Amondsen); Davis Strait 100 fms. (Holm). Greenland without distinct locality (Holm).

Iceland (see the chart fig. 2 Carlgren 1939): Dýrafjörður 24 m; 66 18′ N., 25 59′ W., 621 m; Isafjorður off Hnifsdalur 50 m; Isafjarðardjup 52 m; Jokulfirðir 63 m; Steingrimsfjorður 50–100 m, 188 m; Skagastrond 56 m, 75–113 m; Hofsós depth unknown; Eyjafjörður S. of Hrisey 32–38 m; Akureyri on a harbour pier; Skjálfandi 170 m; Axarfjorður 38 m; Þistilfjorður, Grenjanes 77 m; Mjóifjorður 60 m; Reyðarfjörður 130 m; 226 m, Berufjörður; 10–15 miles, S.S.W. of Eystrahorn, depth not noted; Mýrabugur 63 52′ N., 16 18′ W., 109 m; 63 12.5′ N., 20 06′ W., 510 m; Vestmannaeyjar, 2 localities, one of them 75 m, 63 12′5′ N., 21 29′ W., 151 m; 63 35′ N., 21 29′ W., 151 m; Keflavik 30 m; 64 05′4 N., 22 25′ W., 38 m; Faxaflói 64 14′ N., 23 24′ W., 65 m, Breiðifjörður 65 11′ N., 24 21′ N., 85 m. Iceland without distinct locality on the carapax of *Hyas araneus*.

West Spitzbergen, Spitzbergen Norway 79 47′ N., 11 15′ E., 100 fms. (Swedish Spitzb. exp. 1872–73). Prince Charles Forland 78 41′ N., 16 08′ E., 115 m (Olga exped. St. 27); Icefjord 221–254 m. Bottom temp. 2.55 (Swedish Spitzb. exp. 1908 St. 40); 76 13′ N., 13 10′ E., 160 m; 25 miles N. of Bear Isl., 179 m; 75 23′ N. 17 45′ E., 140–110 m; 74 39′ N., 18 07′ E., 140–155 m; 74 15′ N., 17 36′ E., 180 m; 73 52′ N., 19 55′ E. 130–200 m (Olga exp. Sts. 40, 46, 51, 54, 49, 41); 75 31′ N., 17 50′ E., 225 m. Bottom temp. 1.6 (Norwegian North Atl. exp. St. 326); 79 20′ N., 8 17′ E. 188–236 m, temp. at 180 m 2.17; 78 56′59″ N., 10 20′ E., 40–237 m, temp. at 30 m 2.09 at 220 m 1.59; 78 15′7–78 16′ N., 15 27′–15 30′ E., 87–100 m, temp. at 100 m 1.7; Advent Bay 78 10′ N., 13 16′5 E., 112 m; 77 48′ N., 11 07′ E., 120 m; 77 47′ N., 11 22′ E., 132–162 m; 77 45′ N., 11 56′ E., 117–160 m, temp. at 100 m 3.8; 77 45′ N., 11 07′ E.; 125–175 m; 77 44′ N., 11 45′ E., 185–228 m; 77 41′ N., 10 40′ E., 284–285 m; Bell Sound 241 m, bottom temp. 0.01, 120–190 m; 76 50′ N., 12 50′ E., 212–301 m; 76 34′ N., 76 37′ N., 28 40′–28 46′ E., 155–170 m; 76 16′ N., 28 43′ E., 164 m, temp. at 150 m 1.9; 76 08′ N., 27 30′ E., 184–203 m; 75 58′ N., 28 28′ E., 197 m; 75 58′ N., 26 52′ E., 201 m; 75 39′8 N., 26 47′ E., 180–191 m, temp. at 170 m 0.78; 74 29′ N., 21 42′ E., 200 m; 74 16′ N., 20 35′ E., 115–125 m; 74 15′ N., 20 30′ E., 119–128 m; 74 15′ N., 21 15′ E., 135–120 m; 74 12′ N., 21 52′ E., 223–248 m, temp. at 210 m 1.89; 74 04′ N., 19 40′ E., 126–152 m, bottom temp. 1.9; 74–74 7′ N., 20 30′–20 38′ E., 175–245 m. (All localities teste Grieg): 78 08′30″ N. 13 44′ E., 393 m; 76 45′ N., 23 20′ N., 23 20′ E., 186 m; 76 30′ N., 25 27′ E., 48 m; 72 37′ N., 20 00′ E., 177 m; 72 37′ N., 20 00′ E., 394 m (all 5 localities teste Gravier).

East Spitzbergen: King Charles Land 79 00′ N., 25 55′ E. 195 m.? Between Kanin Peninsula and Swatvi Noss, 78–62 m; about 70 N., 40′ E. 160 m (teste Pax); Kolafjord (Averinzeff, Derjugin): 40–160 fms. (teste Pax); 70 49′ N., 33 46′ E., 215 m, temp. at 200 m 1.6 (Michael Sars exped. 1901); Motowskafjord 69 35′ N., 32 40′ E., 53 m (Andr. Perwoswanny exp.); Chevanna 30 fms. (Sandeberg 1877); Semiostrowa 50–55 fms. (Sandeberg 1877); N. off Ribatschi Peninsula 138 m (teste Pax); 70 09′ N., 31 00′ E., Bottom temp. 1.05 (Michael Sars exp. 1901); Orafjord; Varangerfjord, E. off Ekero (Michael Sars exp. 1901); Vadsö 20–30 fms. (Klinckowstrom); 71 36′ N., 25 45′ E., 300 m, bottom temp. 3.9 (Michael Sars exp. 1900 St. 57). North Cape, Magerö (Verkruzen); Porsangerfjord (Sars) 200 m, bottom temp. 0.2 (Nordgaard); Kistrand 20 fms.; Hammarfest (Lovén); Vargsund 250 m, Stjernoy 200–350 m, Skarvskjar, Stjernoysund 300–350 m, Hella, Öksfjord 200–25 m (Dons); Kvaenangen, Jokelfjord 1000 m, bottom temp. 1° (Nordgaard), Kvaenangen (Aurivillius); Lyngenfjord, Hornesgrunden 15–20 fms. (Bidenkap); Karlsö 30–40 fms. (Malmgren); Ulvsfjord 25–30 fms. (Goës and Malmgren); Kjosen, Ulvsfjord (Norw. North Atlantic exp.); Kalfjord 30 fms.; Ramfjord 80–100 fms. (Goës and Malmgren); Grötsund 70 fms. (Goës and Malmgren); Kvalsund 20 fms.; Tromsö (Kier, Sars); 20–30 fms. (Wulff); Balsfjord, Storsteinnes, 70 fms. (Kier); Malangen, Stönnesbottn, 40–80 m (Nordgaard); Andenes (Kier); Bjarköy 10–15 m; 30–50 m, 35–55 m, 50–60 m, 110–150 m; Gibostad 40 m, 50 m; Evenskiär 20–30 m, 35 m, 45–55 m; Ögsfjord, 100 m, bottom temp. 2.1° (Nordgaard); Skovna 200–300 fms. (Sars); Vestfjord (Bodöm); Foldenfjord 13 m, 45–60 m (Soot Ryen), 530 m, temp. at 500 m 6.55° (Nordgaard); 66°42′ N. 13°13′ E. 177 m (teste GRAVIER); Tjotta, Nordland (Collin); Trondheimfjord: Tautra about 200 m (Mortensen); 30–50 m (Carlgren), Röberg about 300 m (Carlgren); Storfosen 200 m, Garten 250 m, off Sodenes, about 100 m (Mortensen); Gjeiteneset 100–200 m (Dons); N.W. of Siggen in the archipelago of Bergen, 100 fms. (Swedish fishermen); fishing banks W.N.W. of Bergen, 80–170 fms. (Lambert); fishing banks N.W. of Bergen 60–200 fms. (Swedish fishermen); Glesver (Lönnberg and Jägerskiold); 15–21 miles S.E. of Haugesund and Bergen 100–170 fms. (Swedish fishermen); Hardangerfjord (teste GRIEG); Jäderen (Swedish fishermen); N.W. of Egersund 100 fms. (Swedish fishermen); Jutland banks 50–150 fms. (Swedish fishermen). Oslofjord: Bundefjord 50 fms.; Björnen Ranö 200 fms.; Skagerrak 370 fms. (Gunhild exp. St. 7); 11 miles N.W. to N. of Höjen 58°16′ N. 9°35′ E., 660 m (Thor exp. 1908 St. 285); 36 miles N.W. to N. of Höjen 58°12′ N. 9°53′ E., 535 m (Thor exp. St. 223); Skagerrak, 220 m (Thor exp. 1903 St. 20); off Grisbadarne, 85–98 m; Skagerrak (Petersen, *Urticina crassicornis*!); Kosterfjord 20–60 fms. (Aurivillius); Ramsö (Carlgren). Southern part of Kosterfjord, 220–230 m (Sandberg); off Hallö, 21–33 m (Thor exp. St. 212); Väderöar (B. Fries, Carlgren); W.S.W. $^1/_2$ W. of Maseskär, 120 m (Thor exp. St. 1091); Gullmaren 25–80 m (Carlgren and others); W. of Winga, 27–29 fms. (Thor exp.); Kattegat (Lovén, Olsson, Petersen); Nidingeknölen 30 m ("Akka" St. 70); about 56°51′ N. 12°05′ E., 16 m ("Akka" St. 103); about 56°51′ N. 12°11′ E., 56 m ("Akka" St. 81); 10 miles N.W. to W. of Kullen, 32 m (Thor exp. St. 309); N.E. to E. of Torekow, 11 fms. (Lonnberg); between Kullen and Vinga skär at Hallands Vädero, 14.5 fms. (Lönnberg); Krapperup (Gyllenstierna); Danmark, Hellebaek (Lütken); the Sound (Lütken, Winther and others); N. of Hven, 14 fms. (Kramp).

Faroe Isl. 12 miles S. of Akraleiti, Sudero 260 m; Kvivig, Stromo (teste FABRICIUS and LANDT) 61°03′ N. 2°13′ E. 130 m, temp. at 125 m 6.78° (M. Sars Exp. 1902 St. 19), 61°28′ N. 1°15′ E. 100 fms. (Mich. Sars Exp. 1902 St. 28) 61°16′ N. 1°18′ E. 450 m (Swed. Greenl. Exp. 1899), 55°30′ N. 1° E. 40 fms. Shetland Isl. Outer Skerries Haaf (teste NORMAN).

Further distribution: North Sea.

Exterior aspect. The exterior of this species varies considerably and in the same manner as *Hormathia nodosa*. In younger individuals the scapulus is smooth or almost so, or provided with small tubercles, older individuals have more or less strong, tubercles, especially in the upper part of the scapulus (Pl. I figs. 5, 8), sometimes the tubercles are small apart from the coronal tubercles, (Pl. I fig. 2) sometimes only the coronal tubercles are present. I have noted (1933 p. 26) that most specimens from West Greenland have this appearance (Pl. I fig. 11) but also in the Skagerrak apparently similar ones occur. Pl. I fig. 6 shows an individual from this water, here the coronial tubercles were very small. Rarely the species lives in accidental commensation with the crayfish *Hyas* (Pl. I fig. 3). Small individuals can easily be confounded with *H. nodosa* but the species can be distinguished from each other by the size of the nematocysts. *H. nodosa* seems always to be more elongated than *digitata* also in the contracted state (see the figures 2, 3 Pl. III and 6, 10 Pl. IV).

Anatomical description see CARLGREN 1893. The nematocysts of the tentacles have been measured in 15 individuals, those of the actinopharynx in 10, those of the acontia in 20 specimens. The breadth noted by me in STEPHENSON, 1935, of the nematocysts is too narrow.

In a small, strongly contracted specimen from Kvanefjord, Greenland, curious parasites occur in the mesogloea below the sphincter which here showed a more reticular appearence than usually in *digitata*. These parasites were now scattered in the mesogloea, now more and commonly accumulated in smaller or larger groups which sometimes were of considerable size (Pl. V fig. 4). Evidently these parasites are identical or nearly related to those I have noted (1934 p. 15 and 17, fig. 11) in the ectoderm of oral disc of *Paraphellactis michaelsarsi* and in the mesogloea of the scapus of *Actinauge abyssorum*, though they are considerably more numerous here. In the figs. 2 and 3 Pl. VI I have drawn some of these parasites in high magnification. Several of the parasites were free and their form was more or less fusiform or more irregular, sometimes groups of them were encysted (Pl. VI fig. 2). Probably we have to do with Gregarines, probably of another kind than those I have noted in *Sagartiogeton caudatus* and *undatus* (p. 26 textfig. 29).

Fig. 53. *Hormathia digitata* var. *vegae*. *a* sphincter of a specimen, part of sphincter in another specimen (both from Stolbowoj-Blischni).

In the collection of the Actiniaria from the Vega expedition there were 4 specimens which I with some hesitation refer to *Hormathia digitata* but as a special variety, *vegae*. One individual was taken east of Taymyr peninsula either at 76°52′ N. 116° E. in a depth of 36 fms. (bottom temp. 1.4°) or at 76°40′ N. 115°30′ E. in a depth of 35 fms. (bottom temp. ÷ 1.6°) (the collections from both localities which, according to STUXBERG (1880), had same animal life, seem to have been, at least partly, put together), the three others were dredged between the islands Stolbowoj and Blischni at 73°53′ N. and 138° E. in a depth of 12 fms. (bottom temp. 0.4°). The size of the largest specimen was: largest breadth of the pedal disc 3 cm, height of the column [illegible] 17 [illegible] the smallest speci- [illegible] I have drawn the exterior [illegible] 12 Pl. III. As we see the [illegible] sparsely, now close set, but [illegible] The types and size [illegible] agreement with those in [illegible] of the filaments seem [illegible] typical form I have, however, [illegible] filaments of the typical form [illegible] the sphincter (fig. 53) recalls that [illegible] agreed with it. 3 specimens [illegible] showed a different appear- [illegible] Pl. VI I have drawn a section of a part of [illegible] figured in fig. 12 Pl. III. The scapus [illegible] developed cuticle, in the tubercles some- [illegible] outshoots from the mesogloea here [illegible] these outshoots were shorter, some- [illegible] to the cuticle.

[illegible] cells running out from these projections [illegible] I cannot with certainty decide, but at any rate [illegible] intimate connection between them and the cuticle [illegible] being rich in mucus cells which were absent, [illegible] connections. The whole organization recalls [illegible]

[illegible] from the Danish Dijmphna expedition there [illegible] taken in the Kara Sea and attached to tubes [illegible] *H.* [illegible] I have drawn one of them, the largest, in figure [illegible] Pl. III. The three others were smaller and had only about 48 [illegible] were not sexually ripe. Especially one of the smallest [illegible] was provided with papillae recalling tenaculi. Sections [illegible] we have to do with such formations. Here as far [illegible] connecting the mesogloea with the cuticle [illegible] Sections of the column of the largest specimens [illegible] however, more agreement with the individuals from the Vega expedition. The size of the nematocysts was the same as in [illegible] 2 individuals examined). Moreover the whole organization [illegible] of this species. There is, I think, no doubt that the [illegible] from the Dijmphna expedition were identical with [illegible] the Vega expedition but younger.

[illegible] Owing to presence of more or less developed tena- [illegible] with some hesitation referred specimens described above [illegible] *[illegible]ptata*. Nothing is known about such formations [illegible] but it is possible that very young specimens are [illegible] tenaculi in some form or other. As far as I can [illegible] small specimens of *duptata* have sometimes an [illegible] the smaller individuals from the Dijmphna [illegible] however, at present no opportunity to examine [illegible] the case that tenaculi never occur during the [illegible] I think it is necessary to erect a new genus [illegible] from the Dijmphna and Vega expeditions. I [illegible] *Hormathioptas*.

Hormathia nodosa (Fabr).

[illegible] Pl. IV figs. 6, 10.

[illegible] Gravier 1923–24 p. 29, 1926 p. 26.

H. [illegible] Carlgren 1930 p. 3, 1932 p. 262, 265, [illegible] 1934 p. 352, 1939 p. 9.

[illegible] Danielssen 1890 p. 42 Pl. III fig. 1.

[illegible] Carlgren 1893 p. 115, 1928 p. 291 [illegible] 2.

[illegible] Column elongated, often [illegible] into scapus and scapulus. [illegible] more sparsely set, some- [illegible] rarely absent or weak [illegible] present in the uppermost of [illegible] tubercles. Cuticle of the scapus more or less strong, scapulus smooth. Sphincter situated nearer the ectoderm than the endoderm, reticular in its uppermost part, for the rest alveolar with a distinct tendency to transverse stratification, in young individuals reticular (always?) but the muscle meshes somewhat larger. Tentacles 96, in contracted state often longitudinally sulcated. Longitudinal muscles of tentacles strong, ectodermal, radial muscles of oral disc meso-ectodermal. Actinopharynx very long, siphonoglyphs very broad. Retractors of the mesenteries as those of *H. digitata*. Parietobasilar and basilar very weak. No marginal stomata. Nematocysts of the scapus partly 17–23 × 2.5 μ, partly 10–12 × 1.5 μ both basitrichs, those of the tentacles partly 26 × 2.5–31 (43) × 3.5 μ, partly 14–19 × 1.5 μ rare, both basitrichs, those of the actinopharynx partly 26–37 × 2.8–3.5 μ, partly 14–19 × 1.5 μ, both basitrichs, partly 26–32 × 2.5–4 × microbasic *p*-mastigophors, those of the filaments partly 12.7–15 × 1.5–2 μ, basitrichs, partly 24–29 × 4–4.5 μ microbasic *p*-mastigophors, those of the acontia (13 specimens examined) partly 34–48 × 3.5–4 μ, partly 11–18 × 1.5 μ, few, both basitrichs. Spirocysts of tentacles up to 58 × 5–6 μ.

Colour: Scapus light brown, flesh coloured or pale red, covered with brown or mud-coloured cuticle. Scapulus pink or red. Inner tentacles brown-red, intermediate tentacles paler, outermost pale whitish. Round the mouth is a pale yellow-white narrow annulus from which pale rays issue to the inner tentacles (Danielssen 1891, Verrill 1922).

Size up to 8 cm in length and 5 cm broad in the contracted state. The largest tubercles up to 1 cm in diameter.

Occurrence: Hudson Bay, Richmond Gulf, 25 fms.; Jones Sound, Havnefjord between 76° 25′ N. and 76° 40′ N. and 80° 20′ W.–81° 15′ W. (Fram Exped. 1898–1902); Baffin Land, Entrance to Furry and Hekla Straits, 20–30 fms. (Norcross-Bartlett exp. 1933); Labrador, Saglek Bay (Bartlek).

North Greenland without distinct localities (Kieldsen, Ryder, Møller).

West Greenland: 76° 10′ N. 76° 20′ W., 580 m, bottomtemp. ÷ 1.1° (Godthaab exp.); Cape Dudley Digges 76° 01′ N. 68° 28′ W., 30–15 m (Nilsson); Melville Bay 75° 26′ N. 67° 27′ W., 260 fms. (Sofia exp. 1883); Upernavik (Ryder); Upernaviks district, Pröven 16–100 fms. (Torell, Amondsen, Olrik, Bolbroe); Umanak (Amondsen, Torell); N. of Hare Isl. 70° 20′ (McClain); Disco Isl. 69° 31′ N. 56° 01′ W., 100 fms. (Valorous exp.); Jacobshavn (Traustedt); Christianshaab, 15–30 fms. (Öberg); Egedesminde (Traustedt); Ikamiut (Lohmann); North Stromfjord St. 10 A, 22, 31 (Nordmann); Davis Strait, 100 fms. (Holm); Kangamiut, 130 fms. (Nielsen); 65° 36′ N. 56° 21′ W. (Wandel); 65° 31′ N. 54° 31′ W., 68 fms., bottomtemp. 0.2° (Ingolf exp. St. 29); 65° 17′ N. 54° 17′ W., 55 fms. (Ingolf exp. St. 34); 63° 56′ N. 53° 12′ W., 130 fms. (Wandel); Fiskernes (Öberg); Ivigtut (Munster); Bredefjord, 170–180 m (Rink exp.); 60° 22′ N. 47° 27′ W., 120 m, bottomtemp. 5.8° (Godthaab exp. St. 188); Ilua (Landholm); Greenland from the stomach of dog-fishes.

East Greenland: Stormbugt, 8–10 fms., 20 fms.; Danmarks Havn, 10–15 fms.; "Oresund", 10–15 fms.; sound between Maatten and Renskiar, 25–30 fms. (all 4 localities from the Danmark exp.); 73° 55′ N. 19° 20′ W., 150 m (Swedish Polar exp. 1900); 73° 30′ N. 28° 18′ W. Cape Broer Ruys, 25–27 m (Swedish Greenland exp. 1899); Clavering Isl., 10–35 m (Bartlett); King Oscarfjord at the entrance to Kempefjord, 100–55 m (Norwegian exp. 1930); Heklas Havn, 3–6 fms. (Ryder 1891); Tasiusak, 25–30 fms. (East Greenland exp. 1899). Kangerdlugssuak, 11–15 m (E. Mikkelsen 1932). Jan Mayen (Austrian Polar exp.).

Iceland: 2 miles off Sevðisfjorður, 113 m; Reyðarfjarðardjúp, 226 m; N.E. of Iceland 66° N. 11° 41′ W., 280 m (Thor exp. 1903); 64° 53′ N. 10° W., 630 m, temp. at 100 m ÷ 0.69° (Michael Sars exp. 1900); 62° 38′ N. 1° 40′ E., 650 m, bottomtemp. ÷ 0.45°; 62° 35′ N. 1° 01′ E. 620–640 m, temp. at 620 m ÷ 0.03° (Michael Sars exp. 1902).

Faroe Island: Thorshavn (Müller); 250 fms. on fish-line (Michael Sars exp. 1902).

N. of Spitzbergen: Ross Isl. 80°18′ N. 20°23′ E., 85 m (Römer and Schaudinn exp. 1898 St. 13); Low Isl., 16 fms. (Swedish Spitzberg exp. 1861).

West Spitzbergen: Mossel Bay, 9–10 fms.; N.W. off Mossel Bay, 15–20 fms.; Gray Hook, 60 fms.; Norwegian Isl. (all 4 localities from Swedish Spitzberg exp. 1861); 79° N. 11° E., 36–140 m; 78°44′ N. 10°8′ E. 115 m (Olga exp.); 79°10′ N. 11° E., W. of Cape Mitra, 100 m (Swedish Polar exp. 1900); Cross Bay, 10–60 fms. (Swedish Spitzb. exp. 1861).

Icefjord: Cape Boheman, 40–50 m (Swed. Spitzb. exp. 1898); entrance of Save Bay, 125–150 m, temp. at 125 m, 0.87°, 144 m 1.23°, entrance of Dickson Bay, 11–14 m, 29–27 m, bottom temp. about 2°; Klas Billen Bay, 32–40 m, bottom temp. 1.5–2°; Sassen Bay, 19–28 m, bottom temp. 2–3° (all localities from Swedish Spitzberg exp. 1908); Save Harbour, 30–40 fms. (Malmgren 1864); Bel Sound 30–40 fms. (Torell); Duyns Point (Swedish Spitzberg. exp. 1872–73); off Horn Sound 210 m (Swed. Spitzberg. exp. 1898); 76°13′ N. 13°40′ E., 160 m; 76°23′ N. 15°7′ E., 145 m (Olga exp.) — teste Grieg: 79°20′ N. 8°17′ E., 188–236 m; 78°56′59″ N. 10°20′ E., 40–237 m, temp. at 220 m, 1.59°; 78°15′ N. 9°22′ E. 282–297 m, temp. at 275 m, 2.85°; 78°10′ N. 13°46′ E., 412 m; 77°43′ N. 12°07′ E., 130 m; 77°41′ N. 10°10′ E., 281–285 m; 77°41′ N. 11°50′ E. 143–150 m; 76°58′5 N. 12°15′ E., 220–253 m; 76°56′ N. 12°50′ E., 242–301 m.

East Spitzbergen: 80° N. 19°05′ E., 40 fms.; 79°57′ N. 17°05′ E., 25 fms.; Treurenberg Bay, 6–30 fms. (Swedish Spitzberg. exp. 1861). Treurenberg Bay, 22 m (Monaco exp. St. 1074); 79°40′ N. 19°5′ E. Foster Isl. 10 fms.; Waigat Isl. 30 fms. (Swedish Spitzberg. exp. 1861); Hinlopen Strait, Behm Isl. 79°20′ N. 20°55′ E., 80 m; Bismarck Strait 78°58′5″ N. 20°35′ E., 35 m; Greatfjord close by Chanking Point 78°25′ N. 20° E., 105–110 m; Cape Blanck 77°49′ N. 20°3′ E., 65 m (Römer and Schaudinn); W. Thymen Strait, 30–46 fms. (Malmgren 1864); 78°14′ N. 21°45′ E., 38 m; Ryk Yse Isl. 77°49′ N. 25°12′ E., 60–80 m; 78°5′ N. 26°40′ E., 290 m (Römer and Schaudinn); King Charles Land, Bremer Sound, 100–110 m (Swedish Spitzberg. exp. 1898); between Jena and Abel Isl., 40 m; Swedish Forland, 2 miles from Cape Arnesen, 85 m (Römer and Schaudinn). East Spitzbergen without distinct locality (Kükenthal).

Spitzbergen-Bear Island-Norway: 75°49′ N. 24°25′ E., 80 m (Swedish Spitzberg. exp. 1898); 75°10′ N. 17°30′ E., 179 m; 74°31′ N. 17° E., 140–140 m; 75°09′ N. 17°17′ E., 138–191 m; 74°39′ N. 18°07′ E., 140–155 m; 74°31′ N. 17° E., 165 m; 74°17′ N. 17°35′ E., 156 m; 73°52′ N. 19°55′ E., 130–200 m (Olga exp.); 22 quarter-miles S.E. of Bear Isl., 130 m. bottom temp. 0.05°; Bear Island, 130–140 m (Michael Sars exp. 1901); 72°27′ N. 20°51′ E., 349 m, bottom temp. 3.5° (Norwegian North Atl. exped. St. 290); —teste Grieg: 76°16′ N. 28°13′ E., 161 m, temp. at 150 m, 1.9°; 76°15′ N. 27°29′ E., 136 m. temp. at 125 m, 0.75°; 76°08′ N. 27°30′ E., 184–203 m; 75°39′8 N. 26°17′ E., 180–191 m, temp. at 170 m, 0.78°; 75°28′ N. 26°13′ E., 207 m; 75°23′ N. 26°33′ E., 192 m; 74°–74°7′ N. 20°30′–20°38′ E., 175–245 m; 74°57′ N. 26°08′ E., 197–202 m, temp. at 190 m, 0.95°; 74°15′ N. 20°30′ E., 119–128 m; 74°15′ N. 21°15′ E., 135–220 m; 73°19′ N. 32°07′ E., 330 m, temp. at 315 m, 0.9°; 73°17′ N. 18°20′ E., 240–243 m, temp. at 200 m, 1.98°.

Frantz Joseph Land: 10 miles E. of Victoria Isl., 70 m; 1–2 miles off Cape Flora, 50–60 m; S.W. of Camp. Ziegler, 60–80 m (Norwegian exp. 1930); northwest coast of McClintock Isl. 80°22′ (Baldwin-Ziegler exp. 1902).

Barents Sea: 70°49′ N. 33°16′ E., 245 m, temp. at 200 m, 1.6°; 70°9′ N. 31° E., 200 m, bottom temp. about 1.5° (Michael Sars exp. 1901); close by the entrance of Motowski fjord, 272 m (Andrej Perwosvanni exp.) 13 miles N. of Sem Isl., 171–184 m (teste Pax). Murman Coast, several localities (teste Derjugin, Breitfuss, Pax); Olenja Guba (teste Pax).

Norway: Varangerfjord E. of Ekerø; Kiberg 200 m; Kongsfjord 100 m (Michael Sars exp. 1901); Hammarfest (Lovén); Porsangerfjord (Nordgaard).

W. of Kara Strait, 70°25′ N. 57°56′ E., 66 m (Duc d'Orléans exp.). Arctic Sea of Siberia 76°52′ N. 116° E., 36 fms., bottom temp. −1.4°, 76°40′ N. 115°30′ E., 36 fms., bottom temp. −1.6° (Vega exp.).

Exterior aspect: The species varies very much in its exterior (see the diagnosis). In the figures 2 and 3 Pl. III and 6 and 10 Pl. IV I have given some examples of this variation. In the specimen drawn in fig. 2 only the coronal tubercles are developed, fig. 3 shows an individual with fairly closely set, rounded tubercles, in the specimen photographed in fig. 6 the tubercles are fairly sparse. The largest specimen I have seen (fig. 10) had very large, often a little acuminate tubercles scattered over the whole surface of the scapus. Usually the species is considerably longer than *H. digitata*. Where both species occur together it is possible that they hybridize (Carlgren 1902 p. 52).

Anatomical description see Carlgren 1893 p. 115.

Genus **Stephanauge** Verr.

Hormathiidae with the pedal disc well developed, often elongated in the transverse plane and often clasping octocorals, sponges or tubes of worms. Column rather low, indistinctly divisible into scapus and scapulus, the former smooth, the latter, at least in the contracted state, longitudinally furrowed and sometimes provided with tubercles more or less regularly situated. Cinclides few, only in the directive compartments. Sphincter mesogloeal, well developed, perfectly separated from the endodermal circular muscles of the column. Tentacles of ordinary length or longer, with or without mesogloeal thickenings at the outside of the base, probably more numerous than the mesenteries at the limbus. Longitudinal muscles of the tentacles ectodermal, radial muscles of the oral disc ectodermal or ecto-mesogloeal. Two siphonoglyphs. Perfect pairs of mesenteries 6 or 12, 2 pairs of directives. Mesenteries hexamerously arranged. Retractors of the mesenteries rather weak, parietobasilar muscles weak. All stronger mesenteries, the directives sometimes excepted, fertile. Acontia few (sometimes absent?). Cnidom: spirocysts, microbasic *p*-mastigophors, basitrichs.

The difference between the genera *Stephanauge* and *Amphianthus* I have pointed out in 1925 and 1928. As we see below I have not observed any acontia in the type species, *S. nexilis*, and as to *S. acanellae* (*abyssicola* Mos.?) the presence of acontia is somewhat doubtful. I think, however, that an examination on good material will show the presence of acontia also here as in *S. bulbosa*; the gonads of the specimens examined of *nexilis* and *acanellae* were very strong and filled up almost the whole coelenteric cavity rendering the examination more difficult. Verrill mentions, however, the presence of few acontia in *nexilis*.

Stephanauge nexilis (Verr.).

Actinauge nexilis n. sp. Verrill 1883–85 p. 55 Pl. 16 figs. 1, 5, 1883 b p. 511, 531 Pl. 7 figs. 22, 22 a; 1899 p. 145.
Stephanauge nexilis (Verr.) Verrill 1922 p. 99 G., Pl. 22 figs. 5, 6, Pl. 28 figs. 1–4, Pl. 30 fig. 3.
Stephanauge abyssicola p. p. Verrill 1899 p. 217 fig. 31.

Diagnosis: Pedal disc prolonged, clasping the denuded axis of *Balticina* and other Pennatulids. Column rather low, with thick mesogloea, smooth in its proximal part, in the distal part, at least in the contracted state, with longitudinal ridges terminating sometimes at the margin in irregular tubercles. A circular, distinct wall below the furrows in certain states of contraction. Cinclides 1 + 1 or 1 + 2 rarely 3 + 2. Sphincter strong but not filling up [illegible] alveolar. Tentacles in the [illegible] inner considerably longer [illegible] number about 170–200 and [illegible] or less strong mesogloeal thick[illegible] of the tentacles and radial [illegible] Two well developed siphono[illegible] Mesenteries in 5 cycles, those of [illegible] developed in all exocoels; 6 pairs of [illegible] 2 pairs of directives. More numerous mesen[illegible] the proximal part, or at any rate not the [illegible] muscles of the mesenteries weak, somewhat stronger [illegible] Parietobasilar muscles of the stronger mesen[illegible] those of the directives, forming a distinct fold. [illegible] almost all mesenteries but sometimes lacking in the [illegible] Asexual propagation probably absent. Nematocysts [illegible] 16.9–20.4 × 3.5–4.2 μ microbasic *p* mastigophors, [illegible] tentacles partly 14–19.7 × 2–2.8 μ, basitrichs, partly [illegible] 21.5 × 5 μ microbasic *p* mastigophors (development stages? [illegible] of the actinopharynx 18.3–21 × (3.5) 4.2–5.6 μ microbasic *p* mastigophors (strongly opaque capsules up to 32.4 × 4.2 [illegible] specimen, probably development stages), those of the fila[illegible] partly 15.5–18.3 × 2 μ, basitrichs, partly 17–22.6 (24) × 3.5–4.2 μ microbasic *p* mastigophors, those of the acontia? (42.5–84.6 [illegible] 4.2 [illegible])

Colour. Column usually pale salmon or flesh-coloured with streaks of brown in wrinkles, oral disc deep orange-brown with darker brown radii, tentacles salmon-brown (teste VERRILL).

Dimensions of a large specimen: Longitudinal axis of the oral disc about 5 cm, transverse axis 1.9 cm. Largest height 2 [illegible] Inner tentacles, in very contracted state, 0,6 cm.

Occurrence. E. and N.E. coast of N. America: 44° N. 58°55′ W. 300 fms. Gloucester Fisheries 1878, 3 specimens, 43°20′ N. 60° W. 220 fms. 2 specimens. N.E. coast of N. America 1 specimen, off Martha's Vineyard 245 fms. "Fish Hawk" St. 1112, 1 specimen, Banquereau 200 fms. 1879, 4 specimens, St. Peters Bank, Banquereau 100–150 fms. 2 specimens — teste VERRILL: Martha's Vineyard 168–245 fms. on *Balticina*, fishing banks off New Foundland and Nova Scotia on *Balticina* 200–300 fms.; 39°59′16″ N. 70°18′30″ W. 260 fms., 31°00′30″ N. 76°10′30″ W. 178 fms. (Blake Exped. St. 310–327).

Exterior aspect. The column is, in the preserved state, rather low with the base clasping the denuded axis of *Balticina* or other Pennatulids, when these have been injured (VERRILL) and extended along the axis. The transversal axis of the body is considerably shorter. The directives were sometimes situated in the transverse plane, sometimes they had a more oblique position. The column is thick, in its lower part always smooth and forms, at least in the contracted state, a more or less distinct circular wall [illegible] way from the distinct margin. Above the wall the column [illegible] irregularly ridged, forming often more or less distinct irregular [illegible] below the margin. The number of the cinclides of the [illegible] compartments varies. Of 12 specimens examined 7 had [illegible] 2 1 [illegible] 2 2 2 [illegible] 2 and 1 [illegible] 3 [illegible] 2 cinclides.

The tentacles are short, thick and conical in the contracted state, the inner considerably stronger than the outer, and provided with a mesogloeal thickening at the abaxial side of their base. Such a one I have also found in the type specimen of *S.*? (*Stephanauge*) [illegible] R. Hertw. The number of tentacles, arranged [illegible] in 4 specimens examined between 172 and 2[illegible] [illegible] apparently more numerous than the mesenteries [illegible] below. The oral disc is wide, its inner half lacks [illegible] striated, and, owing to contraction, [illegible] The siphonoglyphs are broad, distinct and [illegible] prolongations.

Anatomical description. The sphincter is alveolar, rather [illegible] in its upper part but also here not filling up half of the breadth of the mesogloea, diminishing proximally (fig. 54), and wholly separated from the circular muscles of the column. The ectoderm of the tentacles is very high, the mesogloea of the outer tentacles thicker at the base of the abaxial side than at the adaxial. The ectodermal longitudinal muscles are rather high and somewhat ramified on the inside of the tentacles, on the outside weak and unfolded (fig. 55). The radial muscles of the oral disc are ectodermal.

Fig. 54. *Stephanauge nexilis*. Sphincter.

The mesenteries are hexamerously arranged in 5 cycles, exceptionally there are some pairs of mesenteries of a sixth cycle. They seem to be more numerous at the margin than at the limbus. In one specimen I counted 172 tentacles and the same number of mesenteries at the margin, but only about 128 mesenteries at the limbus, in a second specimen there were 202 tentacles, 100 pairs of mesenteries in the region of the prolongations of the siphonoglyphs but at the base only 76 pairs or a few more—it was, however, difficult to count them here but at any rate the mesenteries in the distal part are more numerous than in the proximal, not the opposite as in *Amphianthus*. Only six pairs of mesenteries are perfect, as shown by several specimens. There are two pairs of directives. The longitudinal muscles of the mesenteries were considerably weaker than in *Amphianthus margaritaceus*, the parietobasilar muscles were often situated on a distinct fold of the mesenteries with some muscles enclosed in the mesogloea, but the muscle lamella itself formed a straight lamella (fig. 56). The oral stomata were well developed as also the marginal stomata in the uppermost part of the stronger mesenteries. The gonads were present in all or almost all mesenteries, the directives can be fertile or sterile. Because of the strong development of the gonads, filling up almost the whole cavity of the body, I have not been able to find any acontia, in the maceration preparations of the base of the mesenteries I have observed large nematocysts of very different length (43.2) 59.2–93.1 × 4.2 (5) μ, which perhaps belonged to acontia as there were no such nematocysts in the filaments. VERRILL 1922 p. 99 mentions, however, that acontia are present, but apparently few. He has drawn a figure (6 Pl. 22) of this species with 4 ejected acontia. As far as I can see the figure represents this species. As all specimens examined by me concerning the arrangement of the mesenteries had two pairs of directives symmetrically arranged, the species probably does not propagate asexually. The nematocysts were usually rather opaque but I think that the nematocysts marked as microbasic *p* mastigophors are such.

Fig. 55. *Stephanauge nexilis.* Transverse section of tentacle.

Fig. 56. *Stephanauge nexilis.* Section of a directive mesentery in the lower part of the actinopharynx.

Remarks: VERRILL in 1922 described the species in detail but in several points incorrectly. The tentacles are about twice as many than VERRILL states. The cinclides are present only in the directive chambers, not scattered. The figure 6 Pl. 22, certainly a magnification of fig. 5 Pl. 6 in the paper of 1883 (Blake-exped.), showing threads representing ejected acontia, is probably incorrect, as it gives an idea of scattered cinclides. The perfect pairs of mesenteries are only 6, not 12 or more as VERRILL states. His figured sections Pl. 28 figs. 3, 4, Pl. 30 fig. 3, 1922, are sections through the oral disc, not through the actinopharynx. Also the first cycle of mesenteries are fertile, in opposition to VERRILL's statement.

Stephanauge acanellae (Verr.).

Sagartia acanellae n. sp. VERRILL 1883 85 p. 16 Pl. 6 figs. 2, 2 a; 1883 b p. 511, 534 Pl. 11 fig. 25.
? *Actinia abyssicola* n. sp. MOSELEY 1877 p. 297 Pl. 4, 5 fig. 5.
? *Stephanactis abyssicola* (Mos.) R. HERTWIG 1882 p. 79 Pl. 2 fig. 13.
? *Stephanauge abyssicola* (Mos.) VERRILL 1899 p. 145; p. p. CARLGREN 1928 p. 300.
? *Raphactis abyssicola* (Mos.) VERRILL 1922 p. 101.

Diagnosis: Pedal disc prolonged in the transverse plane of the body and clasping the stalk of *Acanella* or *Mopsea* so that the lateral lobes come into contact with each other. Column either, and usually, smooth, even in large specimens, or provided with tubercles in the uppermost part. In the latter case the tubercles are sometimes numerous and closely set, sometimes few, scattered or with a tendency to an arrangement in longitudinal rows. Sometimes there are 12 larger tubercles on the circular wall, which is more or less distinct according to the stronger or weaker contraction of the column. Cinclides distinct, often 2 from each directive compartment. Sphincter strong, alveolar, of about equal breadth, filling up most of the breadth of the mesogloea. Tentacles numerous, up to about 130–140, hexamerously arranged in 5 or 6 cycles, thin, conical, not thickened at the outside of the base, the inner comparatively long, the outer shorter and considerably thinner. Longitudinal muscles of the tentacles stronger at the inside than at the base of the outside. Radial muscles of the oral disc rather well developed. Two distinct siphonoglyphs with strong aboral prolongations and situated about in the transverse plane of the prolonged basal disc. Mesenteries in 5 cycles, hexamerously arranged, the last cycle incomplete. Mesenteries at the limbus somewhat fewer than at the margin, 6 pairs of perfect mesenteries as a rule; the mesenteries of the second cycle, so far as can be seen, are rarely perfect in the uppermost part of the actinopharynx. Longitudinal muscles of the mesenteries weak, directive mesenteries, however, with distinct retractors. Parietobasilar and basilar muscles weak. Gonads in all the stronger mesenteries. Nematocysts of the column very numerous, partly 17–24 × 3.5–4.2 μ microbasic *p*-mastigophors, partly 12.7–14.1 × 3.5–4.2 μ probably basitrichs, those of the tentacles partly 19.7–21.1 × 4.2 (4.5) μ microbasic *p*-mastigophors, partly 12–15.5 × 3.5–4.9 μ basitrichs, those of the actinopharynx partly 18.3–22.6 × 5–5.6 microbasic *p* mastigophors?, partly 16.2–19.7 × 4.2 μ basitrichs those of the filaments partly 19.7–22.6 × 3.5–4.5 μ, partly 10.2–15.5 × almost 2–2 (2.5) μ, basitrichs, partly 16.9–21.1 × (3.5) 5 (5.6) μ, probably microbasic *p*-mastigophors, spirocysts of the tentacles up to about 36 (44) × 6.3 μ.

[illegible] salmon coloured, or brownish [illegible] darker than the body, often orange or [illegible] pale salmon but frequently dark purple [illegible] oral disc similar to the tentacles usually [illegible] with brown (VERRILL) (*abyssicola*: [illegible] with few radial streaks of slightly darker [illegible] circular wall) pale pinkish yellow, [illegible] oral disc dark pink (MOSELEY)).

[illegible] The longer diameter of the base in larger specimens 2 [illegible] transverse diameter up to 1.5 cm, height of [illegible] 1.5 [illegible] length of the tentacles (VERRILL). In the specimen from Davis Strait the length of the base was 2.5 cm, [illegible] of the body 1 cm.

Occurrence. Davis Strait 66°49′ N. 56°28′ W. 143 m (Wandel [illegible]); S. of Iceland 62° N. 21°36′ W. 1591 m. Bottom [illegible] (Ingolf exped. St. 40); 42°59′ N. 51°15′ W. 1100 m. [illegible] at 914 m. 3.70° ("Michael Sars" exped. 1910 St. 70) [illegible] E. of Georges Bank 677 fms. St. 2528 1885, 2 specimens; off Nantucket Shoals 407 fms. (U. S. Fish Com. St. "Albatross" St. 2046) 1 specimen, off Marthas Vineyard 372 fms., 365 [illegible] ("Fish Hawk" St. 893, 894) 7, 1 specimen; 40°02′ N. 68°50′ [illegible] W. 547 fms. (U. S. Fish Com. St. "Albatross" St. 2048) 13 specimens (teste VERRILL). Several localities between 39°50′45″ and 41°32′ N. and between 65°35′30″ and 70°18′ W. 260-1212 [illegible] (Blake exped.), Nova Scotia, Grand Bank; (*abyssicola* 40°17′ N. 66°48′ W. 1350 fms. Challenger Exped.).

Exterior aspect. The pedal disc was, in all specimens examined by me, prolonged about in the transverse plane of the [illegible] and usually clasping branches of *Acanella*. The column was usually smooth, some specimens had small tubercles, showing a tendency to be arranged in longitudinal rows in the uppermost part of the column. In the specimen taken in Davis Strait, one side was provided with numerous small tubercles distally and an annulus of low but broader tubercles on the indistinct circular wall. Smooth specimens as well as such having tubercles have been taken in the same locality. The circular wall is nothing [illegible] a product of a certain contraction of the body, often not present or only visible in a part of the periphery. The number of the cinclides varies in the directive compartments but seems mostly to be 2 + 2 or 2 + 1 more seldom fewer or more numerous. Of 22 closely examined specimens 9 had 2 + 2 cinclides, 7 2 + 1, 3 1 + 1, 2 3 + 2 and 1 1 + 1 cinclides. The cinclides were usually situated perpendicularly to the longitudinal axis of the pedal disc although sometimes small displacements in their arrangement occurred.

The tentacles are rather numerous, more than 100, in larger specimens up to 130-140. They are comparatively long, conical, [illegible] at the outside of the base and often, also in preserved [illegible] with long filiform tips. The inner tentacles are larger [illegible] somewhat longer than the often filiform outer [illegible] tentacles seem to be somewhat more numerous than the [illegible] at the limbus, though the difference is small. In one [illegible] 106 tentacles and 104 mesenteries at the limbus, [illegible] 104, in a third 114 resp. somewhat more than [illegible] 120 [illegible]. Thus, the last cycle of mesenteries [illegible] and grow downwards or at least originate [illegible] than at the limbus. At any [illegible] between this species and *S. nexilis* on the [illegible] *Amphianthus* on the other, inasmuch as [illegible] more mesenteries at the limbus [illegible]. The oral disc is very wide and the mouth [illegible]. The actinopharynx is provided with 2 broad [illegible] aborally.

Anatomical description. The ectoderm of the column is [illegible] state of the animals rather [illegible] thickened between the insertions of the directive mesenteries. The sphincter is alveolar, perfectly differentiated from the circular, endodermal muscles of the column, in all places of almost same breadth and filling up most of the breadth of the mesogloea. Its muscle meshes are small, in the uppermost part somewhat larger (fig. 57). The ectoderm of the tentacles is very high, the mesogloea about equally developed on the abaxial as on the adaxial side. The longitudinal muscles of the tentacles are ectodermal and weak, especially on the abaxial side. Also the radial muscles of the oral disc are weak. The ectoderm and the mesogloea of the actinopharynx are rather thick. The ectoderm of the whole actinopharynx is pigmented, as also that of the column, tentacles, and oral disc.

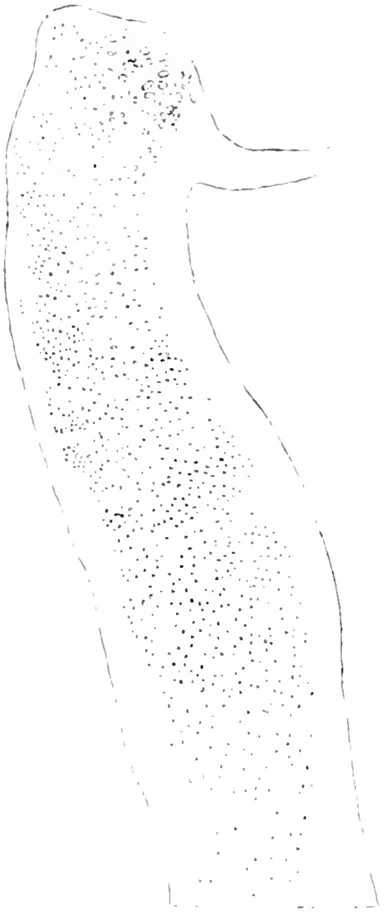

Fig. 57. *Stephanauge acanellae.* Sphincter.

The mesenteries are hexamerously arranged in 4 cycles, to which sometimes are added some mesenteries of a fifth cycle. There are two pairs of directives (always?). As a rule only the 6 first pairs of mesenteries are perfect, in one specimen it seems as though the mesenteries of the second order reach the uppermost part of the actinopharynx. The longitudinal muscles of the mesenteries form weak retractors, somewhat stronger pennons are present on the directives. The parietobasilar and basilar muscles are weak. The gonads are present at least in all the stronger mesenteries. Also in this species I have not been able to ascertain the presence of acontia because of the very strong development of the gonads and the bad preservation of the interior of the animals. The type of the nematocysts were very difficult to decide. Apart from the other nematocysts of the column and tentacles there were strongly opaque nematocysts present. They were in the column $19.7-25.4 \times 5-5.6\ (6.3)\ \mu$, in the tentacles $(14)\ 20.4-25.4\ \mu$. Probably they were developmental stages. The broadest nematocysts of the filaments showed a strongly granular appearance, so that it was impossible to distinguish the type, but in another example they seem to be microbasic *p* mastigophors. In this example I found also stenothels and holotrichs, certainly foreign bodies, in the maceration preparations of the filaments and mesenteries.

Remarks: Although it may be possible that MOSELEY's *Actinia abyssicola* (= *Stephanactis abyssicola* R. Hertwig) and *Sagartia acanellae* Verr. are identical species, I have here, in opposition to what I wrote in 1928 (p. 300–301), preferred to call the above species *Stephanauge acanellae* and put up with a query *A. abyssicola* as synonymous with *acanellae*. If the statement of MOSELEY and R. HERTWIG is correct as to the number of mesenteries and the tentacles—MOSELEY mentions about 60 tentacles and HERTWIG 90–100 mesenteries at the limbus in *abyssicola*—we should have to do with two different species, *Amphianthus abyssicola* and *Stephanauge axinellae*. But there were 2 specimens in the collection and it is doubtful whether the statements refer to the same specimen. However that may be, *Sagartia acanellae* is nearly related to *Stephanauge nexilis* and may go to the same genus. As to *A. abyssicola* MC MURRICH (1893 p. 193) and VERRILL (1899 p. 115) have suggested, that this species is identical with *Stephanauge nexilis*, but later VERRILL (1922 p. 101) refers it to his genus *Raphactis* (= *Amphianthus* CARLGREN 1934 p. 10).

Genus **Amphianthus** R. Hertw.

Syn. *Korenia, Gephyra, Gephyropsis, Raphactis, Stelidactis, Synanthus* (p. p.), *Stephanactis* (p. p.).

Hormathiidae with the pedal disc often prolonged in the transverse plane and clasping branches of octocorals, sponges or other objects. Column rather low, mostly thick, sometimes smooth, sometimes provided with small tubercles, commonly arranged in more or less distinct longitudinal rows. Cinclides as a rule only from the directive compartment, sometimes singular, sometimes 2–4 in each compartment, in the latter case one above the other, probably always principally endodermal evaginations (cinclides in young specimens indistinct or absent ?). Column in contracted state often forming a circular wall in the lowest part of the sphincter which is mesogloeal, rather strong to strong, and wholly separated from the circular muscles of the column. Margin distinct. Tentacles cylindrical or conical, sometimes more or less thickened at the outside of the base, hexamerously or irregularly arranged. Inner tentacles considerably stronger than the outer ones. Number of tentacles fewer than that of the mesenteries. Longitudinal muscles of tentacles and radial muscles of oral disc ectodermal. Actinopharynx with few longitudinal ridges. Siphonoglyphs 1–3, often situated perpendicularly to the longitudinal axis of the pedal disc. Mesenteries hexamerously or irregularly arranged, 1–3 pairs of directives. At least 6 pairs of mesenteries perfect, often more, sometimes there are pairs of mesenteries, one mesentery of which is perfect, its partner imperfect. Retractors of the mesenteries comparatively weak, apart from those of the directives. Mesenteries of the first order and at least the stronger of the other fertile, the directives usually excepted. Acontia mostly short but broad, their nematocysts basitrichs. Cnidom: spirocysts, basitrichs, microbasic *p*-mastigophors.

In my papers (1925, 1928 a) I have discussed the Amphianthids, so that there is no need to repeat this discussion in all details here. I have pointed out that the genus *Stephanauge* (type *nexilis*) probably is a distinct genus separated from *Amphianthus* probably by a richer development of mesenteries at the margin than at the limbus. The examination of *nexilis* supports such an organisation though the difference between the number of mesenteries at the distal end and that of the proximal is not so conspicuous as in *Stephanauge bulbosa* (CARLGREN 1928 a p. 222). On the contrary the mesenteries at the limbus are more numerous than those of the margin in *Amphianthus* or, in other words, the mesenteries, at least those of the younger cycles, grow from the base upwards in *Amphianthus*, from the distal end downwards or possibly from both ends in *Stephanauge*. This difference is sufficient to my mind to separate the two genera though undoubtedly near related to each other.

The near relationship of *Gephyra* (*Gephyropsis*) with the Amphiantids HERTWIG (1882 p. 76) and ANDRES (1883 p. 382, 576) have already suggested. In fact the genus *Gephyra* is identical with *Amphianthus* and *Korenia* (CARLGREN 1928). Also the genus *Raphactis* is nothing but *Amphianthus*. I have examined the type *R. nitida* Verr. and also observed acontia here (CARLGREN 1934). As to the genus *Synanthus* it is more difficult to decide its identity with *Amphianthus* as the first description of the type *S. mirabilis* Verr. is very imperfect. ANDRES (1883 p. 584) suggested, probably rightly, it may be a Zoanthid. VERRILL's *mirabilis* of 1883 belongs to the genus *Isozoanthus* (CARLGREN 1924 p. 187), while his specimens of 1899 and 1922 probably are *Amphianthus* or possibly *Stephanauge*. Also the description of *Bunodes minuta* R. Hertw. suggests that we have to do with an *Amphianthus*. As a matter of fact, before reading the description I have stated the near relationship of this species to *Amphianthus* during my visit to London in 1897.

Amphianthus margaritaceus (Dan.).

Korenia margaritacea n. sp. DANIELSSEN 1890 p. 1 Pl. 1 fig. 4. Pl. 7 figs. 1–5.

Amphianthus (*Korenia*) *margaritaceus* (Dan.) CARLGREN 1928 p. 258, 300; 1932 p. 264; 1933 p. 32; CARLGREN in BROCH 1936 p. 5; 1939 p. 14, 22.

Diagnosis: Pedal disc wide, with a cuticle. Column in the contracted state with or without a distinct circular wall, smooth in young specimens, in older provided with rounded mesogloea-papillae being small but numerous next to the tentacles and here, at least in contracted specimens, not distinctly arranged in rows; below these papillae a small smooth or somewhat tuberculated area, at the circular wall often large tubercles and further down smaller tubercles arranged in 15–18 longitudinal rows. The lowest part of the column smooth. Cinclides 1–4, sometimes indistinct or absent (?) in young specimens. Sphincter strong, broad, extended over almost the whole breadth of the mesogloea, in its upper and inner part reticular with rather large meshes, in its outer part alveolar. Tentacles about 60–70, conical, rather short, often somewhat thickened at the base of their abaxial side, inner tentacles about twice as long as the outer ones. Two siphonoglyphs. 6 pairs of perfect mesenteries; moreover, the mesenteries of the second cycle are often perfect in the uppermost part of the actinopharynx. Retractors fairly well developed on the strongest mesenteries, especially on the directives, parietobasilar and basilar muscles weak. All stronger mesenteries, except the directives, fertile. Nematocysts of the column partly about 14–28.2 × 3.5–4.2 μ, basitrichs, partly 17–18.3 × 4.2–5 μ, microbasic *p*-mastigophors, those of the tentacles 11.1–28.2 × 3.5–4.2 (5) μ, basitrichs (on the outer side of their base 18.3–21 × 4.2–49 μ, microbasic *p*-mastigophors, sometimes absent), those of the actinopharynx partly 28.2–36 × 3.5–4.2 μ, basitrichs, partly 27.5–31 × 3.5–5 μ, microbasic *p*-mastigophors, those of the filaments partly 18.3–21 × 2.8–4 μ, basitrichs, 22.6–29 (31) × 3.5–4.2 μ microbasic *p*-mastigophors, those of the acontia 31–46.5 × 4.2–5 (5.5) μ basitrichs (13.4–15.5 × 2 μ rare, basitrichs), spirocysts of the tentacles up to 55 × 7 μ.

Colour: Column and pedal disc pale rose red to almost white with mother-of-pearl lustre. Oral disc a darker rose red with a slightly darker annulus around the mouth. Tentacles somewhat darker rose-red than the oral disc (DANIELSSEN). The ectoderm of the column contains, in preserved state, a yellow brown pigment.

Dimensions: Column about 1 cm high, at the margin 1 cm, at the limbus 2.2–1 × 0.5 cm broad. Largest specimen (St. 26 Swed. exp.) in contracted preserved state: Largest breadth 2.2 × 1 cm, height 1 cm.

[illegible] 74 16' N., 70 30' W., 1200 m. [illegible] St. 1[illegible] 1 spec.; 69 50' N. [illegible] (Godthaab exped. St. 54).

[illegible] 72 12' N., 14 49' W., 2000 m. (Kolthoff [illegible]

[illegible] N., 7 06' W., 2465 m. Bottom temp. — 1 [illegible] exped. St. 113) 1 very small spec. [illegible] N., [illegible] W., 1575 m. Bottom temp. — 0.8 (Ingolf [illegible] 67 53' N., 10 19' W., 1902 m. Bottom

[illegible] *[illegible]aceus*. Sphincter.

[illegible] exped. St. 126) 1 specimen; 63 53' N., 6 22' W. [illegible] Bottom temp. — 1 (Michael Sars exped. 1900 St. 9) 6 [illegible] 17' N., 1 27' W., 1977 m. Bottom temp. — 1 (Norw. N. Atl. exped. St. 35) 78 10' N., 8 41' E., 2700 m. Bottom temp. — 1.4 [illegible] exped. 1898 St. 26) [illegible] specimens, 77 58' N. [illegible] E., 2458 m. Bottom temp. — 1.4 (Norw. N. Atl. exped. St. [illegible] 65 13' N., 0 33' E., 2844 m. Bottom temp. [illegible] N. Atl. exped. St. 53, teste DANIELSSEN). [illegible] 46 41' N., 147 28' E., about 3500 m. Bottom [illegible] 3000 m. 34.65 pro mille (P. Uschakow

[illegible] of the specimens which live [illegible] so that the lateral [illegible] on the specimens attached [illegible] covered with a cuticle. The [illegible] either in the directive or [illegible] these. The cinclides, of [illegible] one in each directive [illegible] position in relation to the [illegible] are not situated oppo- [illegible] of the body are not equally [illegible] cinclides are not visible or

[illegible] in older animals [illegible] tubercles, of which at least the largest are somewhat invaginated in their middle but not perforated (in contradiction to DANIELSSEN's statement).

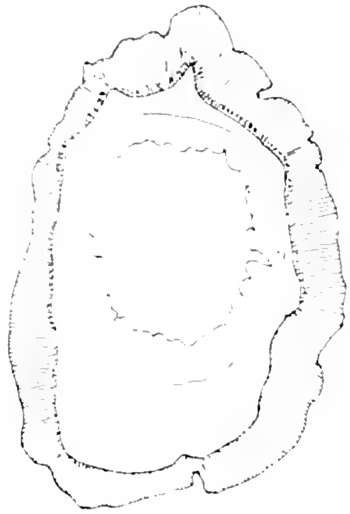

Fig. 59. *Amphianthus margaritaceus*. Transverse section of tentacle.

Towards the margin the tubercles are closely set, so that there is no regular arrangement of them in contracted specimens, in the expanded state they appear to be arranged in longitudinal rows. Exceptionally (in a large specimen) the tubercles were flattened but prolonged like lobes probably in connection with an especial state of contraction. Below these tubercles there was a small area, smooth or with few tubercles, and lower down 15–18 longitudinal rows of tubercles the uppermost of which were the largest. In some specimens, evidently in connection with a certain state of contraction, there was a circular wall around the upper part of the column. Often it is, however, indistinct or absent. The lower part of the column is smooth, here or in the lowest, tuberculated area the cinclides are situated.

The tentacles, up to about 67 in number, are conical, rather robust, the outer ones half as long as the inner ones, hexamerously arranged in 5 cycles, the 5th cycle incomplete. The oral disc is wide with radial furrows corresponding to the insertions of mesenteries, the actinopharynx short with few longitudinal furrows and 2 distinct siphonoglyphs.

Fig. 60. *Amphianthus margaritaceus*. Transverse section of a directive mesentery in the region of the cnidoglandular tract.

Anatomical description: The ectoderm of the pedal disc is rather high and provided with a thick cuticle, that of the column a little thinner and pigmented, yellowish-brown, the mesogloea thick, especially in the region of the sphincter and in the circular wall when present. The cells of the mesogloea are numerous but poor in protoplasm, the tubercles are thickenings of the mesogloea. The statement of DANIELSSEN that there are ectodermal muscles in the column is wrong. The cinclides are probably mainly endodermal excavations as in other species of *Amphianthus*. The sphincter is very strong, filling up almost the whole breadth of the thick mesogloea, reticular in its upper and inner, alveolar in its outer parts. The fairly large meshes show on the inside a little tendency to transverse stratification inasmuch they are radially extended, the meshes on the outside are alveolar and small (fig. 58). The sphincter ends aborally at the uppermost part of the circular wall, if such is present.

The ectoderm of the tentacles is thicker than the mesogloea on the adaxiale side, on the abaxial side the opposite. Here the mesogloea is often thickened at the base forms but never any distinct bulbous swellings. The longitudinal muscles of the tentacles are ectodermal, stronger on the adaxial side than on the abaxial (fig. 59).

The mesenteries are hexamerously but somewhat irregularly arranged so that some of the primary exocoels contain more mesenteries than the others. In a specimen I found 42 mesenteries in the upper part of the body, 48 below the actinopharynx. The one side was more regularly developed than the other. The arrangement of the pairs was the following:

$$\overset{\text{dm}}{\underline{1}},\ 4,\ 3,\ 4,\ \underline{2},\ 3,\ \underline{1},\ 3,\ \underline{2},\ 3,\ \underline{1},\ 3,\ \underline{2},\ 3,\ \overset{\text{dm}}{\underline{1}},\ \underline{2},\ \overset{*}{\underline{3}},\ \underline{1},\ 2,\ \underline{1},\ 3,\ \underline{2},\ \overset{\circ}{4},\ 3,\ 4$$

dm: directive pairs, o: single mesentery, *: only the one mesentery perfect. The underlined figures are perfect mesenteries.

As we see, there were in the first half 3 cycles of mesenteries regularly developed and moreover two pairs of a fourth cycle in two tertiary exocoels next to the one directive pair, in the other half in the first primary exocoel one pair of the second cycle and one pair of the third, in the second primary exocoel only a pair of the second cycle and in the third primary exocoel we find mesenteries of the same cycles as in the first exocoel of the first half, except that the mesenteries of the fourth order are single mesenteries instead of pairs. The mesenteries of the first and second orders were perfect apart from a pair, situated in the transverse plane of the second order. Moreover a mesentery of the third order was perfect, its partner imperfect. All mesenteries, except the directives and the very small mesenteries of the fourth cycle, were fertile, as seen also on other sectioned specimens. In the specimen the mesenterial arrangement of which is described above, the longitudinal axis of the pedal disc and the directive axis correspond, in three other specimens the position of the directive axis was about the same, in a fifth the directive and the transverse axis of the pedal disc almost correspond, to judge from the position of the cinclides. Another closely examined specimen had about 96 mesenteries at the limbus and 67 in the upper part of the actinopharynx. Here 7 pairs of mesenteries, of which 2 pairs of directives, were perfect and one pair consisted of one perfect and one imperfect mesentery. The retractors, usually weak diffuse, were better developed on the directives (fig. 60), the parietobasilar muscles, forming a shelf on the stronger mesenteries, were almost unfolded, the basilar muscles weak, the acontia of typical structure, thick.

Remarks: Although the 2 examples from the Ochotsk Sea were taken in a temperature of + 1.82° I have with some hesitation identified them with *margaritaceus*. The nematocysts of the acontia were 34–43 commonly 38–41 × 4.5 μ, and the cinclides 1 + 1.

Amphianthus norvegicus n. sp.

Pl. I fig. 1, Pl. III figs. 5, 6.

? *Sagartia splendens* n. sp. DANIELSSEN 1890 p. 33 Pl. 1 fig. 12, Pl. 10 figs. 10–13.

Diagnosis: Pedal disc usually round, sometimes a little undulated. Cinclides present but not (or hardly?) visible in the living state of the species. Column smooth, without tubercles. Sphincter consisting of very small meshes in its uppermost part, for the rest mostly of single muscle fibrillae. Tentacles up to about 100 of ordinary length, the inner about twice as long and broad as the outer ones, 1 or 2 siphonoglyphs, in the latter case often irregularly situated. Perfect pairs of mesenteries varying 4–6–11 or more? + some single mesenteries forming pairs with imperfect ones. All stronger mesenteries, incl. the directives, fertile. Reproduction also by tearing off a part of the most proximal part. Nematocysts of the column partly 15.5–21 × 2.8 μ, common, basitrichs, partly 21–25.4 × 4.2–5.6 μ sparse, microbasic *p*-mastigophors, those of the tentacles partly 21–27.5 × 2.8–4.2 μ, basitrichs, partly 19.7–25.4 × 3.5–6 μ, often a little curved, fairly common at the outside of the base, on other places very rare, microbasic *p*-mastigophors, those of the actinopharynx partly 23–31 × 3.5 × 3.5–4.2 μ, common, microbasic *p*-mastigophors, partly 21–28.2 × 3.5–4.2 μ, basitrichs, those of the filaments 21.8–26.8 × 3.5–4.2 μ, common, microbasic *p*-mastigophors, partly 8.5–10 × 2 μ, few, basitrichs, those of the acontia 40.2–58 × 5.5–6 μ, basitrichs. Spirocysts of tentacles up to about 18 × 6 μ.

Colour: Column, tentacles and oral disc rose-red, actinopharynx shading into orange (CARLGREN)–? Column pale rose-red shading a little to yellow. Round the mouth a bright red annulus from which bright red stripes radiate to the tentacles. Tentacles bright red (*Sagartia splendens* DANIELSSEN).

Dimensions of the largest specimen from Trondheimfjord in expanded, preserved state: Length of the column 1.8 cm, breadth in its uppermost part 1.8 cm. Length of the inner and outer, contracted tentacles 0.5 resp. 0.3 cm. Another expanded specimen from the same locality: Length of the column 0.8 cm, its breadth 1.5 cm. The other specimens were smaller.

Occurrence: Norway: Trondheimfjord, Brettingsnes, several specimens, 3 on *Ascidia obliqua* S. Bock 1939, Galgenes, Rodberg about 300 m on Ascidians (CARLGREN 1921), several specimens; 130–180 m ("Gunnerus" 1933) 4 specimens; W.N.W. of Bergen 90–200 fms. (G. NILSSON) 5 specimens; off Bergen 100–170 fms. (M. Olsson) 1 specimen; Jaderen 100–150 fms. (WESTERGREN) 1 specimen; ? Husön, Sognefjord on *Stylaster* (Norw. N. Atl. exped. *Sagartia splendens*).

Exterior aspect: The pedal disc is wide and sometimes somewhat undulated (*Sagartia splendens* and some specimens taken in Trondheimfjord) probably correlated with an asexual reproduction. Of 2 very badly preserved specimens taken in Trondheimfjord one had developed a laceration piece, the 2 others were connected with a rather long string at the base, indicating that the laceration takes place by tearing as in *Metridium*. The column is smooth, in expanded state thin with visible insertions of the stronger mesenteries, in contracted state often provided with indistinct longitudinal furrows which in specimens drawn in often are deeper in the distal part of the body. The column is usually of same breadth and length, sometimes the middle part is thinner than both discs. In living specimens I have not observed any cinclides, in one preserved I have, however, found a cinclis in sections. The margin is rather distinct, but a fossa is absent.

The conical tentacles are arranged close to the margin, so that the most part of the oral disc lacks tentacles. They are of ordinary length in expanded state, when contracted considerably shorter and often transversally wrinkled, the outer tentacles about half as long as the inner ones. The number of tentacles varies.

[illegible] Pl. III, fig. 6) there were 99 tentacles, [illegible] 87 [illegible] (Pl. III fig. 50, 81). Owing to [illegible] mesenteries (compare below) [illegible] exact information of the arrangement of [illegible] are arranged in 5 cycles in large [illegible] the tentacles is smaller than that of the [illegible] 2 [illegible] second specimen had 112 mesenteries [illegible] another individual had 76 tentacles and [illegible] mesenteries at the base. The oral disc is wide and radially [illegible] sometimes eccentrically situated, the actinopharynx [illegible] length and longitudinally ridged. There are [illegible] in the latter case often (always?) unsymmetrical [illegible] two specimens examined had only one, 2 other [illegible]

Anatomical description. For the anatomical examination I [illegible] 5 specimens one of which was very well expanded [illegible]

The ectoderm of the column is rather thin, the mesogloea [illegible] cells poor in protoplasm, rather thick in [illegible] expanded state thinner, in the region of [illegible] thicker. The sphincter is rather strong, [illegible] its distal part and diminishing gradually [illegible] at least in larger specimens, not in communication [illegible] circular muscles of the column, only in [illegible] part the muscles sometimes lie close to the [illegible] The structure of the sphincter was of the same appearance [illegible] specimens examined. The muscle meshes are very [illegible] sphincter. Here usually [illegible] only single muscle [illegible] rather high and in expanded [illegible] mesogloea. The longitudinal muscles of the tentacles and radial muscles of the oral disc are ectodermal and weak.

[illegible] sphincter.

The arrangement of the mesenteries is irregular, the mesenteries of certain pairs often show very different sizes. In the section (fig. 62) of a specimen taken W.N.W. of Bergen and provided with only one pair of directives and one siphonoglyph I have found 33 pairs of mesenteries, 6 pairs and 4 single mesenteries of which were perfect. Another specimen, provided with 56 mesenteries in the distal part, had only 4 pairs of mesenteries, including one directive pair, and 3 single mesenteries perfect. In a third specimen with 2 pairs of directives 15 mesenteries, 6 pairs and 3 single mesenteries, were perfect in the uppermost part of the actinopharynx. In a fourth specimens with 87 tentacles 56 pairs of mesenteries were present at the lowest part of the actinopharynx, the youngest of them end before they reach the margin. Here 6 pairs were perfect and 5 pairs consisted of one perfect and one imperfect mesentery. The arrangement of these mesenteries was the following:

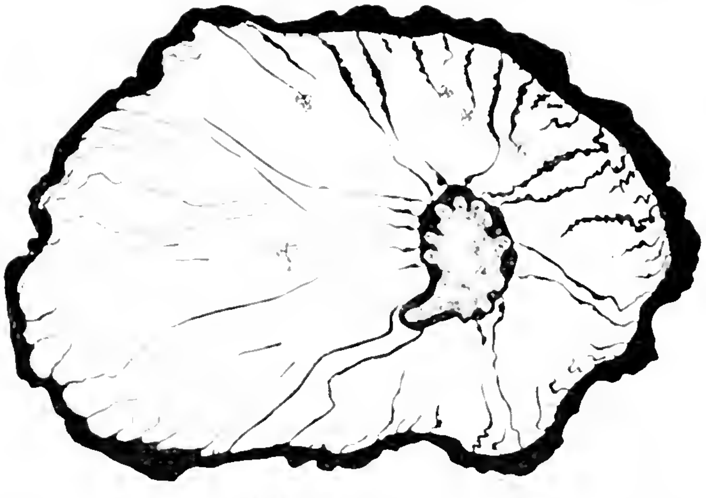

Fig. 62. *Amphianthus* [illegible]. Section of the body in the region of the actinopharynx.

$$\overset{\text{dm}}{\mathrm{PP}},\ \mathit{p}\mathrm{i},\ \mathrm{PP},\ \mathrm{ip},\ \mathrm{Pi},\ \mathrm{pP},\ \overset{\text{dm}}{\mathrm{PP}},\ \mathrm{Pi},\ \mathrm{PP},\ \mathrm{pi},\ \mathit{pp}.$$

dm: directives, P: mesenteries grown together with the actinopharynx in its whole length, *p*: in half of its length, p: in its uppermost part, i: imperfect mesenteries. A fifth specimen had 5 perfect pairs, of which one directive, and 3 single mesenteries perfect. A sixth individual had 11 perfect pairs and 2 single perfect mesenteries. The mesenteries are more numerous in the proximal than in the distal part. In an example with 76 tentacles there were about 150 mesenteries at the base. The mesenteries are thin, thickened in their uppermost and lowest parts, their longitudinal muscles weak, forming no distinct pennons, the parietobasilar and basilar muscles also weak and only a little folded. The filaments are of the usual structure, the mesogloea of the ciliated tract well developed, the acontia long and thick, with numerous nematocysts and between them many granular gland cells. Only the stronger mesenteries are provided with filaments and acontia. The reproductive organs, in two specimens examined testes, appear on the mesenteries of the first cycle including the directives. The weaker mesenteries are sterile. A marginal stoma is present in the perfect mesenteries. The size of the basitrichs of the acontia I have measured in 10 individuals. They were 51–58 × 5.5–6 μ; 42–50 × 5.5–6 μ, 48–57 × 5–6 μ, 43–53 × (5) 5.5 μ; 41–46 × 5–5.5 μ from a small individual, 46–53 × 5–5.5 μ; 41–58 × about 6 μ; 46–51 × 5.5–6 μ, 46–55 × 6 μ and 40.2–54 × 5–5 (6) μ.

The basitrichs of the acontia seem to be armed in their whole length. As far I can see the thread has a weaker armature above the basal part which is, as usual, provided with longer barbs. If this supposition should be verified on exploded capsules, it supports my suggestion that the basitrichs of the Anthozoa have arisen from hoplotelic microbasic *b*-mastigophors (see CARLGREN 1940 p. 54, 55).

Remarks: Possibly *Sagartia splendens* Dan. is identical with this species but, as the type of *S. splendens* is lost, it is difficult to decide. Therefore I prefer to regard the specimens above described as a new species.

Amphianthus mopseae (Dan.).

Stelidiactis mopseae n. sp. DANIELSSEN 1890 p. 17 Pl. 2 figs. 4, 5, Pl. 8 figs. 7–11.
? *Stelidiactis tubulariae* n. sp. DANIELSSEN 1890 p. 19 Pl. 2 figs. 6–7, Pl. 8 fig. 12.

Diagnosis: Pedal disc prolonged in the directive plane (always?) clasping the stalk of *Mopsea* or *Tubularia*. Column provided with 24 ridges (teste DANIELSSEN) without tubercles. Cinclides at least 2 from the directive compartments. Sphincter rather strong, alveolar, not stratified, not occupying the whole breadth of the mesogloea. Tentacles up to about 48, not thickened on their outside, short, conical. More than 6 pairs of mesenteries perfect. Two siphonoglyphs (always?). Mesenteries at the limbus more numerous than those at the margin. Retractors of the mesenteries, parietobasilar, and basilar muscles weak. All stronger mesenteries, including the directives, fertile. Nematocysts of the tentacles about 14 × 1.5 μ basitrichs, those of the actinopharynx 19–21 (24) × 2.8–3.5 μ those of the filaments 18.3–22.6 × 2.8–3.5 μ, those of the acontia 30–36 × 4.2–4.5 (5) μ, basitrichs. Spirocysts of the tentacles up to 31 × 4.5 μ.

Colour: Column mother-of-pearl coloured, tinged faintly with rose red. Oral disc salmon red with somewhat darker rays issuing from the mouth. Tentacles a little lighter in colour than the oral disc (DANIELSSEN, *Stelidiactis mopseae*). Column as the former. Tentacles somewhat darker red with a bright red annulus round the base (DANIELSSEN *Stelidiactis tubulariae*).

Dimensions in contracted state: height 0.5–0.4 cm, breadth of the base about 0.9 × 0.45, in expanded state: length of the pedal disc 3.4 cm, height of the column and breadth of the oral disc 1.2 cm (DANIELSSEN *S. mopseae*). *Stelidiactis tubulariae* in expanded state: Pedal disc 2.5, height of the column and breadth of the oral disc 2 cm (DANIELSSEN).

Occurrence: Norway: Westfjord 68°12′ N. 15°10′ E. 624 m. Bottom temp. 6.5° (Norw. N. Atl. Exped. St. 255 *S. mopseae*) 1 specimen; 64°18′ N. 6°32′ E. 283 m. Bottom temp. 6.9° (Norw. N. Atl. Exped. St. 79 *S. tubulariae*).

Exterior aspect: I have examined the single, not well preserved specimen of *S. mopseae*. The pedal disc was oblong and clasped a branch of *Mopsea borealis*. It is drawn out in the directive plane, provided with a cuticle and radially folded. According to DANIELSSEN the comparatively low column is provided with 24 ridges and between these deep furrows and in the furrows cinclides here and there but without any regularity. In the preserved state of the specimen there is hardly anything to see of these formations, only traces of ridges. In sections through a part of the column enclosing 5 perfect mesenteries I found at least 2, probably 3 cinclides arranged in a longitudinal row in the directive compartment — a slide with sections was a little damaged during the manipulations with the sections, so I cannot decide with certainty, if 2 or 3 cinclides were present. Whether there were cinclides in other compartmens than in the directives is very doubtful. In order to confirm it, it would have been necessary to cut the most of the specimen, which I have given up, as only a single specimen was present. Probably no other cinclides than those issuing from the directive compartments were present as in other *Amphianthus*-species. It must be noted that DANIELSSEN falsely stated that in *A.* (*Korenia*) *margaritaceus* the papillae were provided with a minute round opening (loop-hole) in the extremity (compare this species). The figure 8 Pl. 8 of *S. mopseae* in the work of DANIELSSEN is certainly very schematic, the supposed cinclides are e. g. here regularly arranged contrary to the statement in the text. The furrows of the lower part of the body do not correspond to the insertions of the mesenteries (see fig. 9 Pl. VIII in DANIELSSEN's work).

According to DANIELSSEN the number of tentacles was 24 in *A. mopseae*, 18 in *A. tubulariae*. Meanwhile I think that the tentacles of the former were more than 24, as in a small segment of the specimen I found three tentacles invaginated into three adjacent endocoels. The tentacles are short (conically acuminate and thick at the base, DANIELSSEN) and lack basal thickenings on the outside. The oral disc is round, strongly arcuate (DANIELSSEN), also in preserved state the mouth is situated on a cone. The actinopharynx is rather long and longitudinally sulcated. The two siphonoglyphs are distinct, situated in the longitudinal axis of the animal and provided with distinct aboral prolongations.

Fig. 63. *Amphianthus mopseae*, Sphincter.

Anatomical description: The ectoderm of the column is of ordinary height to judge from small remaining fragments of it, the mesogloea very thick, especially in the lower part of the column, and contains cells poor in protoplasm. The cinclides, principally evaginations from the endoderm, are wide, conical towards the endoderm, the outer aperture considerably smaller. The sphincter is rather strong, mesogloeal, not stratified, alveolar with small muscle meshes, perfectly differentiated from the endodermal muscles of the column, occupying only a part of the mesogloea, in its upper part situated nearer to the ectoderm than to the endoderm (fig. 63).

The ectoderm of the tentacles is very high, to judge from the invaginated tentacles. In maceration preparations I observed only some small nematocysts 11–17 × 1.5–2 μ in size, and spirocysts up to about 31 × 4.5 μ. Moreover there were also some spool like opaque capsules 11.3–14 × 2.8–3.5 μ. The statements of the size of the stinging capsules are, however, uncertain as only fragments [illegible] tentacles. As the capsules [illegible] were [illegible] opaque or granular, [illegible] types, but I think that [illegible] as well as basitrichs present [illegible] the former probably somewhat [illegible] longitudinal muscles of the oral disc [illegible] The ordinarily high ectoderm of [illegible] longitudinal muscles, the mesogloea is [illegible]

[illegible] the exact number of the mesenteries, [illegible] about 48 pairs at the base. In almost a quadrant [illegible] I counted 23 mesenteries at the limbus.

[illegible] the mesenteries are considerably fewer and probably 18–24 pairs. DANIELSSEN stated that only 6 pairs of mesenteries [illegible] perfect. In fact there were certainly also a second cycle [illegible] attached to the actinopharynx, but whether all [illegible] of this cycle were perfect I cannot decide. The mesogloea [illegible] mesenteries is rather thick, especially in their lowest [illegible] longitudinal muscles are weak forming distinct but weak retractors only in the reproductive region, the parietobasilar and basilar muscles weak. Oral and well developed marginal stomata were present. The acontia were packed together close by the directives in the sectioned piece. Also other mesenteries than the directives seem to be provided with acontia. The nematocysts, basitrichs, of the acontia were very numerous. All stronger mesenteries and the directives were fertile, containing testes. DANIELSSEN has drawn a figure (II Pl. VIII) of the reproduction organs. [illegible] shows distinctly a testis, though DANIELSSEN [illegible] it. If the figure is correct, it seems as also an ovum were present. DANIELSSEN described the reproduction organs as [illegible]

Remarks: I think that *A. tubularia* is the same species as [illegible]. The colour and the description of the species agree very well but as no specimens of *tubularia* were preserved, it is not possible to decide with certainty.

Amphianthus islandicus n. sp.

Diagnosis: Pedal disc wide. Column smooth, without tubercles. Cinclides 2 from the directive endocoel. Sphincter very strong [illegible] of very fine meshes (or single fibrillae), wholly separated from the longitudinal muscles of the column, occupying in its upper part most of the breadth of the mesogloea, diminishing downwards. Tentacles conical, up to about 100 in number, without [illegible] thickenings. Siphonoglyph broad, almost without [illegible]. Mesenteries irregularly arranged, at the base [illegible] 100–170. Perfect mesenteries more than 6 pairs. One or two [illegible] directives. Retractors of the mesenteries very weak. Parietobasilar muscles weak. Acontia well developed. Nematocysts [illegible] actinopharynx 17–22.6 × 4–2.5 μ microbasic *p*-mastigophors?, [illegible] 8.5–11 × 1.5–2 μ, basitrichs, those of the [illegible] 10.5–19.7 × 3.5–5.5 μ microbasic *p*-mastigophors?, [illegible] 19.7 × 1.5–2.8 basitrichs very sparse, those of the [illegible] 17–21 × 3.5–4.5 μ microbasic *p*-mastigophors, [illegible] 17–21 × 2.8 μ few basitrichs, those of the filaments [illegible] 14.2–19.7 × 3.5–4.2 μ microbasic *p*-mastigophors, [illegible] 7 × [illegible] 2 μ basitrichs, those of the acontia 23 [illegible] Spirocysts of tentacles up to 41 × 7 μ.

[illegible]

[illegible] breadth of pedal disc 1.3 × 1.2 cm, [illegible] column, that of the smallest, breadth [illegible]

[illegible] N. 22°25' W. 326–216 m (Thor exped. [illegible]

[illegible] Both specimens were contracted and the [illegible] was almost circular, the column smooth, in its upper part provided with indistinct longitudinal furrows possibly caused by contraction. In the larger specimens there were 2 cinclides close to each other in the part corresponding to the single directive endocoel, the smaller specimen was possibly devoid of cinclides, at least they were not visible under a lens. The tentacles of the larger individual occupied about half of the oral disc and were about 100 in number. The actinopharynx was provided with 16 longitudinal furrows in the larger specimen which had only one siphonoglyph. The smaller had probably two.

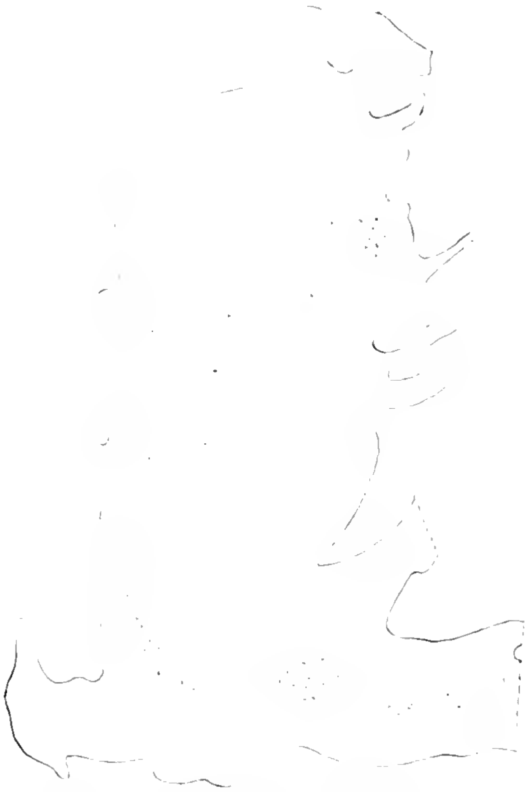

Fig. 61. *Amphianthus islandicus*. Sphincter.

Anatomical description: The anatomy of this species agrees with other species of the genus *Amphianthus*. Fig. 61 shows a section of the sphincter. The muscle meshes are considerably finer than in *Amphianthus dohrnii*. The longer individual had 10 pairs and 3 single mesenteries perfect, among them a single directive pair. The perfect mesenteries of the smaller individual were 9½. Two directives were probably present here, I have, however, only dissected this individual. The longitudinal muscles of the mesenteries formed very weak retractors, the parietobasilar muscles too were also weak, the acontia thick.

The basitrichs were, apart from those of the acontia, few, so that the above named size of them is somewhat uncertain. Some of the larger nematocysts were exploded, their shaft about of same length as the capsule; the shaft was not drawn out in a thread, thus the nematocysts may have been amastigophors, but possibly the threads were broken off. However, an examination of living material is necessary to ascertain if amastigophors are present in the genus *Amphianthus*.

Remarks: The species is certainly nearly related to *A. dohrnii* and it may be possible that they belong to same species. *Dohrnii* has, according to ANDRES, up to 96 tentacles. I have found up to about 70 in specimens from Naples. The cinclides were commonly apparently 1—1 but 2 cinclides have been found in the part corresponding to the directives. The sphincter of *dohrnii* has, however, coarser meshes than *islandicus*, and the basitrichs of the acontia are somewhat larger in the former than in the latter.

Amphianthus ingolfi n. sp.

Diagnosis: Pedal disc wide. Column smooth. 1 cinclis from each directive endocoel. Sphincter alveolar, strong with fine meshes which are situated far from each other in the strongly thickened uppermost part of the column. Tentacles about 48, considerably fewer than the mesenteries, not thickened on the aboral side. 1 siphonoglyph and 1 pair of directives (in the larger specimen) Mesenteries at the base about 116. Retractors of the mesenteries weak. Asexual reproduction by fragmentation (tearing). Nematocysts of the tentacles partly 15.5–26.8 × 3–4.2 μ, microbasic mastigophors, partly 11.3–22.6 × 2–3 μ, basitrichs, those of the actinopharynx partly 17.6–21 × 3–3.5 μ, microbasic mastigophors, partly 21–25.1 × 2.8–3 μ, basitrichs, those of the filaments partly 19.7–21 × 2.8–3 μ, microbasic *p*-mastigophors, partly 10–16.9 × 1.5–2 μ, basitrichs, those of the acontia 35.2–46.5 × 4.2–5.5 μ, basitrichs. Spirocysts of tentacles up to 48 × 7 μ.

Fig. 65. *Amphianthus ingolfi*. Sphincter.

Colour unknown.

Size of the larger specimen in the contracted state: breadth of pedal disc 0.7 × 0.5 cm, height of the column 0.45–0.5 cm, that of the smaller: breadth of pedal disc 0.7 × 0.6 cm, height of column 0.1 cm, breadth of distal part 0.35 cm.

Occurrence: 60°37′ N, 27°52′ W, 1505 m, bottom temp. 4.5°, Ingolf exped. St. 78, 2 specimens.

Exterior aspect: Both examples were of same appearance. The smaller example had a very wide pedal disc, the body of the larger example was of about same breadth. The larger specimen had 1 cinclis, on the smaller one I could not find any cinclis under the lens. The tentacles were about 48 in the larger individual. The larger specimen was provided with a bud-like swelling at the base indicating reproduction by fragmentation.

Anatomical description: The interior of the smaller individual was not well preserved so that the description has been made from the larger specimen. A section of the sphincter is drawn in fig. 65. There were about 48 mesenteries in the upper part of the body, at the base about 116. Probably only 1 directive pair was present, 7 pairs and 2 single mesenteries were perfect. The retractors were weak. I have measured the basitrichs of the acontia in both specimens. In the smaller example the length varied between 35.2 and 46.5 μ, in the larger one between 36.7 and 45 μ. The average size of 52 measured nematocysts, 26 of each specimen, was 41.22 μ.

Amphianthus verruculatus n. sp.

Diagnosis: Pedal disc wide, often embracing Hydroids or skeletons of Octocorals. Column smooth in its lower part, in its uppermost provided with more or less distinct rows of very small tubercles (sometimes absent?). Probably only one cinclis from the directive compartment. Sphincter very strong, alveolar-reticular to reticular with rather large muscle meshes, occupying in its upper part almost the whole breadth of the mesogloea, diminishing downward. Tentacles between 40 and 50, without aboral swellings. Number of siphonoglyphs and pairs of directives one or two. Considerably more mesenteries than tentacles. Nematocysts of the column 17–21 × about 3.5 μ, microbasic *p*-mastigophors, those of the tentacles partly (14) 17–21 × 3.5 μ, microbasic *p*-mastigophors, partly 11.3–18.3 × 3.5–4 μ, basitrichs, those of the actinopharynx partly 19.7–21 × 3.5 μ, microbasic *p*-mastigophors, partly 15.5–21 × about 3 μ, basitrichs, those of the filaments partly 15.5–21 × 3–4 μ, microbasic *p*-mastigophors partly 12–22 × 2.5–3 μ, basitrichs, those of the acontia 29.6–43.7 × 4.2–5 μ, basitrichs. Spirocysts of tentacles up to 37–50 × 7–about 8 μ.

Colour unknown.

Size of the largest specimen from St. 35: the very expanded basal disc about 1 cm broad, height of the body 0.6 cm. All other specimens were very small: largest length of pedal disc 0.4–0.6 cm, height of the body 0.3–0.15 cm.

Occurrence: 66°35′ N, 56°38′ W, 599 m, bottom temp. 3.9°, Ingolf exped. St. 32, 1 specimen; 66°22′ N, 57°16′ W, 686 m, Tjalfe exped. 1909, 1 specimen; 65°16′ N, 55°05′ W, 682 m, bottom temp. 3.6°, Ingolf exped. St. 35, 2 specimens, 64°54′ N, 55°10′ W, 740 m, bottom temp. 3.8°, Ingolf exped. St. 27, 1 specimen; 62°06′ N, 22°30′ W, 1587 m, bottom temp. 3.1°, Ingolf exped. St. 68, 1 specimen.

? 70°53′ N, 54°03′ W, about 700 m. Bottom temp. 1.5°, Godthaab exped. St. 113

Exterior aspect: The column was smooth, apart from its uppermost part which had more or less distinct, longitudinal rows of very small tubercles only visible under a strong lens. The rows of tubercles were most distinct in the smaller example from St. 35 and in that taken by the "Tjalfe". In the larger example dredged at St. 35 no tubercles were visible, but, as the uppermost part of it was very contracted it is possible that this specimen also has had them. As the sphincter was of same appearance as those of the other specimens, and the size of the nematocysts [illegible] two or a little larger [illegible] the same species. The [illegible] 40 [illegible] mesenteries at the [illegible]

[illegible] Owing to the smallness of the [illegible] of the inner organs I cannot [illegible] rather. Also the largest specimen [illegible] contracted. I have examined the [illegible] from that taken at station 27 [illegible] and I have drawn the sphincter [illegible] station 32 (fig. 66). The lowermost [illegible] more alveolar. In other speci[illegible] but the appearance of it was [illegible] the nematocysts of the acontia [illegible] in the specimen from St. 32.


Fig. 66.


Fig. 67.

Figs. 66, 67. *Actinothoe verruculata*. Sphincter, that in 67 figured from the Godthaab station 143.

They varied between 31 and 36.7, the nematocysts of the largest individual from 35 to 43.7.

Remarks. I have with some hesitation referred the specimen from station 143 to *verruculatus*. The nematocysts agreed fairly well with this species but were somewhat longer in the column, tentacles and actinopharynx, but the specimen was also considerably larger (the column was 1 cm high and the base up to 1.7 cm broad). Also the sphincter (fig. 65) showed same appearance but was more extended, probably in correspondence with a different state of contraction. The nematocysts of the column were (15) 18–23 × 3.5–4 μ, those of the tentacles 19–25 × about 2.8 μ, those of the actinopharynx partly 25–29 × 4.5 μ, microbasic *p*-mastigophors, partly 25–29 × about 3 μ, basitrichs, those of the acontia 33–37 × about 4 μ, basitrichs.

Family Metridiidae.

Acontiaria the acontia of which are provided with microbasic *b*-mastigophors and microbasic amastigophors, the latter sometimes very rare or absent. Sphincter mesogloeal. Mesenteries not divided into macro- and microcnemes.

The separation of the genus *Metridium* from the family Hormathiidae is undoubtedly necessary. The genus has very few characters of important ones only the mesogloeal sphincter which, however, has another situation in *Metridium*, and the usually 6 perfect pairs of mesenteries—in common with this family. Already the types of the nematocysts are very different. Pax (1936 p. 103) places *Metridium* together with *Hormathia* and other Hormathiids and writes "Wenn aber die Metridiidae als eigene Familie aufrecht erhalten werden sollen, so muss sich doch ein einziges Merkmal angeben lassen durch dass man sie mit Sicherheit von den Hormathiidae unterscheiden kann. Das ist tatsächlich nicht der Fall." It is to be regretted that Pax had so little knowledge of the organization of the Hormathiidae. But it is too much to expect of an author who has determined specimens of *Hormathia* as *Paranthus* (see Carlgren 1927 p. 88, 89).

Genus **Metridium** Oken.

Metridiidae with wide pedal disc. Column smooth, divisible into scapus and capitulum, the former ending distally in a collar. Cinclides scattered on the scapus. Sphincter mesogloeal, not situated close to the tentacles but at the uppermost part of the scapus. Tentacles short and delicate, extraordinarily numerous in large individuals. Longitudinal muscles of tentacles ectodermal, radial muscles of oral disc ectodermal or meso-ectodermal. Oral disc lobed in large races. Siphonoglyphs and directive pairs up to 3. Typically 6 perfect and sterile pairs of mesenteries, but especially in small races, and in individuals arisen from asexual reproduction, there are more, though not many, perfect pairs and some of the 6 primaries may be fertile. More mesenteries at the margin than at the limbus. Retractors of the mesenteries diffuse to more concentrated. Cnidom: spirocysts, microbasic *b*-mastigophors, microbasic *p*-mastigophors, microbasic amastigophors, basitrichs. Spirocysts small.

Metridium senile (L.).

Metridium dianthus (Ell.) Appellöf 1905 p. 63, 83, 86, 105; Grieg 1913 p. 143; Carlgren 1930 p. 3; Broch 1927 p. 6.

Metridium senile (L.) Carlgren 1933 p. 281; 1939 p. 8; Rawlinson 1934 p. 901; Stephenson 1935 p. 261 Pl. XV fig. 1, Pl. XVI figs. 1–2, Pl. XXV figs. 1–2, Pl. XXVI figs. 1–2, Pl. XXVII figs. 1–2, textfigs. 7 (13) 34 (A–C) 74, 82; Pax 1936 p. 108 figs. 66, 67.

Metridium senile var. *fimbriatum* (Verr.) Carlgren 1934 p. 353; 1936 p. 23. For further references see Carlgren 1893 p. 102, 1928 p. 298, Andres 1883 p. 345 and Stephenson 1935 p. 267.

Pedal disc wide. Column usually pillarlike. Sphincter usually alveolar at least with tendency to longitudinal stratification. Tentacles up to many hundred, usually short, sometimes longer. Typically 6 pairs of perfect mesenteries but in some races up to 15. Reproduction by fragmentation (tearing) from the limbus, possibly by longitudinal fission too. Nematocysts of the column partly 9.5–30 × 3.5 (4) μ, basitrichs, partly 11–35 × 3–5 μ, microbasic amastigophors, those of the tentacles partly 15.5–36 × 3.5–5 μ, microbasic amastigophors, partly 12–31 × about 2 μ, basitrichs, those of the actinopharynx partly 17–46 (53) × 3–5 μ, microbasic *p*-mastigophors, partly 19.7–13 × 2.5–3 μ, basitrichs, those of the filaments partly 10–14 × 3–3.5 μ, partly 21–48 × 4–5.5 (6) μ, both microbasic *p*-mastigophors, partly 15.5–21 × 2 μ, very rare, basitrichs, those of the acontia partly 33–80 × 3–5.5 μ, microbasic *b*-mastigophors, partly 32–89 × 3–6.5 (8) μ, microbasic amastigophors, the latter sometimes absent or almost so. Spirocysts up to about 29 × 3.5 μ.

Colour very variable: Column red-brown, flesh-coloured, olive-brown, salmon-coloured, pale orange-coloured, cream or pure white. Generally the disc and the tentacles are of same colour as the column, the latter often provided with a transverse bar some way above their base. The lips are white or cream, often reddish or orange. The pale orange and especially the pure white forms occur in Bohuslän principally in deeper waters.

Size up to 19 cm long and 10–11 cm broad in well preserved state (var. *fimbriatum*).

Occurrence: West Greenland: Ikamiut (Lohmann); Egedesminde (Traustedt); Holsteinsborg 20 fms. (Holm), 22–35 m (Godthaab exp.), (Bernberg, Traustedt); Holsteinsborg harbour (Ingolf exp.); the district of Holsteinsborg (Bernberg); Ikertokfjord; head of Kapisigdlik fjord W. of Laxeelv 10–0 m (Dana exp.).

Arctic coast of America to Cape Cod (teste Parker); from Long Island Sound and Northern New Jersey to Bay of Fundy, Gulf of St. Lawrence (teste Verrill); New Haven, Newport; New York; Chaleur Bay (Johansen); New Foundland (Verkrüzen); Grand Manan (U. States Fish Com.).

Iceland: Dýrafjörður, 3 localities, one of them 15 m. (Ingolf exp.) (Lundbeck), 8 m (Koch); Isafjörður (Caroe, Ingolf exp.); Isafjarðardjup 9–28 m; Skötufjörður 9–28 m; Steingrimsfjörður; Skagaströnd 70–100 m; Eyjafjörður 22–38 m (Möller); S. of Hrísey, Eyjafjörður 17–20 fms. (Beskytteren exp. 1903); Akureyri, littoral; Berufjörður (Torell); S. of Eystrahorn, 64° 17′ N. 14° 11′ W. 75 m (Michael Sars exp. 1900) 10–15½ miles S.S.W. of Eystrahorn; Heimaey, Vestmannaeyar from the ventricle of a cod-fish; 64° 05′ N. 22° 22′ W. 45 m; Hafnarfjörður 7,5–13 m; Reykjavík; Hvammsvík, Hvalfjörður 0–20 m.

Faroe Islands (Møller), east side of Klaksvig (Bordo), Vestmannasund S. of Egilsnes (the small individuals not determinated (Carlgren 1930 p. 11) were certainly *M. senile*); Orkney and Shetland Isls. (teste Stephenson and Norman). North Sea: 55° 13′ N. 3° 15′ E., 30 fms. (Dana exp. 1922); 54° 45′ N. (Dana exp. 1922); Helgoland (Carlgren); Büsum (teste Pax); coast of Schleswig-Holstein (teste Möbius); west coast of Jutland: 36 miles N. to W. ¾ W. of Horns Rev lightship, 40 m (Thor exp.); Jutland Bank, 60–130 fms. (Uddstrom); Hanvrighuk, Ringkjobing fjord (Johansen); west of the British Isles; English Channel (teste Gosse and Stephenson); north west coast of France to Rade du Croisic, Pierac (teste Fischer); the Mediterranean (temporary?, teste Pax).

Murman Coast, W. off Kanin Peninsula (teste Pax), Kildin Isl., relict sea of Mogilnoje (teste Pax); Kolafjord (Awerinzeff, Derjugin). Norway: Öksfjord (undertidal); Hasvik; Soroy; Grotoy; Rost; Terningen, Verrafjord; Titran; Mastad, Veroy, Flatvadsund, Floro (Dons); Ulfsfjord, Kjosen; Kvenangen, 90 m (Nordgaard), Tromso, 20–30 fms. (teste Sars), 50 m; Balsfjord, 70 fms. (Kiaer); Foldenfjord, Namdalen (Collett); Trondheimfjord (Nordgaard, Dons), Ilsvika, Beian (Kiaer), Vaagsfjord (teste Grieg); Bergen (teste Sars); Solsvig, Manger, 20 fms., Floro (Sars), Godosund, Espevaer (Badenkap).

Skagerak: Lindesnes, Korshamn, littoral, Kjepso, 20–0 m (teste Broch); Oslofjord (Esmarck); Drobak (Broch and others); Hanstholm (Carlgren); N.W. of Hirtshals, 16 fms. (Thor exp.); Bohuslän on many localities.

Limfjord (Mortensen, Carlgren and others); Tisted Bredning, 11–12 m (Biol. Station).

Kattegat: Frederikshavn (Carlgren, Kramp and others);

[illegible] Gerum, Raunefjord [illegible] about 57°03' N [illegible] 56°48' N, 12°20' E [illegible] St. 71, 62, 89, 79 [illegible] 13,5 [illegible] 17 m (Thor exp.) [illegible] Skelderviken, 23 m [illegible] 21 m (Lönnberg) [illegible] Vedgaarde Kramp, Lands- [illegible] northwest of Knabak (Lönnberg) [illegible] Kramp [illegible] 15 miles S.W. of Ven [illegible] Godthaab exp.), Ulkasharpen, S. of [illegible]

[illegible] Mortensen, Lütken), between Strib [illegible] Middelfart [illegible] S.E. of Fænø (Petersen). [illegible] Kiel Bay (Michael- [illegible] Norton Sound, low water (E.W. Nelson). Men- [illegible] 1932 [illegible] Sitka, Whale Isl. near Sitka, St. [illegible] Kodiak teste TORREY); Puget Sound, Nanaimo [illegible] Friday Harbour [illegible] Kincaid, Victoria, British Columbia; [illegible] Oakland harbour [illegible] Kamchatka, Petropaulowsk, [illegible] Avatcha Bay (Swedish Kamchatka exp. 1920–21); [illegible] Hokkaido teste WASSILIEFF.

There are several varieties or races of *Metridium senile*. At [illegible] we can distinguish 4 or 5, between some of them intermediates have been noted.

1) var. *dianthus* (and *marginatum*). I have described the [illegible] of this form in 1893. It is characterized [illegible] large individuals having a strongly lobed oral disc and no, [illegible] rare amastigophors in their acontia. In small [illegible] however, the disc is not lobed and the amastigophors [illegible] acontia. The nematocysts in larger individuals are [illegible] size. The sphincter is alveolar and shows at least a tendency [illegible] stratification. The nematocysts of a small individual about 1 cm long and 0,5–0,6 cm broad from Bohuslän were in the scapus partly 10–15,5 × 1,5–3 µ, basitrichs, partly 17–19,7 × 3,5–4,2 µ, microbasic amastigophors, those of the tentacles partly 15,5–25 × 3,5–4,2 µ, microbasic amastigophors, partly 15,5–18,3 × 2,5–2,8 µ, basitrichs, those of the actinopharynx partly 19,7–25,4 × 4–4,5 (5) µ, microbasic *p*-mastigophors, partly 19,7–28,8 × 2,5–2,8 µ, those of the filaments partly 21–24 × 4,5–5,5 µ, partly 11,3–14 × 3–3,5 µ, both microbasic *p*-mastigophors, those of the acontia partly 39,5–48 × 3–3,5 µ, microbasic *b*-mastigophors, partly 38–46,5 × 4,2–5,6 µ, microbasic amastigophors. The spirocysts of tentacles were up to 19,7 × 3,5–4,2 µ.

2) var. *fimbriatum*. It agrees in its exterior with *dianthus* but grows considerably larger than this variety and its acontia are always provided with amastigophors. The nematocysts are larger than those of *dianthus* and reach the maximum of size in *fimbriatum*.

3) var. *pallidum*, a smaller variety than *dianthus*, usually not lobed. The sphincter is reticular and the cinclides seem to be predominantly endocoelic, in contradistinction to those of *dianthus* in which they are generally exocoelic. The tentacles are larger than those of *dianthus*. The size of nematocysts of this variety is unknown. Intermediate forms between *pallidum* and *dianthus* occur (STEPHENSON 1935).

4) a dwarf race described by Miss RAWLINSON 1931 from Dingle. A small but fertile form. The oral disc is rarely distinctly lobed. The acontia are provided with amastigophors. The nematocysts agree fairly well with those of small young specimens of *dianthus*.

5) a small form not described in detail by PAX (1914) from the relict sea Magilnoje. The variety *pallidum* is known from the British Isles and France, and Helgoland, the Dingle race from England, the variety *fimbriatum* from Bering Sea and the Northern Pacific. Probably a closer examination of the species on the Scandinavian coast will show that different forms exist also there. See also STEPHENSON'S description of *Metridium* 1935.

Appendix.

Family Edwardsiidae.

Edwardsia norvegica n. sp.

Diagnosis. Physa well developed, capable of involution. [illegible] gonad. Nemathybomes small, scattered, numerous in the lower part of the scapus, fewer in the upper. Periderm thick in the lower part of the scapus, distally thinner. Tentacles 16. Retractors of the macrocnemes concentrated in the upper part of the gonad region with at most 20 folds, as a rule richly ramified. Parietal muscles well developed, now elongated, now more concentrated, with high, somewhat branched folds. The outer lamellar part of the macrocnemes attached close to the outside of the retractors. The expansion of the parietal muscles on the column of ordinary type. Nematocysts of the nemathybomes 47–58 × about 3 µ, microbasic *b*-mastigophors, those of the tentacles 29–34 × about 2,5 µ (numerous) basitrichs, those of the actinopharynx partly 41–53 × about 3 µ, microbasic *p*-mastigophors, partly 22–24 × 2,5 µ, basitrichs, spirocysts of the tentacles 13 × 2–25 × 3,5 µ.

[illegible] of the nemathybomes.

Colour unknown.

Dimensions in somewhat contracted state: length 2 cm, largest breadth 0,45 cm.

Occurrence. Norway, Trondheimfjord, Galgenes 250–300 m ("Gunnerus" 4/9 1925) 1 specimen.

Exterior aspect. The physa was well developed and completely drawn in, so that it is evidently capable of involution. The uppermost part of the column was a little invaginated, the distal ends of some tentacles were, however, visible. The column was somewhat polygonal, especially conspicuously in the contracted basal and distal ends. The nemathybomes were small, in the lower part of the scapus numerous and scattered over the whole surface (fig. 68, 69), in the upper part fewer and mostly placed in the middle-line between the insertions of the mesenteries, sometimes, however, situated nearer the insertions. Small fragments of foreign bodies were stuck to the cuticle of the scapus.

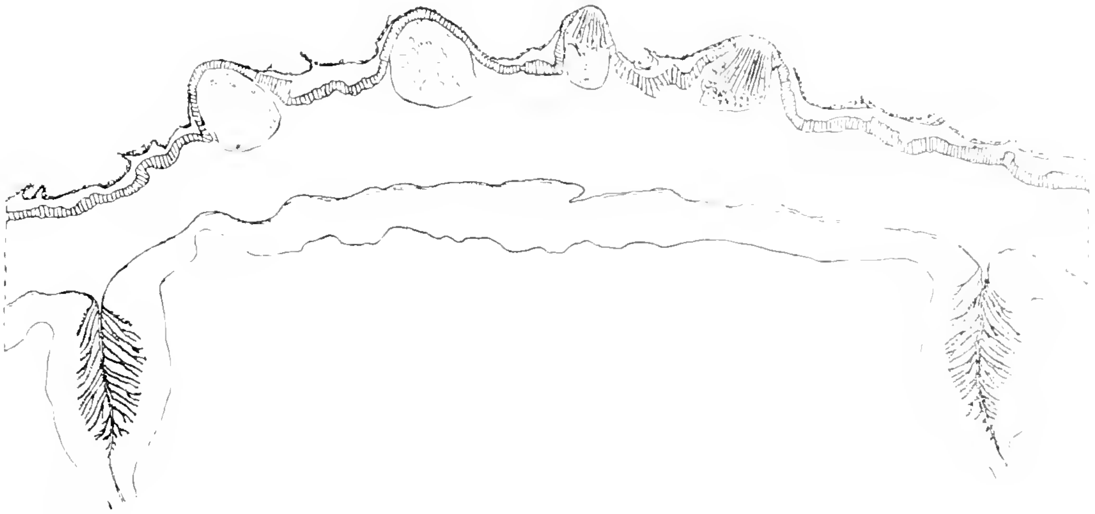
Fig. 69. *Edwardsia norvegica*. Section of the column between two mesenteries in the lower part of the body. 4 nemathybomes are visible

The tentacles were 16 and of typical appearance as also was the actinopharynx.

Anatomical description: The ectoderm of the physa was high, that of the scapus thinner. The cuticle was thin in the upper part of the scapus and outside the nemathybomes, in the lower part thick, its outer parts were easily deciduous. The ectoderm of the tentacles was of the usual appearance.

The retractors of the macrocnemes are not strong, their folds high and richly branched, but few in number. In the upper part of the gonad region there were about 20 folds (fig. 70 *b*) in the lower part fewer. As to the parietal muscles (fig. 70 *a*) compare the diagnosis.

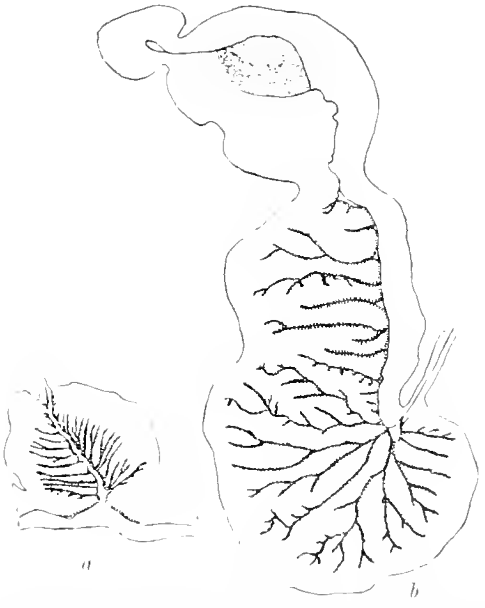

Fig. 70. *Edwardsia norvegica*. Parietal muscle (*a*) and retractor (*b*) of mesentery in the upper part of the fertile region.

Remarks: I have not been able to identify this species with any before known.

Isoedwardsia nidarosiensis n. sp.

Diagnosis: Ectoderm and cuticle of the scapus rather thin, the latter very incrusted. Nemathybomes few, small, scattered. Tentacles 16. Retractors of the macrocnemes rather strong, in the upper part of the reproductive region with about 15–20 folds ramified especially in their outer parts. Lamellar part of the macrocnemes issuing not far from the middle of the retractors. Parietal muscles very strong in the upper part of the gonad region, their expansion on the column of ordinary type. Nematocysts of the nemathybomes about 62–67 × 2.5–3 μ, microbasic *b*-mastigophors (thinner type), those of the tentacles 31–45 × about 2.8 μ, basitrichs, common, those of the actinopharynx partly 60–74.5 × 3.5 μ, basitrichs, very numerous, partly 26–31 × 2.5–2.8 μ, basitrichs, sparse, partly 41–49.5 × 5.6 μ, microbasic *p*-mastigophors, very sparse, those of the filaments partly 28–45 × 4.5–6.5 μ, microbasic *p*-mastigophors, partly 20–29.5 × 2.5–2.8 μ, partly 27–42.5 × 4.2 μ, both basitrichs. Spirocysts of the tentacles 14–24 × 2–3 μ.

Cnidom: spirocysts, basitrichs, microbasic *b*-mastigophors, microbasic *p*-mastigophors.

Colour in formalin two days after preservation: Scapus dirty gray, capitulum, tentacles, oral disc and actinopharynx orange coloured.

Dimensions in strongly contracted state: length 1 cm, largest breadth of the proximal part of the scapus 0.5 cm, that of the capitular region 0.3 cm, length of the tentacles about 0.2 cm.

Occurrence: Norway, Trondheimfjord, Hestdalen, Selviksstrand 125–150 m. ("Gunnerus" 1921) 1 specimen.

Exterior aspect. No distinct physa. Although in a very small area in the middle of the proximal end of the body the mesogloea was considerably thinner than in the other parts of the scapus, I think we are not dealing with a real physa here. The ectoderm has a structure like that of the other parts of the scapus to judge from remaining fragments of the ectoderm provided with a cuticle. Because there were nemathybomes present in the proximal end, though still more sparse than in other parts of the scapus, the species may be an *Isoedwardsia*. The proximal end was rounded, the proximal part bulbous swollen, the upper part of the scapus and the capitulum somewhat polygonal. Owing to concentration the scapus was strongly and irregularly wrinkled, giving it a granular appearance. The cuticle was rather thin but strongly incrusted with foreign bodies, spicula, sand grains and detritus. The nemathybomes were small, few and scattered and only visible in sections.

[illegible] of about same length. [illegible] actinopharynx was partly evaginated [illegible]

The high ectoderm of the apex of the tentacles had extraordinarily numerous nematocysts (size compare diagnosis). The ectodermal longitudinal muscles of the tentacles were rather strong.

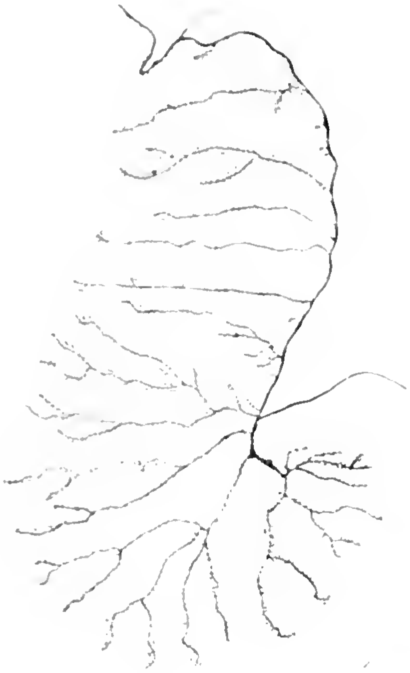

Fig. 71.

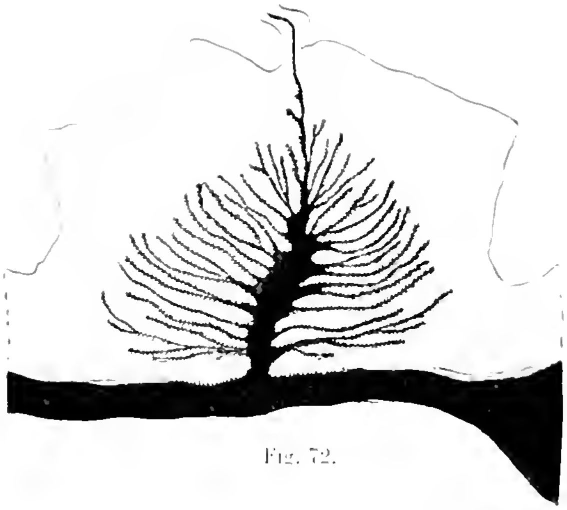

Fig. 72.

[illegible] Retractor (fig. 71) and parietal muscle of a mesentery in the upper part of the scapus (fig. 72).

A[illegible] For the anatomical examination [illegible] part of the proximal end and a piece of the [illegible] tentacles, oral disc and actinopharynx and the [illegible] scapus. [illegible] of the scapus was low also in the proximal part [illegible] provided with a cuticle. The nemathybomes [illegible] which were broader in the basal than in [illegible]. The mesogloea was stratified owing to contrac[illegible] in its outer parts and contained rather large [illegible] the endodermal circular muscles were [illegible] high folds, somewhat weaker in the capu[illegible] of the scapulus was more than thrice [illegible] its nematocysts rather numerous, [illegible] and 17–22 × about 2 μ in size.

In the high ridges of the actinopharynx there were extraordinarily numerous large nematocysts and sparse smaller ones.

The retractors of the macrocnemes were rather strong, forming about 15–20 primary folds in the upper part of the scapus. Especially in the outer part of the retractors the folds were ramified (fig. 71). The parietal muscles were strong, especially in comparison with the pennons, and provided with numerous folds (fig. 72). In transverse sections they were mostly triangular in the upper part of the scapus, sometimes more elongated in a radial direction. The expansion of the parietal muscles on the column was as usual. The outer lamellar part of the macrocnemes was attached not far from the middle of the pennons. The specimen was a male with well developed testes.

Family Andwakiidae.

Andwakia parva Carlgr.

Pl. IV fig. 7, Pl. VI fig. 7.

[illegible] parva n. sp. Carlgren 1940 p. 28, 60 figs. VI 6–8.

[illegible] scapus and scapulus. [illegible] to the substratum, scapus [illegible] a thick cuticle. Sphincter [illegible] meshes. Tentacles [illegible] 24 [illegible] short. Longitudinal [illegible] like arranged. One [illegible]. Mesenteries usually [illegible] in the proximal part [illegible]. Mesenteries not [illegible] macrocnemes [illegible] second cycle often have [illegible] perfect mesenteries provided with retractors, ciliated tracts of the filaments (and reproductive organs?). Retractors of the stronger mesenteries concentrated, with few high, somewhat branched folds. Parietal muscles well developed, in their upper part fan like, in their lower ones more radially elongated. Nematocysts of the scapulus partly 12–15 × 3.5–4 μ, microbasic amastigophors, partly 12–13 × 3–almost 3.5 μ, partly 9–10 × 2 μ, both basitrichs, those of the tentacles partly 14–17 × over 2.5 μ, microbasic amastigophors, partly 16–20 × about 2.5 μ, basitrichs, those of the actinopharynx 18–22 × about 4 μ, probably microbasic *p*-mastigophors, partly 17–22 × about 2.5 μ, basitrichs, those of the filaments partly 11–15 × 4–4.5 μ, microbasic *p*-mastigophors, partly 8–12 × 4–4.5 μ, basitrichs, those of the acontia partly 24–31 × 3.5 μ, microbasic amastigophors, partly 22–23 × 2.5 μ, basitrichs. Owing to the irregularities of the arrangement of the mesenteries and siphonoglyphs the species probably propagates itself asexually.

Colour: Scapus grayish brown or grayish, scapulus orange-coloured, tentacles at the base orange, two white spots more or less transversally situated, sometimes joined at about the middle of the tentacles or a little nearer their bases, tentacles for the rest uncoloured, opaque, sometimes a little powdered with white, in contracted state their endoderm seems darker. Oral disc orange-coloured, especially at the insertions of the mesenteries. Actinopharynx pale orange. In smaller specimens the colour is often pale and the spots on the tentacles sometimes absent.

Fig. 73. *Andwakia parva.* Section of the scapus showing a tenaculum.

Dimensions: A small specimen, not exceeding 1 cm in length and 0.3 cm in breadth.

Occurrence: Sweden: Bohuslän, Väderöarne in the vicinity of the *Lophohelia*-reef at a depth of 60–70 m together with *Octineon suecicum* on shells and small stones, numerous specimens (CARLGREN and GUSTAFSSON 1932–39).

Exterior aspect: The species is cylindrical in the expanded state, when contracted hemisphaeric (Pl. IV fig. 7, Pl. VI fig. 7). The column is divisible into physa, scapus and scapulus. The physa is, however, seldom visible, as it is closely attached to the substratum on which the species lives, but when the animal releases itself from the substratum the basal part of the body forms a distinct physa which it uses for locomotion. The scapus is provided with a cuticle and numerous tenaculi of same structure as those of *Phellia gausapata.* To the tenaculi grains of sand are often fastened. The scapulus is rather short, the tentacles thin and rather short, in number never more than 24 (in 5 specimens I counted 19–22 (1:19, 3:20, 1:22), and arranged in two cycles. The oral disc is inconsiderable, the actinopharynx longitudinally sulcated. The siphonoglyphs are very little differentiated, in number two or one.

Anatomical description: The ectoderm of the scapus is rather high with a cuticle, which is very thick in the tenaculi. The tenaculi seem to be of the same appearance as in *Phellia gausapata*, although sometimes the chitinized cells, connecting the mesogloea with the cuticle, are few (fig. 73). The mesogloea of the tenaculi is thickened. The ectoderm of the scapulus is higher than in the scapus, the mesogloeal sphincter strong, mostly consisting of large muscle-meshes and wholly separated from the endodermal muscles of the column; more than half of the sphincter (fig. 74) is situated in the scapus. The ectodermal muscles of the tentacles are arranged like a palisade and very little ramified. The ectoderm of the actinopharynx is high, that of the indistinct siphonoglyphs has somewhat longer cilia than in other parts of the actinopharynx.

The mesenteries are more or less irregularly arranged. 6 specimens sectioned showed the following arrangement of the mesenteries: d: directive pairs, p: perfect mesenteries, i: imperfect mesenteries:

1. $\overset{dd}{pp}$, ii, pp, ii, pp, ii, $\overset{dd}{pp}$, ii, pp, ii = 20 mesenteries: 2 pairs of directives.
2. $\overset{dd}{pp}$, ii, pp, ii, pp, ii, $\overset{dd}{pp}$, ii, pp, ii, ii = 22 - : 2
3. $\overset{dd}{pp}$, ii, pp, ii, pp, ii, pp, ii, pp, ii = 20 : 1 pair -
4. $\overset{dd}{pp}$, ii, pp, ii, ii,, pp, ii, pp, ii, pp, ii, ii = 24 : 1 -
5. $\overset{dd}{pp}$, ii, pp, ii, ip, ii, pp, ii, pi, ii = 20 : 1 -
6. $\overset{dd}{pp}$, ii, pp, ii, pp, ii, pi, ii, ip, ii = 20 : 1 -

Fig. 74. *Andwakia parva.* Sphincter.

[illegible] (fig. 75) [illegible] part the [illegible] of the *pp* formed [illegible] side), *p m* [illegible] mesentery, *p* was

Fig. 75. [illegible] Transverse section of a perfect mesentery in the region of the cnidoglandular tract.

[illegible] partner, perhaps not perfect but provided with [illegible].

The [illegible] of mesenteries agrees with that of the tentacles. [illegible] seems not to develop mesenteries earlier in the [illegible] distal part. The retractors, present only on the [illegible] mesenteries, were concentrated with rather few, somewhat ramified folds (fig. 75). The parietal muscles of the perfect as well as of the imperfect mesenteries (fig. 76) are in their upper part more or less fan-like, in their lower part elongated in a radial direction, the muscles are here somewhat weaker on the side where the retractor is situated than on the opposite (fig. 77). The ciliated tracts of the filaments are well developed on the perfect mesenteries, the cnidoglandular tract is present also at least on several imperfect mesenteries which, however, had not ciliated tracts.

[illegible] of an imperfect mesentery [illegible] actinopharynx.

Fig. 77. *Andwakia parva.* Transverse section of a directive mesentery in its lower part.

The perfect and some of the imperfect mesenteries are provided with acontia. No sectioned specimen was fertile, but owing to the smallness of the imperfect mesenteries it is not likely that they develop generative organs. The species propagates probably asexually, as there are so many irregularities in the arrangement of the mesenteries. The specimens occur often together on shell-fragments or on small stones.

The nematocysts of the acontia I have examined in 4 specimens, their size showed good agreement. The microbasic amastigophors were 24–32, 27–31, 26–31 and 24–31 μ, the basitrichs 24–29, 26–29, 24–30 and 22–23 μ.

Family Octineonidae.

[illegible] and acontia, the latter [illegible] 1921 s. 132, 1931 p. 40) referred [illegible] Actinostolidae, with which it [illegible] I suggested, that in [illegible] as well as basitrichs in the acontia as I could at that time examine the acontia only in sections. As the following species had no amastigophors in the acontia I have now made a renewed examination of these organs in *O. lindahli* on material presented me 1934 by the British Museum. The maceration preparations of the acontia showed clearly that in this species also only basitrichs are present.

Genus **Octineon** Fowl.

Pedal disc flat, broad, body conical, the upper part often raised as a cylinder from the lower one, divisible into scapus and scapulus, the former with a cuticle, sometimes incrusted with grains of sand as also is the pedal disc. Ectoderm of the scapus showing tendency to reduction in certain places. Scapulus without spirocysts and cuticle. Sphincter mesogloeal. Tentacles few, hexamerously arranged, rather weak, considerably fewer than the mesenteries, capable of invagination. Siphonoglyphs indistinct. Only the 8 "Edwardsia"-mesenteries perfect, fertile, with filaments and acontia and circumscript retractors, the 5th and 6th couples, forming pairs with the lateral "Edwardsia"-mesenteries, stronger than those of the second cycle but of same appearance. Parietobasilar muscles broad but weak, their innermost part forming a shelf (always?) on the "Edwardsia"-mesenteries. Considerably more mesenteries in the proximal than in the distal part. Cnidom: spirocysts, basitrichs microbasic *p*-mastigophors.

Octineon suecicum Carlg.

Octineon suecicum n. sp. Carlgren 1910 p. 28, 59 figs. IX 14–16.

Diagnosis: Cuticle of the scapus strong, neither the scapus nor the pedal disc incrusted with sand. Sphincter mesogloeal with small muscle meshes, wholly separated from the endodermal circular muscles of the column. Tentacles small, up to 24. Pennons of the "Edwardsia"-mesenteries and the muscles of the 5th and 6th couples stronger than in *O. lindahli*. Relation between the number of mesenteries and that of the tentacles less than in this species (about 1:1). Nematocysts of the scapus 12–13 × about 3.5 μ, basitrichs, those of the tentacles 11–19 × almost 2–2 μ, often curved, basitrichs, those of the actinopharynx partly 17–23 × about 3.5 μ, microbasic *p*-mastigophors, partly 14–24 × almost 3 μ, basitrichs, those of the filaments partly 11–14 × 3–3.5 μ, microbasic *p*-mastigophors, partly 17–19 × (3.5) 4 μ, microbasic *p*-mastigophors, partly (8) 10–12.5 μ, basitrichs, those of the acontia partly 48–65 × 1.5–5.5 μ, partly 11–20 × 1.5–almost 2 μ, very sparse, both basitrichs. Spirocysts of tentacles about 12 × 2–24 × 2.5 μ.

Colour: Cuticle in older specimens brownish or dirty grey, the upper part of the scapulus provided with 6 opaque white, elongated spots, alternate with them on the lowest part of the scapulus three opaque-white longitudinal lines, especially visible when the animal is wholly expanded, sometimes more indistinctly arranged. Oral disc colourless or redbrown, tentacles uncoloured, sometimes with an indistinct cross-band in the middle, their base white or yellowish-white, actinopharynx brownish, shading into orange.

Dimensions: height up to 0.8 cm in half contracted state, pedal disc 0.9 × 0.6 cm.

Occurrence: Sweden, Bohuslän Väderöar in the vicinity of the Lophohelia-reef 60–70 m; on small stones or shells together with *Andwakia parva*.

Exterior aspect: The pedal disc is flattened and very wide. When wholly contracted the animal is almost disc-like, half contracted it forms a low conus, wholly or almost wholly expanded, the upper part rises as a cylinder from the strongly flattened, lower part. The body is divisible into scapus and scapulus, the former provided with a cuticle, which in older specimens is thick and in contracted state of the animal very wrinkled. The tentacles are thin and delicate and capable of invagination as those of *O. lindahli* and *Halcampoides*. In sections of contracted specimens some tentacles are often invaginated. Their number are about 24, at least in older specimens. The actinopharynx is of ordinary length, the siphonoglyphs are indistinct.

Anatomical description: The organization of this species agrees very well with that of *O. lindahli* (compare Fowler 1894, Carlgren 1921 p. 132–133, 1931 p. 40). The ectoderm of the scapus is mostly thin, but certainly present and provided with a cuticle. In certain places it is thicker than the mesogloea, and the nuclei of the cells and small nematocysts are clearly visible, in other places, also in the same section, not so distinct, as there seems to be a subcuticle above the reduced and possibly partly chitinized ectoderm cells. Possibly we have to do with an organization as in the tenaculi, but as the reduction of the ectoderm is distributed

Fig. 78. *Octineon suecicum*. Section of a part of the scapus showing the gland-cells in the transformed ectoderm.

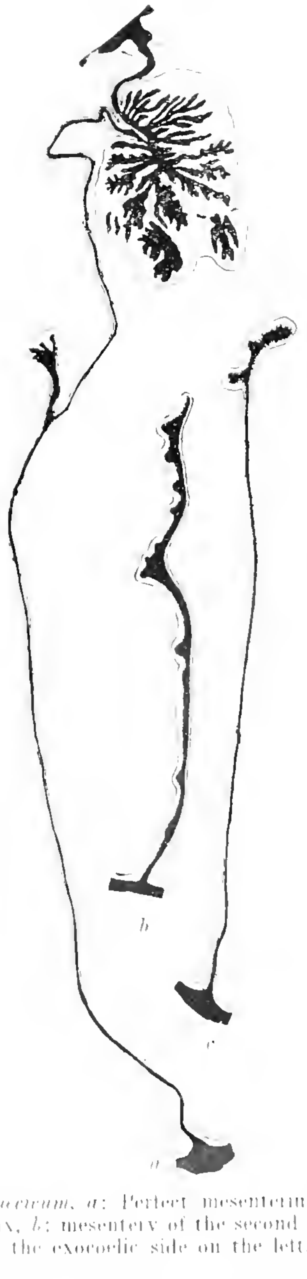

Fig. 79. *Octineon suecicum*. *a*: Perfect mesenterium in the lower part of the actinopharynx, *b*: mesentery of the second order, *c*: the same in its lower part; the exocoelic side on the left. Cross sections.

[illegible] papillae it is question- [illegible] provided with distinct tena- [illegible] as the ectoderm is often not [illegible] by the gland cells, which [illegible] layer (fig. 78). Such gland cells [illegible] and especially in the endoderm [illegible] form an almost continuous layer at [illegible]. Also in the endoderm of the mesenteries [illegible] similar manner. Probably we have to do [illegible] the gland cells of the mesogloea sometimes [illegible] cells. FOWLER, having not seen any ectoderm [illegible] (in opposition to myself), suggested [illegible] of mesogloea for the adhesion of the sand" [illegible] by wandering cells from the endoderm, [illegible] been able to detect their presence". Whether there [illegible] cells in *lindahli* I cannot confirm owing to [illegible] preservation of the specimens, but in *succicum* such [illegible] cells may be present.

[illegible] is mesogloeal and rather strong, its muscle meshes [illegible] separated from the circular muscles of the [illegible]. Whether the sphincter in the expanded state of the animal [illegible] extension as in *lindahli*, I have not been able to [illegible] as the mesogloea in the region of the sphincter was [illegible] owing to strong contraction. The ectoderm of the [illegible] tentacles and oral disc is of usual appearance, that of the actinopharynx, apart from that in the ridges, considerably [illegible] than the thin mesogloea.

[illegible] mesenteries are more numerous in the proximal than in [illegible] relation is about 1:1. [illegible] basal disc in one specimen. [illegible] are macrocnemes and [illegible] reproductive organs, all [illegible]. The folds of the retractors are more robust and more numerous, at least in older specimens (fig. 79 a) than those of *O. lindahli*, sometimes the pennons showed a tendency to be divided into two parts at the upper part of the actinopharynx, a tendency more conspicuous in other retractors than in that figured (fig. 80). Apart from the retractors the longitudinal muscles of the "Edwardsia"-mesenteries are missing or, if present, at any rate very weak; on the opposite side of the retractors the muscles are clearly visible, forming a distinct layer and terminating, at least sometimes, as a fold running out from the main lamella of the mesenteries. The description of FOWLER indicates that the muscles form folds in a similar manner in *O. lindahli*, but whether this fold is so deep, that it forms a distinct lamella is questionable, as the figures 11–17 Pl. 30 are difficult to interpret; an offshoot in the mesentery drawn in fig. 11 may possibly be a similar fold. A closer examination is desiderable. The imperfect mesenteries of the 5th and 6th couples, forming pairs with the lateral "Edwardsia"-mesenteries, have no distinct retractors but their free borders have rather numerous longitudinal muscle folds, stronger on the 5th couple than on the 6th (fig. 81). On the endocoel sides the muscles are missing or, at any rate, if present, very weak, on the opposite sides, however, clearly visible. Thus, the muscles corresponding to the parietobasilar muscles are here developed. The mesenteries of the second cycle (figs. 79 b, c) agree with those of the 5th and 6th couples but are weaker and show the same arrangement of the here weaker muscles. The ciliated tracts of the filaments are well developed. One of the specimens examined was fertile and had ovaries, enclosing small ova, in the perfect mesenteries.


[illegible] of a retractor of a perfect [illegible] of the actinopharynx.


Fig. 81. *Octineon succicum*. Inner part of the sixth couple of mesenteries.

I have measured the numerous basitrichs in the acontia in 4 specimens. They were 48–60 × 5 μ, 50–60 × 5 μ, 53–58 × 5 μ and 52–65 × 5 μ. Moreover there occur in the acontia also small but few nematocysts about 14–20 × 1.5 μ, basitrichs. The cnidae of the tentacles and actinopharynx I have examined in 2 specimens.

The size of the cnidae in *O. lindahli* agrees very well with those in *succicum*. In maceration preparations of *lindahli* I have found the following measures of the cnidae: tentacles: basitrichs 14–18 × 1.5–2 μ; acontia; basitrichs unexploded 50–57 × 5 μ, exploded 48–58 × 5 μ, moreover smaller basitrichs 17–19 × 2 μ, very sparse; spirocysts of the tentacles about 12 × 2.5–21 × 5 μ.

Family Actiniidae.

Genus Anemonia.

Actiniidae with well developed pedal disc. Column smooth, provided with marginal sphaerules on the parapet (not in the fossa as in *Actinia*), sometimes miscarried or absent in young individuals. Sphincter endodermal, concentrated or extended, diffuse. Tentacles long, sometimes not perfectly retractile, considerably fewer than the mesenteries at the base; longitudinal muscles of tentacles ectodermal. Siphonoglyphs in varying number. Perfect mesenteries numerous. Gonads appearing from the mesenteries of the first cycle onwards. Cnidom: Spirocysts, atrichs, basitrichs, microbasic *p*-mastigophors (and sometimes holotrichs?).

Anemonia sulcata (Pennant).

Literature and synonyms see Andres 1883 and Stephenson 1935, also: *Anemonia sulcata* Penn. Weill 1934 p. 567 figs. 375, 376.

Diagnosis: Tentacles long, almost of same length as the column when expanded, in number up to about 200 in large individuals, often irregularly arranged owing to asexual reproduction by longitudinal fission. Marginal sphaerules, when present, in varying number. Sphincter concentrated or more extended, diffuse. Arrangement of mesenteries often irregular. Number of mesenteries at the base up to about 250 (or more?). Retractors of mesenteries extended, diffuse, parietobasilar muscles weak. Endoderm provided with zooxanthellae. Nematocysts of the column partly 14–17 × 2.5–3 μ, basitrichs, partly 24–27 × about 5 μ, holotrichs?, sparse, those of the marginal sphaerules partly 29.6–39 × 3–4.2 μ (45–55 × 4–5 μ), those of the tentacles 17–34 × (40) × 2–3 (5) μ, basitrichs, those of the actinopharynx partly 27–32.5 × 3–3.5 μ (up to 70 × 10 μ? Weill 1934) basitrichs, partly 21–22.6 × about 4.2 μ few, microbasic *p*-mastigophors, those of the filaments partly 26–35.2 × 4.2–almost 5 μ, partly 18.3–21 × 2 μ, both probably basitrichs, partly 18.3–24 × 3.5–4.5 (5) μ, microbasic *p*-mastigophors. Spirocysts of tentacles up to about 39 × 3 μ.

Colour of the present specimens according to Dons: Column greyish brown, tentacles emerald green.

Size of one of the largest individuals: breadth of the very contracted pedal disc 0.7–1.2 cm, that of the expanded oral disc 1.3 cm, length of inner tentacles about 1 cm.

Occurrence: Norway, Espeland in the vicinity of Bergen on algae (Dons 1936) several specimens.

Further distribution: South and west coasts of England, west coast of Scotland, Ireland, France, Spain, the Mediterranean, Madeira, Canaries.

The information of the size of the nematocysts and spirocysts in the diagnosis is based on an examination of an individual of medium size from the Canary islands. In brackets I have given the measures which Weill (1934) has noted and which more essentially differ from mine. I am very sceptical that the basitrichs can reach a size of 70 × 10 μ in the actinopharynx. This may be a mistake of Weill who did not note the large basitrichs in the filaments. Weill (1934) has drawn a figure (376 p. 568) of a nematocyst in size about 27.5 μ. Although he has not seen this nematocyst in an exploded state he thinks that it may be an atrich. I have found several such in my individuals, but the thread of the capsules showed sometimes a more regularly arrangement about as in the textfigure 4 d of *Arachnanthus australiae* (Carlgren 1937) though the spirals were fewer (9 in one specimen). To my mind it is very questionable if these nematocysts are atrichs. They recall very much some holotrichs in the Ceriantharia and the holotrichs in *Diadumene* (Carlgren 1940 p. 38 fig. 17). The wall of the capsules seem to be very thin, the thread thick and, as far I can see — unfortunately no capsules were exploded — armed or at any rate not smooth. Possibly one could suggest that the thread was very compressed and does not become its definite length ere it explodes. Such a presumption is, however, hardly plausible, as I have never found atrichs the thread of which is compressed in such a way in the capsules, and the thread of the atrichs is thin. For my part I must at present characterize these nematocysts as holotrichs, though an examination of the thread in an exploded state is desirable in order to definitively decide the nature of these capsules. In the diagnosis of the genus and species I have used the term concentrated diffuse instead of circumscript-diffuse because this term seems to me better to answer to the appearance (see Stephenson 1928 fig. 1 e). When we speak of a circumscript-diffuse sphincter a part of it may be circumscript.

The pedal disc and the lower part of the body were fairly strongly contracted in the present specimens, the upper part of the body was expanded, with longitudinal furrows corresponding to the insertions of the mesenteries. No marginal sphaerules were developed. The sphincter was, in one specimen examined, concentrated diffuse. The largest specimen had 84 tentacles but between 130–140 mesenteries at the base. Of 4 specimens examined 2 had 2 siphonoglyphs, 2 only one. There were many perfect mesenteries. The nematocysts agree rather well in their size with those of the specimen from the Canary Islands. The basitrichs of the column were 12.7–15.5 × 2.5–2.8 μ, the holotrichs? 24–27 × about 5 μ, the basitrichs of the tentacles 21–30.5 × about 3 μ, the basitrichs of the actinopharynx 27–34 × 3.5–4.2 μ, the microbasic *p*-mastigophors 21–24 × 4.2 μ, the larger basitrichs of the filaments 28.2–35.2 × 4.2–5 μ, the microbasic *p*-mastigophors 18.3–22.6 × 4.2–5 μ.

For further details see Simon (1892), Schneider (1902, 1908), Pax (1907) and Stephenson (1935).

Family Actinostolidae.

Parasicyonis ingolfi n. sp.

Diagnosis: Body low. Sphincter very strong, reticular to alveolar in the outer and upper parts, with traces of stratification. Tentacles 72, probably arranged 6 + 12 + 18 + 36. About half of the oral disc devoid of tentacles. Arrangement of the mesenteries probably 6 + 12 + 18 + 36 = 72 pairs, 2 pairs of directives. The 36 first pairs with rather well developed diffuse retractors in the upper part of the body. Parietobasilar muscles weak. Nematocysts of the column 17–21 × 2.5–2.8 μ, basitrichs, those of the tentacles 22–34 × 2.5–2.8 μ, basitrichs, those of the actinopharynx partly 25.8–28.2 × 4.2 μ, microbasic *p*-mastigophors, partly 23.3–28.2 × 2.8–3.2 μ, basitrichs, those of the filaments partly (18.3) 24–28.2 × (4.2) 4.5–5 μ, microbasic *p*-mastigophors, partly 12.7–21.8 × 2.4–2.8 μ, basitrichs. Spirocysts of tentacles up to 48 × about 4 μ.

Colour in alcohol: yellowish with large dark brown spots of indeciduous ectoderm. Tentacles and actinopharynx paler than the column but pigmented.

Dimensions: Breadth 2.8 cm. Length of the column about 1.8 cm, height of the strongly contracted specimen about 0.5 cm.

[illegible] N. [illegible] W. 115 [illegible]

[illegible] section of a part of a tentacle.

[illegible] The [illegible] specimen was very contracted, [illegible] a part of the actinopharynx [illegible] were conspicuous. In this stage [illegible] developed and provided with a cuticle, [illegible] distinct tubercles but with irregular [illegible] between these flattened thickenings, [illegible] The distal, involved part is longi- [illegible] the margin is not distinct, owing to [illegible] it is difficult to decide the [illegible] I see, the ridges of the uppermost [illegible] outer tentacles without definite [illegible] of the basal outer sides of the [illegible] but broad, irregularly wrinkled, [illegible] together from the sides and not

[illegible] outer [illegible] half as [illegible] arranged [illegible] it seems as if there were only two cycles of tentacles. About the inner half of the oral disc is devoid of tentacles. The actinopharynx is of ordinary length and provided with 2 siphonoglyphs.

Anatomical description. Owing to the strong contraction of the specimen and the bad preservation I cannot give a detailed description of the anatomy.

The ectoderm of the pedal disc is of ordinary thickness and pigmented, its cuticle strong. The mesogloea is thin in comparison with that of the column, but thicker than the ectoderm, and fibrillar. The ectoderm of the column is pigmented, without a cuticle and rather high but many times thinner than the mesogloea. The mesogloea is thick, especially in the sphincter region, the fibrillae are extended in the inner parts of the mesogloea, in the outer they cross each other, so that a basket work of fibrillae arises. The endodermal circular muscles of the column are weak, on the other hand the sphincter is strong and very broad, but diminishing rather abruptly, mainly reticular with the meshes drawn out in a radial direction. In its upper and outer parts the sphincter shows a tendency to be alveolar and stratified (fig. 83).

The ectoderm of the tentacles is high and very folded, as also the mesogloea. The longitudinal muscles are strong and mesogloeal, the large muscle meshes often drawn out in a radial direction (fig. 82). The radial muscles of the oral disc agree with the longitudinal muscles of the tentacles.

The pairs of mesenteries are probably 72 (6 + 12 + 18 + 36 = 72), the last 36 of which are present only in the proximal part of the body, the other mesenteries reach the distal end. In about

Fig. 84. *Paranthopsis ingolfi*. Section of a mesentery in the region of the endoglandular tract.

the half of the animal there were 18 perfect mesenteries. Thus, I think that 6 + 12 18 pairs are perfect in the whole specimen. Of these two pairs are directives. Possibly irregularities of the arrangement of the youngest mesenteries may occur, but owing to the bad preservation of the mesenteries it is very difficult to decide it. The longitudinal muscles of the 36 first pairs are rather well developed and form broad, diffuse retractors which, in some places, especially in the upper part of the body, are rather high (fig. 84). The muscles of the 36 other pairs are weak. The parietobasilar muscles are weak, at least in their upper part, and not situated on a fold of the mesogloea. In the lower part of some mesenteries there are muscle meshes enclosed in the mesogloea. Possibly these enclosures indicate parts of the parietobasilar muscles, but as they lie closer to the longitudinal muscles I am more inclined to suppose that they belong to these. The basilar muscles are distinct but not strong. Only the 36 youngest pairs of mesenteries are fertile and provided with large ova. All mesenteries are provided with filaments.

II. Distribution of the species.

In some previous papers I have given a survey of the Actiniaria from West Greenland and adjacent areas (1933), from East Greenland (1928), from Iceland (1939) and from the Faroe Islands (1930). These reports are here brought near to completion. I now account for all the material of the Actiniaria as well as of the Ceriantharia and Zoantharia (the two latter in brackets) which I have examined from the Ingolf expedition and from northern and arctic regions. We begin with the enumeration of the species from the westernmost waters.

West and Northwest Greenland, Davis Strait and Baffin Bay: *Actinernus nobilis, Edwardsia andresi, Halcampoides purpurea, Aethelmis intestinalis, Peachia parasitica, Halcampa arctica, Cactosoma abyssorum, Haliactis arctica, Liponema multicornis, Bolocera tuediae, Bolocera maxima, Bunodactis stella, Bunodactis spetsbergensis, Cribrinopsis similis, Tealia felina crassicornis, Epiactis nordmanni, Anthosactis jan mayeni, Tealidium jungerseni, Pycnanthus laevis, Sicyonis tuberculata, Sicyonis ingolfi* (S. of Greenland), *Parasicyonis groenlandica, Actinostola callosa, Actinostola groenlandica, Actinostola spetsbergensis, Stomphia coccinea, Kadosactis rosea, Chondrophellia coronata, Phelliactis hertwigi, Phelliactis robusta, Actinauge verrillii, Allantactis parasitica, Hormathia nodosa, Hormathia digitata, Metridium senile dianthus, Stephanauge acanellae, Amphianthus margaritaceus, Amphianthus verruculatus,* (*Siphonactinopsis laevis?*): in all 38 (*39?*) species.

To these is to be added the unidentified *Actinia? spectabilis* Fabr.

(*Cerianthus* sp.? (*lloydii?* see below) *Isozoanthus bulbosus, Isozoanthus davisi, Isozoanthus ingolfi, Epizoanthus lindahli, Epizoanthus erdmanni, Epizoanthus danielseni, Epizoanthus glacialis*; in all 8 species.)

As to the distribution of the species in the different areas see Carlgren (1933).

East Greenland and Danmark Strait: East Greenland, *Edwardsia vitrea, Edwardsia arctica, Edwardsia incerta, Nematostella* (*Milne-Edwardsia*) *polaris, Nematostella nathorsti, Halcampoides purpurea, Bunodactis stella, Tealia felina crassicornis, Anthosactis jan mayeni, Hormathia nodosa, Allantactis parasitica,* Danmark Strait, northern, arctic part: *Parasicyonis ingolfi*, southern atlantic part: *Tealidium jungerseni, Sicyonis tuberculata, Daontesia praelonga, Sagartiogeton verrilli, Sagartiogeton ingolfi, Chondrophellia coronata, Phelliactis robusta, Phelliactis hertwigi, Paraphelliactis spinosa,* in all *21* species. Probably some more species are present in the waters of the not closely examined south-east coast.

(*Cerianthus* sp.? — *Isozoanthus bulbosus, Isozoanthus arborescens, Isozoanthus magninsulosus, Isozoanthus islandicus, Epizoanthus lindahli, Epizoanthus erdmanni*; in all 7 species.)

Iceland, costal area: *Ptychodactis patula, Edwardsia tuberculata, Edwardsia andresi, Edwardsia islandica, Nematostella polaris, Limnactinia laevis, Halcampoides purpurea, Halcampa arctica, Bolocera tuediae, Bunodactis stella, Cribrinopsis similis, Tealia felina crassicornis, Parasicyonis sarsi, Actinostola spetsbergensis, Stomphia coccinea, Sagartia troglodytes, Sagartia elegans, Phellia gausapata, Hormathia digitata, Hormathia nodosa, Allantactis parasitica, Actinauge verrillii, Amphianthus islandicus, Metridium senile dianthus*; in all *24* species.

(*Isozoanthus multinsulosus, Isozoanthus altisulcatus, Parazoanthus anguicomus, Epizoanthus erdmanni, Epizoanthus incrustatus*; in all *5* species).

Atlantic abyssal area S.W. to S.E. of Iceland: *Isoedwardsia ingolfi, Bolocera tuediae, Epiparactis dubia, Sicyonis variabilis, Actinostola callosa, Daontesia praelonga, Sagartiogeton abyssorum, Chondrophellia coronata, Phelliactis hertwigi, Phelliactis robusta, Stephanauge acanellae, Amphianthus ingolfi, Amphianthus verruculatus*; in all *13* species.

(*Isozoanthus arborescens, Epizoanthus paguriphilus*; in all 2 species.)

The area between Iceland and the Faroe Islands: *Halcampa arctica, Cribrinopsis similis, Hormathia digitata, Hormathia nodosa*; in all *4* species.

The Faroes, coastal area: *Edwardsia tuberculata, Edwardsia danica, Actinia equina, Bolocera tuediae, Cribrinopsis similis, Tealia felina coriacea, Stomphia coccinea, Sagartia troglodytes, Hormathia digitata, Hormathia nodosa, Metridium senile dianthus*; in all *11* species.

(*Parazoanthus haddoni, Epizoanthus incrustatus*, in all 2 species.)

Cold deep basin of the Norwegian Sea: *Bathyphellia margaritacea, Kadosactis rosea, Amphianthus margaritaceus*. To this area probably belong also *Anthosactis ingolfi, Parasicyonis ingolfi* and *Kodiodes pedunculata*[1] taken at depths between about 1370 and 2000 m, each in a single locality. In all 3 species.

The boundary at the area between and - temperatures in the Norvegian Sea: *Edwardsia vitrea, Halcampoides purpurea, Cactosoma abyssorum, Bunodactis spetsbergensis, Cribrinopsis similis, Epiactis arctica, Pycnanthus densus, Actinostola spetsbergensis*; in all 8 species. All localities, apart from that of *Cactosoma*, which was taken at as well as - the temperatures were below zero ( ).

(*Cerianthus vogti* (new locality: 63 26′ N 7 56′ W., 471 fms, bottom temp. ÷ 0.69, Ingolf exp. St. 138). — *Epizoanthus roseus, Epizoanthus glacialis; Epizoanthus koreni* ( ) in all *4* species).

West Spitzbergen: *Edwardsia vitrea, Nematostella polaris, Halcampa arctica, Bunodactis stella, Cribrinopsis similis, Tealia felina crassicornis, Actinostola spetsbergensis, Stomphia coccinea, Stomphia polaris, Kadosactis* (?) *spetsbergensis, Allantactis parasitica, Hormathia digitata, Hormathia nodosa*; in all *13* species.

(*Cerianthus* sp.? (*roulei*) — *Epizoanthus erdmanni*; in all 2 species.)

East Spitzbergen: *Edwardsia vitrea, Nematostella polaris, Nematostella nathorsti, Halcampa arctica, Haliactis arctica, Bunodactis stella, Bunodactis spetsbergensis, Cribrinopsis similis, Tealia felina crassicornis, Actinostola spetsbergensis, Stomphia coccinea, Stomphia polaris, Allantactis parasitica, Hormathia digitata?, Hormathia nodosa*; in all *14* (15?) species.

(*Cerianthus* sp.?; *Epizoanthus erdmanni*; in all 2 species.)

The area between Spitzbergen and Norway: *Edwardsia*

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[1] I have examined the type, but as it was badly preserved and only part of it remains, it was impossible to clear up its systematic place. The sphincter was mesogloeal and very strong, occupying almost the whole breadth of the mesogloea, its muscle meshes very large.

[illegible] *Haliactis arctica*, [illegible] *Hormathia* [illegible] *12* species.

[illegible] var. *borea*, [illegible] species.)

[illegible] *Ptychodactis patula*, [illegible] *Edwardsia andresi* (at [illegible] *Halcampa duodecim-*[illegible] *Bolocera tuediae*, *Bunodactis* [illegible] *Cribrinopsis similis*, *Tealia* [illegible] *Parasicyonis sarsii*, [illegible] *Amphianthus* [illegible] *21* species.

[illegible] *Epizoanthus lindahli* var. *nordgaardi*, [illegible] *Epizoanthus danielsseni* var. *borea*, *Epi*[illegible] 8 species.

[illegible] Lindesnes: *Ptychodactis patula*, *Se*[illegible] *Protanthea simplex*, *Gonactinia prolifera*, *Edward*[illegible] *Edwardsia costata*, *Isoedward*[illegible] *Paraedwardsia arenaria*, *Para*[illegible] *purpurea*, *Peachia boeckii*, [illegible] *Halcampa duodecimcirrata*, *Andvakia mira* [illegible] *Bolocera tuediae*, *Tealia* [illegible] and *tuberculata*, *Parasicyonis sarsii*, [illegible] *Actinostola callosa*, *Actinostola abyssorum*, *Sa*[illegible] *Sagartia elegans*, *Kadosactis abyssicola*, *Sagartio*[illegible] *Sagartiogeton laceratus*, [illegible] *Phellia gausapata*, [illegible] *Actinauge richardi*, *Amphian*[illegible] *Metridium senile dianthus*, in all 38 species. To [illegible] the uninvestigated *Actinopsis flava*, Kor. & Dan., [illegible] see comments CARLGREN 1921 p. 71) and [illegible] Forb. are to be added. As to *Actinopsis flava* I [illegible] pointed out that this species possibly is identical [illegible] *Protanthea simplex* (CARLGREN 1928 p. 150). Moreover I think [illegible] *Actinia rosula*, which, according to EHRENBERG, lives [illegible] same species as *Protanthea*. Nothing in the short [illegible] contradicts such a supposition. The right name of this [illegible] then be *Protanthea* (eventually *Actinopsis*) *rosula* [illegible]

[illegible] *Pachycerianthus multiplicatus*, *Arachnactis* [illegible] *Parazoan*-[illegible] *Epizoanthus incrustatus*, *Epizoanthus norvegicus* in [illegible]

[illegible] Hanstholm, Lindesnes to Skagen Paternoster light-[illegible] *Protanthea simplex*, *Gonactinia prolifera*, *Edwardsia andresi*, [illegible] *Edwardsia longicornis*, *Edwardsia pallida*, [illegible] *Fagesia carnea*, *Paraedwardsia arenaria*, *Halcam*-[illegible] *Halcampa duodecimcirrata*, [illegible] *Anemonactis mazeli*, *Andvakia parva*, *Octineon* [illegible] *Tealia felina* var. *coriacea* and *lofotensis*, [illegible] *Actinostola callosa*, *Kadosactis abyssicola*, *Sagar*-[illegible] *Sagartiogeton undatus* and var. [illegible] *Sagartiogeton laceratus*, *Hor*-[illegible] *Metridium senile dianthus*, in all 28 species.

[illegible] *Pachycerianthus multiplicatus* [illegible] *Epizoan*-[illegible] *norvegicus*; in all *4* species.)

[illegible] *prolifera*, *Edwardsia longicornis*, *Ed*-[illegible] *Fagesia carnea*, *Halcam*-[illegible] *Anemonactis mazeli*, *Bolocera* [illegible] *lofotensis*, *Stomphia coccinea*, [illegible] *Sagartiogeton undatus*, *Sa*-[illegible] *Hormathia digitata*, [illegible] species.

[illegible] *multiplicatus* [illegible] *Isozoan*-[illegible]

thus danicus (only in Limfjord. MORTENSEN notes (1897) also *Zoanthus?* *sulcatus* from Limfjord, possibly identical with *danicus*.) In all *5* species.)

The Sound from Gilbjerg Hoved-Kullen: *Edwardsia longicornis*, *Edwardsia danica*, *Halcampa duodecimcirrata*, *Bolocera tuediae*, *Tealia felina coriacea*, *Stomphia coccinea*, *Sagartia troglodytes*, *Sagartia elegans*, *Sagartiogeton undatus*, *Sagartiogeton laceratus*, *Hormathia digitata*, *Metridium senile dianthus*, in all *12* species.

Great Belt: *Edwardsia danica*, *Halcampa duodecimcirrata*, *Tealia felina coriacea*, *Sagartiogeton undatus*, *Stomphia coccinea*, *Metridium senile dianthus*: in all *6* species. Probably some more species may be present here.

Little Belt: *Edwardsia danica*, *Halcampa duodecimcirrata*, *Tealia felina coriacea*, *Sagartia troglodytes?*, *Sagartiogeton undatus*, *Metridium senile dianthus*; in all *5* (*6?*) species.

Kiel Bay: *Edwardsia danica*, *Halcampa duodecimcirrata*, *Tealia felina coriacea*, *Metridium senile dianthus* and probably *Sagartiogeton undatus* in all *4* (*5*) species.

Lübeck Bay: *Edwardsia danica*, *Halcampa duodecimcirrata*, *Tealia felina*; in all *3* species.

Mecklenburger Bay: *Edwardsia danica*, *Halcampa duodecimcirrata*; in all *2* species.

Arcona Basin and Bornholm to about 16° E.: *Halcampa duodecimcirrata*. (*Tealia felina lofotensis*[1])? S. of Bornholm): *1* (*2?*) species.

Coast of Murman: *Edwardsia fusca*, *Actinia equina*, *Bunodactis stella*, *Cribrinopsis similis*, *Tealia felina crassicornis*, *Actinostola spetsbergensis*, *Stomphia coccinea*, *Allantactis parasitica*, *Hormathia digitata*, *Hormathia nodosa*, *Metridium senile dianthus* and var. *margaritopensis*; in all *11* species.

(*Cerianthus*, probably *lloydii*, *Arachnactis albida* — *Epizoanthus erdmanni*; in all *3* species).

Franz Joseph Land: *Edwardsia arctica*, *Halcampa arctica*, *Bunodactis spetsbergensis*, *Tealia felina crassicornis*, *Stomphia coccinea*, *Hormathia nodosa*; in all *6* species.

The White Sea and Barents Sea: *Nematostella polaris* (new localities: 65°36′ N. 19°0.2′18″ E. 65°13′12″ N. 37°15′ E.), *Halcampa arctica*, *Haliactis arctica*, *Actinostola spetsbergensis*, *Allantactis parasitica*, *Hormathia digitata*, *Hormathia nodosa*; in all *7* species.

(*Epizoanthus lindahli*.)

Kara Sea: *Edwardsia arctica*, *Bunodactis stella*, *Tealia felina crassicornis*, *Anthosactis jan mayeni*, *Actinostola spetsbergensis*, *Allantactis parasitica*, *Hormathia digitata* var. *regae?*, in all *7*. species.

Siberian Sea, Cape Tscheljuskin to Cape Onman: *Haliactis arctica*, *Bunodactis stella*, *Epiactis marsupialis*, *Epiactis incerta*, *Anthosactis jan mayeni*, *Actinostola spetsbergensis*, *Allantactis parasitica*, *Hormathia digitata* var. *regae*, *Hormathia nodosa*; in all *9* species.

Bering Strait, Cape Lisburn-Cape Onman to Cape Chaplin-Norton Sound: *Ptychodactis patula*, *Edwardsia regae*, *Haliactis arctica*, *Bunodactis stella*, *Bunodactis spetsbergensis*, *Tealia felina crassicornis*, *Epiactis marsupialis*, *Epiactis lewisi*, *Epiactis arctica* (N. of Bering Str.), *Actinostola spetsbergensis*, *Stomphia coccinea*; in all *11* species.

Bering Sea, Bering Strait to Aleutean Isl.-Bering Isl.: *Halcampoides purpurea*, *Peachia parasitica*, *Halcampa? regae*, *Charisea saxicola*, *Liponema multicornis*, *Bunodactis stella*, *Cnidopus ritteri*, *Anthopleura xanthogrammica*, *Cribrinopsis similis*, *Tealia felina crassicornis* and var. *coriacea*, *Actinostola spetsbergensis*, *Stomphia coccinea*, *Metridium senile fimbriatum*; in all *13* species.

Since the Actiniaria dealt with here include not only those of the Ingolf expedition but also those taken by several other expeditions from arctic, boreal and North Atlantic regions it is clear that their zoogeographical character is very different. I have below made an attempt to classify them though, of course, the zoogeographical classification is dubious for several species.

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[1] The locality seems to me somewhat dubious. Possibly a confounding of labels has taken place.

Especially this is the case when a species has been taken in a single locality or in two localities one of which showed a negative temperature the other a positive one. In brackets I have also included the Ceriantharia and Zoantharia as I have previously given a zoogeographical survey of only a few species of these orders.

Atlantic abyssal species: *Actinernus nobilis, Isoedwardsia ingolfi, Bolocera maxima, Tealidium jungerseni, Epiparactis dubia, Pycnanthus laevis, Parasicyonis groenlandica, Sicyonis tuberculata, Sicyonis ingolfi, Sicyonis variabilis, Daontesia praelonga, Sagartiogeton abyssorum, Sagartiogeton ingolfi, Chondrophellia coronata, Phelliactis hertwigi, Phelliactis robusta, Paraphelliactis spinosa, Stephanauge axinellae, Amphianthus ingolfi, Amphianthus verruculatus.*

(*Isozoanthus islandicus, Isozoanthus dubius, Isozoanthus multinsulosus, Epizoanthus abyssorum, Epizoanthus paguriphilus.*)

Boreal species: *Protanthea simplex, Edwardsia tuberculata, Edwardsia longicornis, Edwardsia pallida, Edwardsia danica, Edwardsia islandica, Edwardsia finmarchica, Edwardsia norvegica, Edwardsia loveni?, Edwardsia costata, Isoedwardsia nidarosiensis, Fagesia (Milne-Edwardsia) loveni, Fagesia carnea, Paraedwardsia arenaria, Paraedwardsia sarsi, Limnactinia laevis, Peachia boeckii, Halcampa duodecimcirrata, Andwakia mirabilis, Andwakia parva, Octineon suecicum, Tealia felina* varieties *coriacea, tuberculata* and *lofotensis, Parasicyonis sarsi, Actinostola abyssorum, Kadosactis abyssicola, Sagartiogeton robustus, Sagartiogeton flexibilis, Sagartiogeton undatus* with its variety *anguicomus, Sagartiogeton lacerатus, Sagartiogeton viduatus, Sagartiogeton tubicolus, Phellia gausapata* (*Stephanauge nexilis, Actinauge longicornis?*) *Amphianthus norvegicus, Amphianthus mopseae, Amphianthus islandicus.*

(*Cerianthus lloydii Pachycerianthus multiplicatus, Arachnanthus sarsi, Botruanthus norvegicus, Isozoanthus altisulcatus, Isozoanthus danicus, Isozoanthus multinsulosus, Isozoanthus arborescens, Parazoanthus anguicomus, Parazoanthus haddoni, Epizoanthus norvegicus, Epizoanthus loveni?*).

Boreal-atlantic species: *Bolocera tuediae, Actinostola callosa, Actinauge richardi* (east-atlantic species).

Boreal-west-atlantic species: *Sagartiogeton verrilli.*

Boreal-lusitanic-mediterranean species (not abyssal): *Gonactinia prolifera, Peachia hastata, Anemonactis (Eloactis) mazelii, Actinia equina, Anemonia sulcata, Sagartia troglodytes, Sagartia elegans, Adamsia palliata.*

(*Epizoanthus incrustatus.*)

Low-arctic-boreal species: *Edwardsia andresi, Metridium senile.*

Arctic-boreal species: *Ptychodactis patula, Sideractis glacialis, Actinauge verrilli, Hormathia nodosa, Hormathia digitata.*

(*Cerianthus lloydii?* possibly only boreal; the specimens from arctic regions were so badly preserved that an examination of better material is necessary in order to decide their identity with *lloydii*; *Isozoanthus ingolfi?, Epizoanthus glacialis*).

Low-arctic species: *Cactosoma abyssorum, Liponema multicornis, Pycnanthus densus?*

(*Epizoanthus erdmanni, Epizoanthus danielsseni*).

Arctic, strongly marked abyssal species: *Anthosactis ingolfi, Parasicyonis ingolfi, Bathyphellia margaritacea, Kadosactis rosea, Amphianthus margaritaceus*[1]), *Kodioides pedunculata.* (*Cerianthus vogti, Cerianthus roulei? — Isozoanthus bulbosus*[2]), *Epizoanthus roseus*).

Arctic, not, or usually not, abyssal species: *Edwardsia arctica* (also abyssal see below), *Edwardsia vegae, Edwardsia vitrea, Nematostella (Milne-Edwardsia) polaris, Nematostella nathorsti* (taken also in the abyssal region), *Aethelmus intestinalis, Peachia parasitica, Halcampa arctica, Halcampa? vegae, Epiactis arctica, Epiactis nordmanni, Epiactis marsupialis, Epiactis incerta, Epiactis lewisi, Actinostola groenlandica, Stomphia polaris, Kadosactis spitsbergensis.*

(*Cerianthus danielsseni* Roule, *Epizoanthus lindahli*)

Panarctic species: *Haliactis arctica, Bunodactis stella, Tealia felina crassicornis, Cribrinopsis similis, Bunodactis spetsbergensis, Anthosactis jan mayeni, Actinostola spetsbergensis, Stomphia coccinea, Allantactis parasitica.*

Cosmopolitan species: *Halcampoides purpurea.*

It is not my intention to discuss in detail the distribution of each species here. In the maps given by me in 1933 and in this paper (figs. 85–95) of the distribution of several species we find species showing a westerly distribution as *Actinauge verrilli* as well as an easterly one as *Hormathia digitata.* Of some interest are, however, some of the panarctic species as those living in Bering Strait and southwards. Although the Actinian fauna of Bering Strait and the northern Pacific Ocean is slightly explored I think, however, that we can draw some conclusions when comparing this fauna with that of the North Atlantic. Of the species occurring in Bering Strait or in Bering Sea or in both, some, *Cnidopus ritteri, Charisea saxicola* and *Anthopleura xanthogrammica*, belong to the North Pacific fauna, some others are in common with those in the North Atlantic, one, *Metridium senile fimbriatum*, has its corresponding variety in the boreal atlantic *Metridium senile dianthus*, three species, two of them *Epiactis lewisi* and *Edwardsia vegae*, dredged in Bering Strait, the third, *Halcampa? vegae*, taken in Bering Sea are known each from only a single locality. The panarctic species, *Haliactis arctica, Tealia felina crassicornis, Actinostola spetsbergensis* and *Stomphia coccinea*, occur in Bering Strait as well as in Bering Sea, *Bunodactis spetsbergensis* only in the former, *Cribrinopsis similis* only in the latter (it is, however, possible that the specimens, being very badly preserved, belonged to the nearly related north-american *C. williamsi*). *Anthosactis jan mayeni* and *Allantactis parasitica* in their distribution (see CARLGREN 1933 figs. 7, 16) have not reached Bering Strait, though it is possible that they occur northward of it in colder water. To the panarctic species seem to belong also *Ptychodactis patula* and *Liponema multicornis*, the former taken in Bering Strait, the latter in Bering Sea, though they are dredged in few localities. The nature of *Epiactis arctica* found only in two localities, the one north of Bering Strait, the other in the North Atlantic but in + temperature, is somewhat dubious as to its zoogeographical character. It is interesting that the boreal *Tealia felina coriacea* (or possibly *tuberculata*) occurs in Bering Sea giving support to my opinion that *crassicornis* is the mother form from which the varieties of *Tealia* provided with verrucae have originated. Very interesting also is the fact that the high-arctic abyssal *Amphianthus margaritaceus* and the higharctic *Edwardsia arctica* occur in the North Pacific, the former in the Sea of Ochotsk at about a depth of 3500 m and at a bottom temperature of −1.82° (locality 46° 11'5 N, 147° 28' E.), the latter in the Sea of Japan at depth of 2300 m and at a bottom temperature of −0.18° (locality 41° 38'5 N, 132° 08' E.). How do we explain this distribution? As far I can see there is no other possibility than that the named species are relicts from the period in the earth development when the waters between N. America and Asia were considerably deeper than now. The presence of *Ptychodactis, Liponema* and *Tealia felina coriacea* in the Bering Strait or in the Bering Sea indicate that these waters do not have a high arctic character. But more investigations of the waters from Bering Strait southward are necessary before we can hope to solve all zoogeographical problems concerning these waters. It is not excluded that we shall meet more surprises than those BROCH found (Oktokorallen des nördlichsten Pacifischen Ocean. Norsk Vid. Akad. Oslo 1935) when he found several boreal species of Octocorallia in the Sea of Ochotsk.

At the end I give figures (figs. 85–95) of the distribution of some species. As to the distribution of some other species see my paper of 1933.

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[1]) See below.

[2]) As to the distribution of this species and the comments on it see CARLGREN 1933 fig. 7 and p. 44 and 46. Because *Daontesia* has apparently transgressed the banks between Iceland and Faroe Islands — it occurs on the atlantic side in + temperatures as well as on the border to the Norwegian Sea in − temperature — it is possible that the distribution of *Isozoanthus bulbosus* can be explained in the same way.

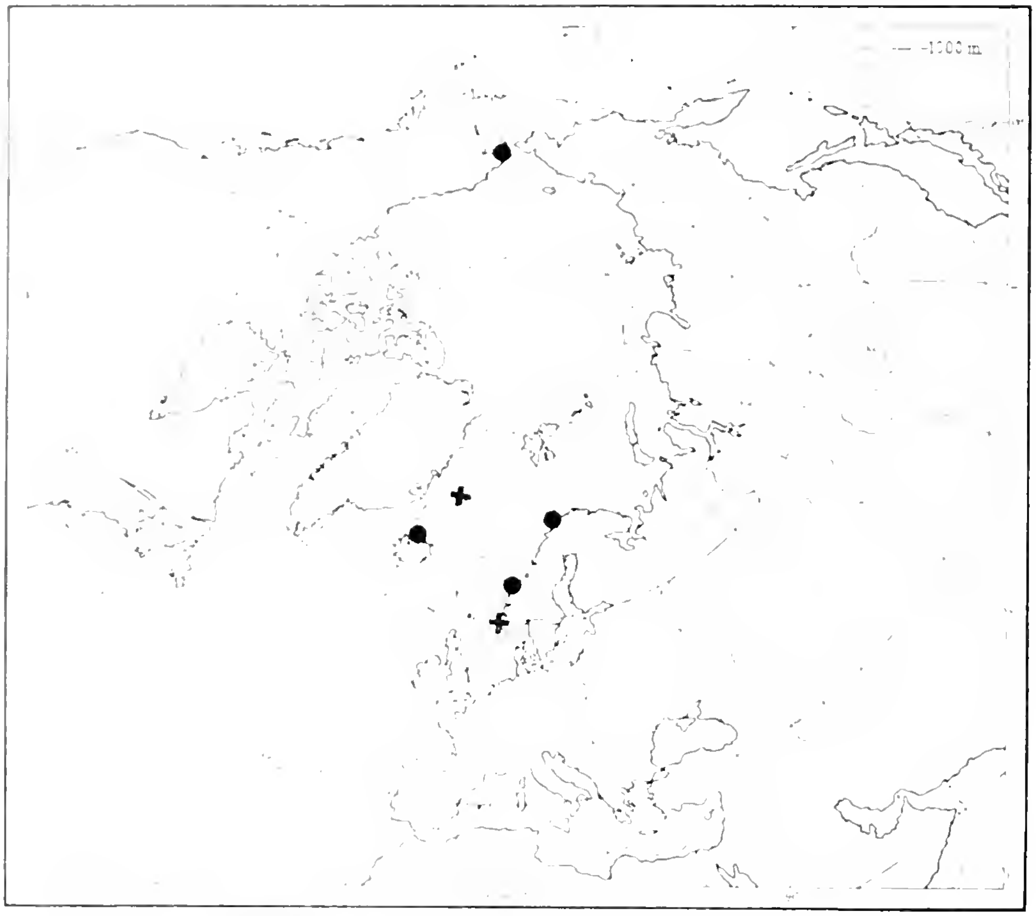

Fig. 85. ● *Ptychodactis patula* + *Sideractis glacialis* (taken also in Trondhjemfjord).

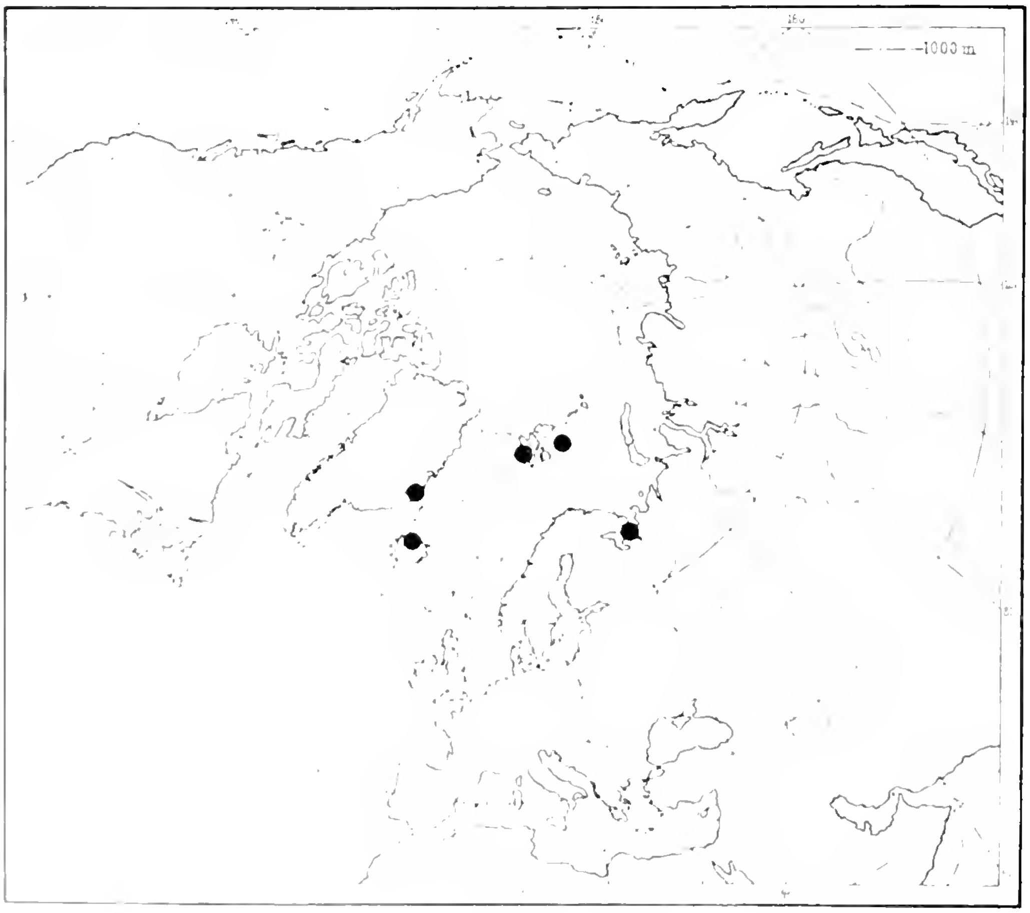

Fig. 86. *Nematostella polaris*.

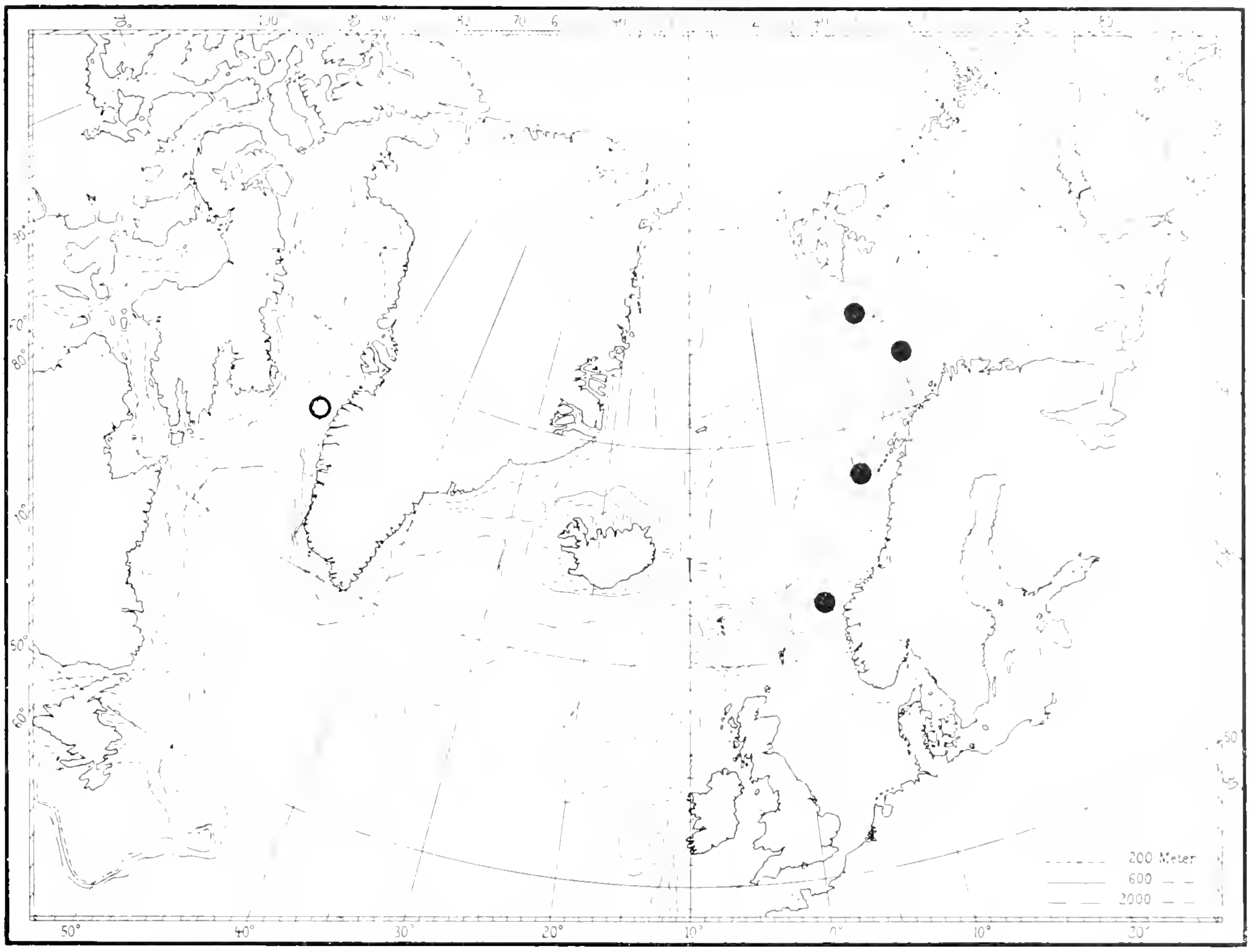

Fig. 87. *Cactosoma abyssorum.* ○ exact locality unknown.

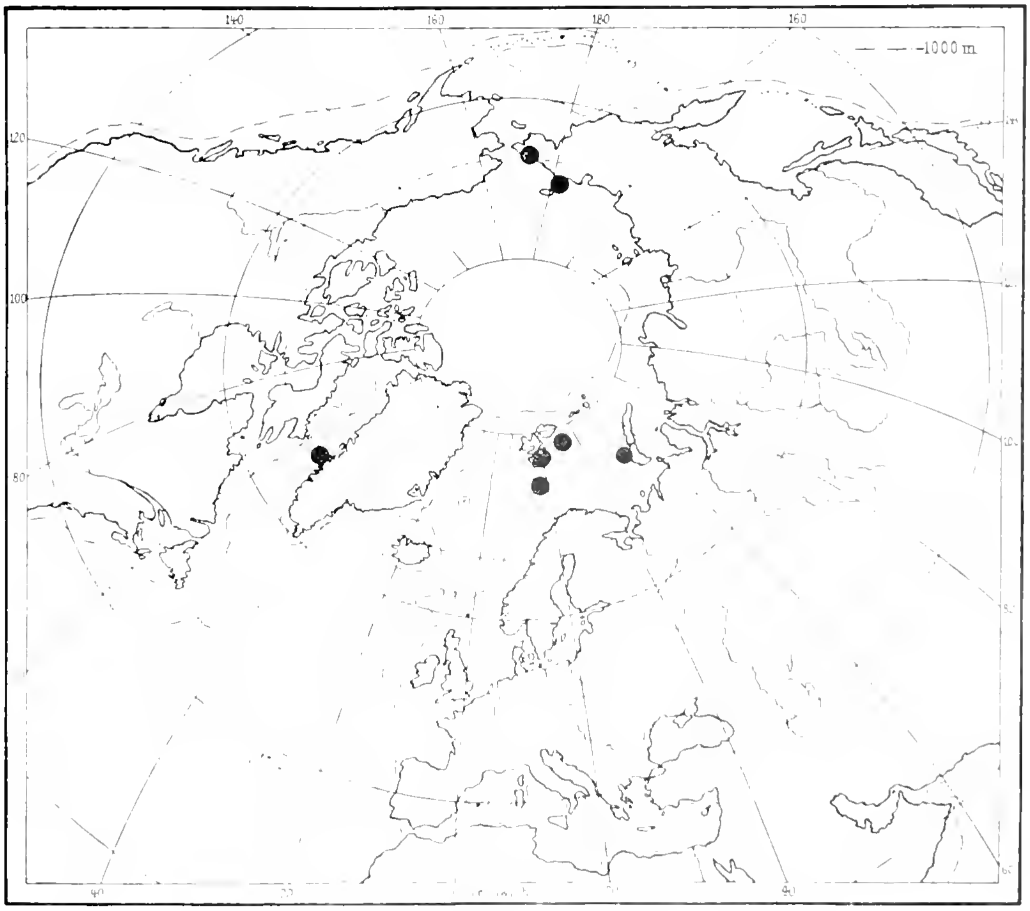

Fig. 88. *Halactis arctica.*

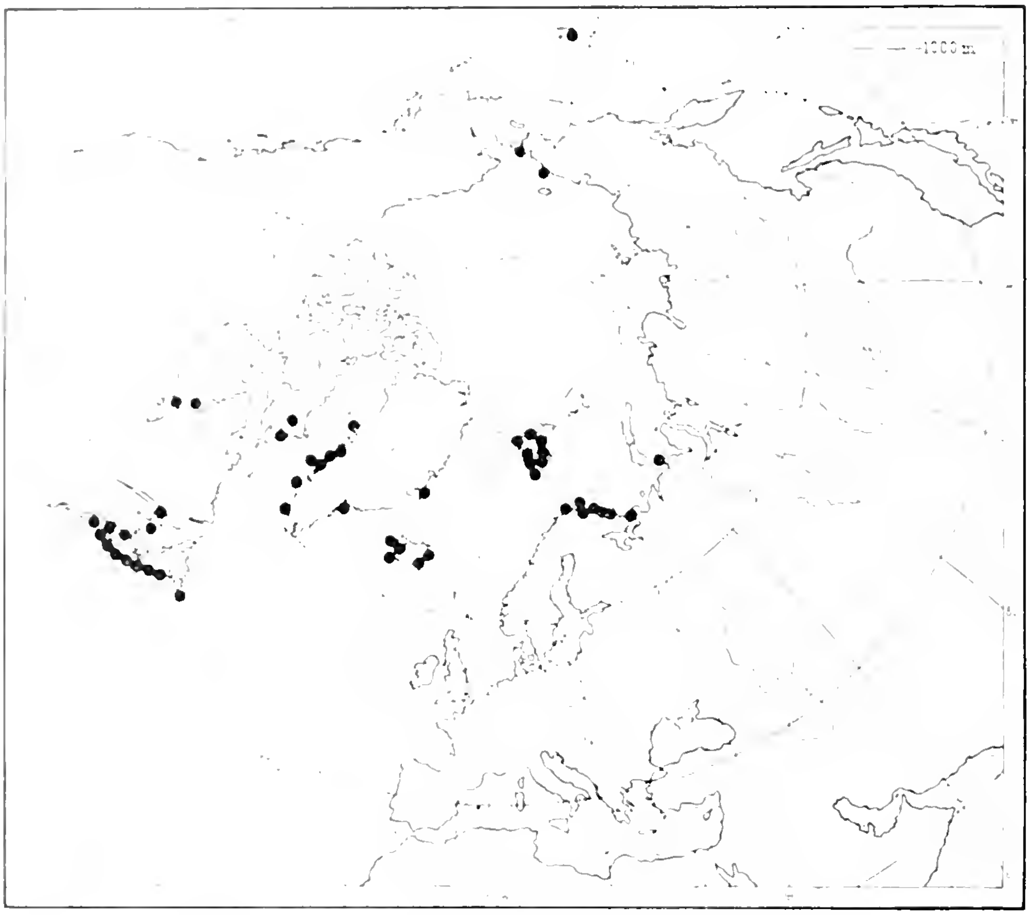

Fig. 89. *Bunodactis stella.*

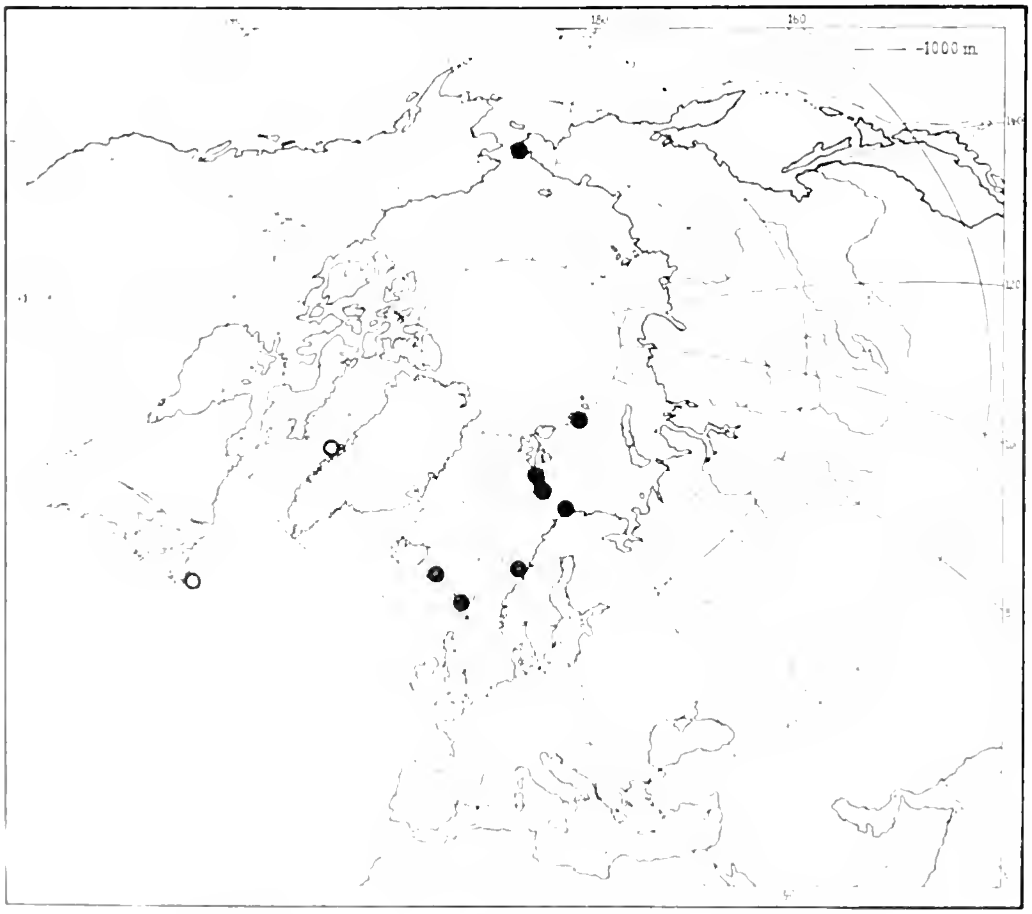

Fig. 90. *[illegible]* ○ exact locality unknown.

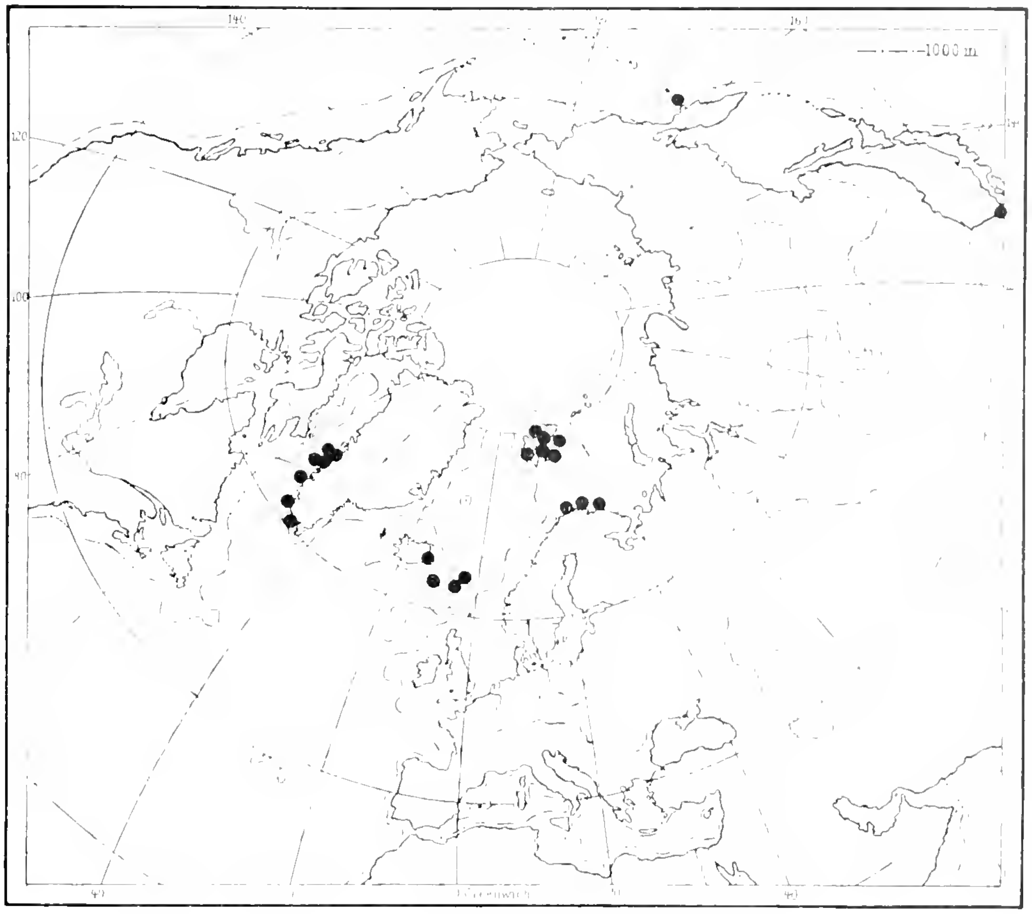

Fig. 91. *Cribrinopsis similis.*

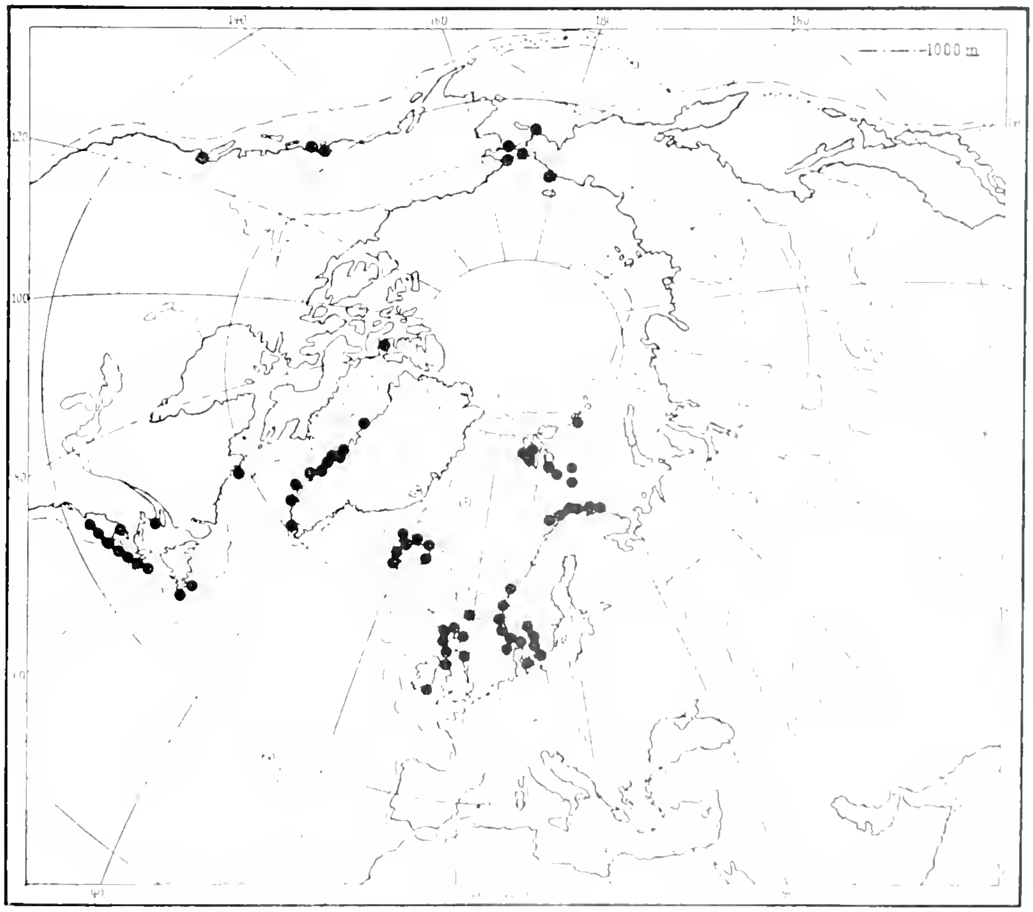

Fig. 92. *Stomphia coccinea.*

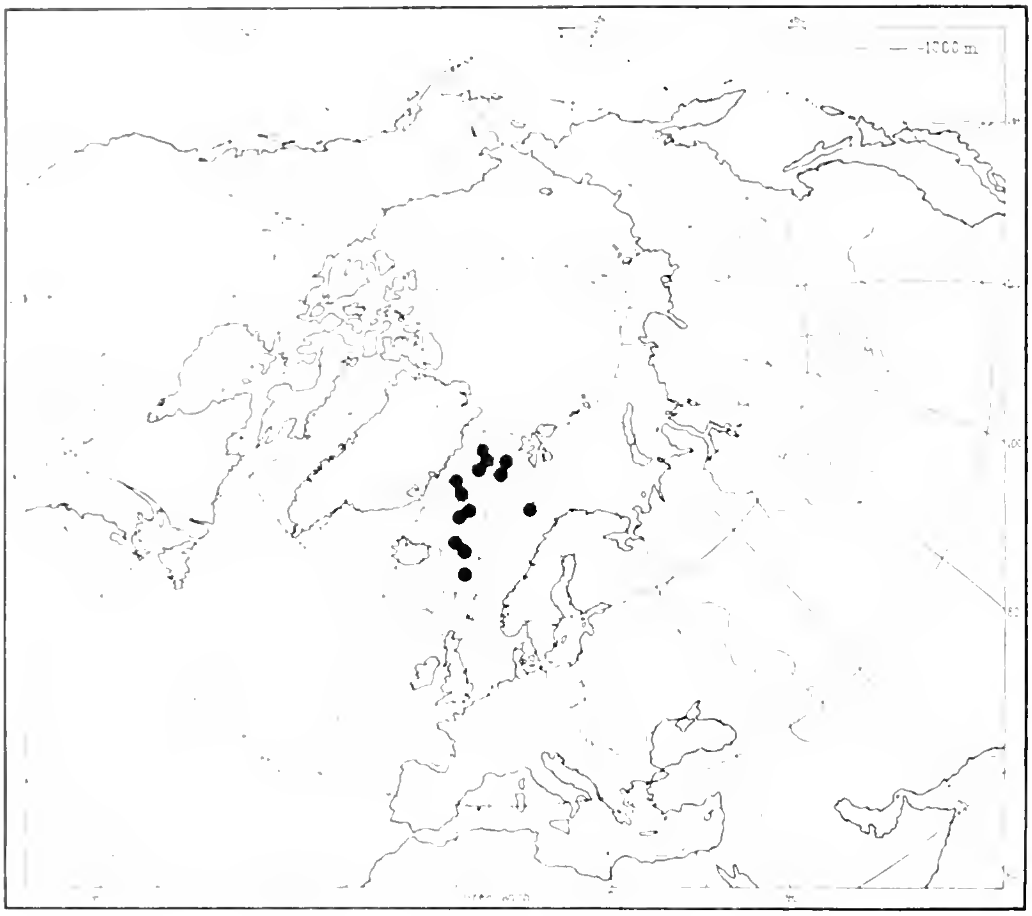

Fig. 63. *Bathyphellia margaritacea.*

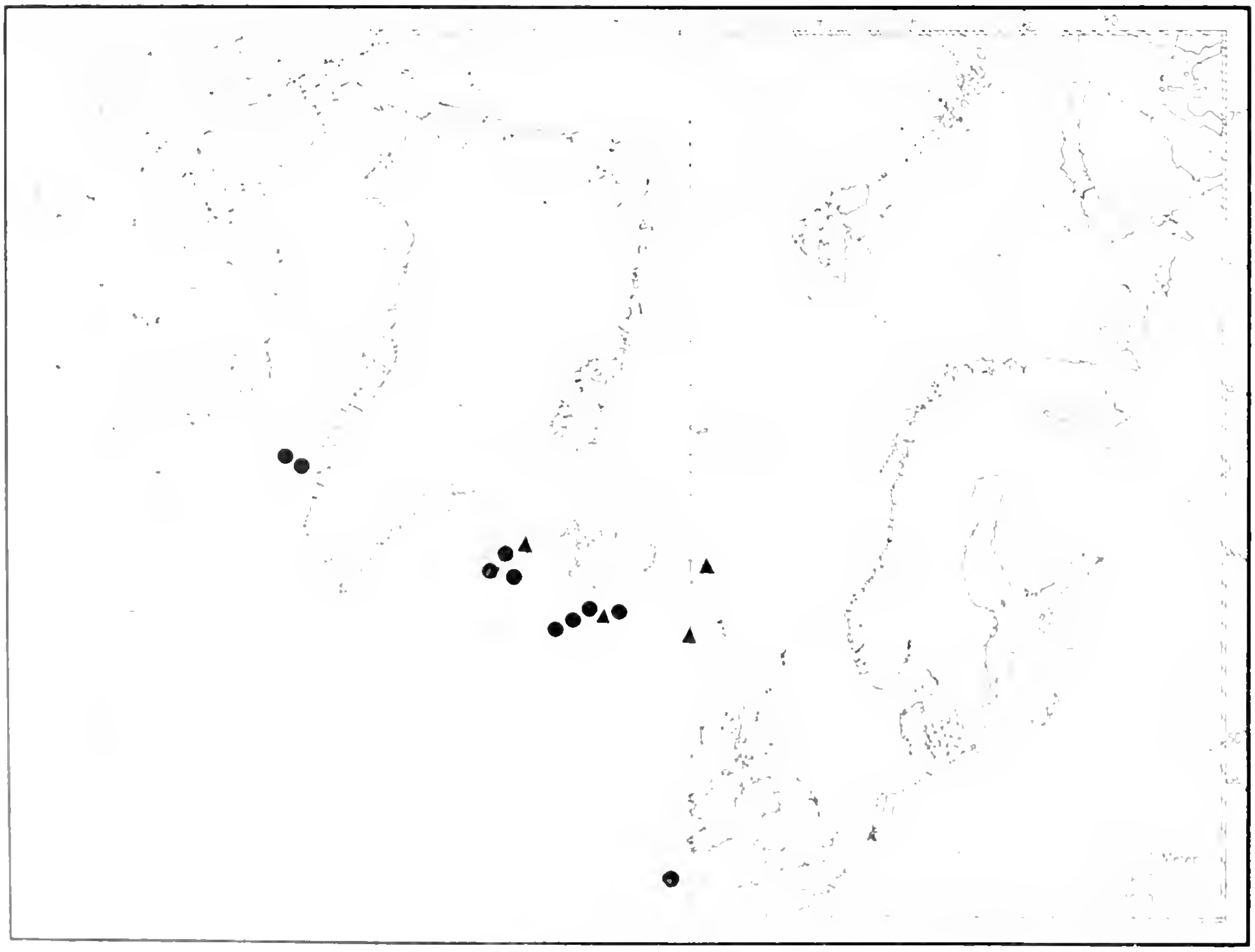

Fig. 64. ▲ *Daontesia porcupina.* ● *Phelliactis robusta.*

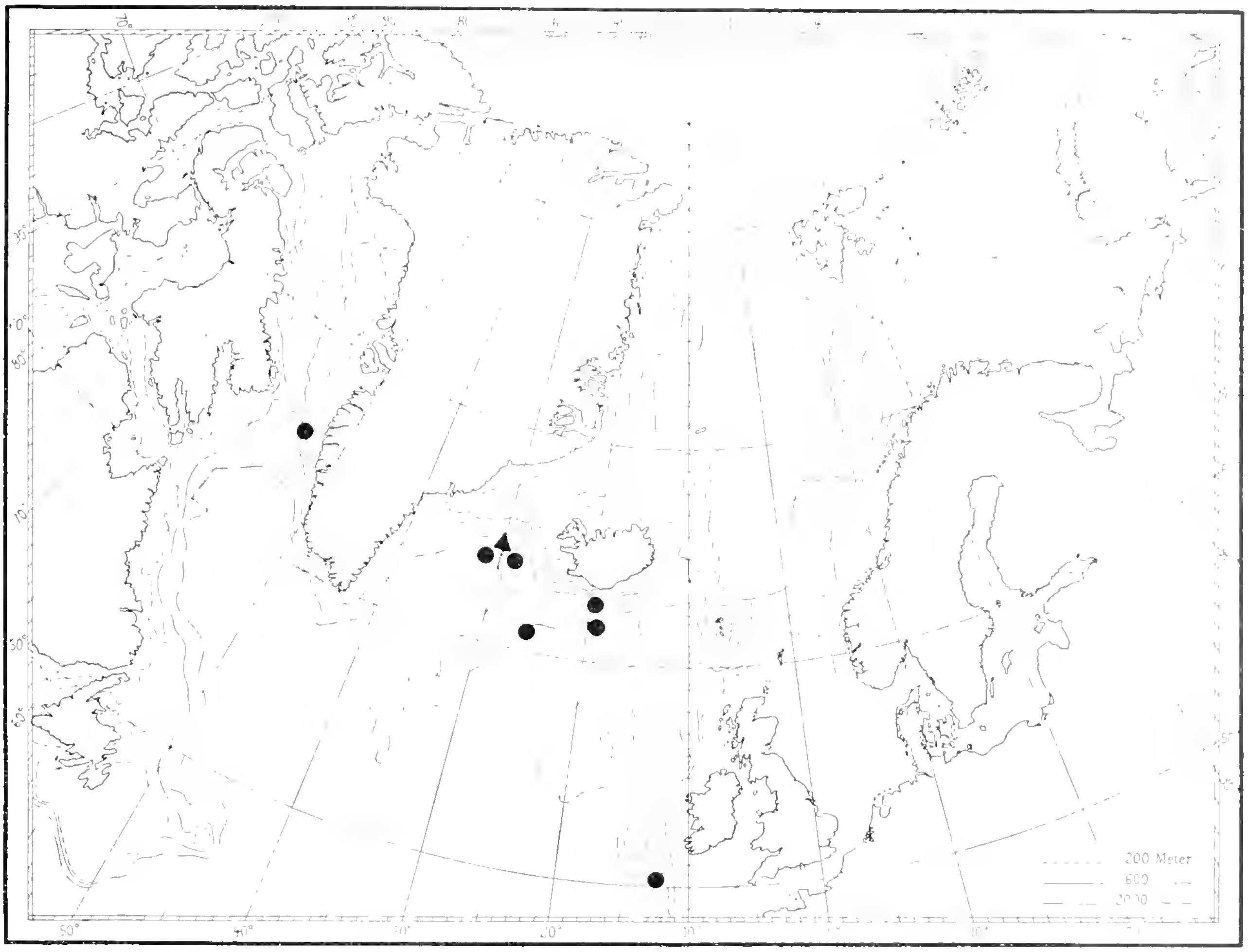

Fig. 95. ▲ *Paraphellinctis spinosa*. ● *Chondrophellia coronata*.

III. Contributions to the Anatomy, Genealogy, and Classification of the Actiniaria.

The Actiniaria belong to the groups of animals the classification of which is based on their anatomy. Since R. HERTWIG (1882, 1888) published his report on the Actiniaria of the Challenger expedition our knowledge of their organization has been considerably augmented. A short survey of the anatomy is to be found in the works of PAX (1914 and 1925)—the latter work is, however, unreliable in several points—and in those of STEPHENSON (1920–22 and 1928). Both authors have made an attempt to classify the Actiniaria, STEPHENSON has also to a certain extent dealt with their genealogy. By his classification of the Actiniaria STEPHENSON (1920 p. 468) used a "new" method based on simple summation of anatomical characters. Such a method is principally usable—I had already (in 1900) pointed out that we must take into account all anatomical characters in classification—provided that we give some characters a greater value than the others, i. e. we must make a balance not only between more important and other less important characters, but also between the important characters themselves. This also seems to have been in STEPHENSON's mind (1920 p. 470, and 1921 p. 508), when he speaks of the systematical place of *Boloceroides*. The particulars on which STEPHENSON (1920–22) grounded his classification, are, in several points, open to criticism, for which reason I wrote some years later the following unpublished survey of the anatomy and its use in classification, a survey, however, completed here by the results of later investigations. Since then I have in some points modified my opinion as to the use of certain anatomical details for classification, in several others STEPHENSON now agrees with me, so that our classification in the main is now the same. Although it might seem superfluous to publish this survey, I think, that it is necessary in order to make clear my own opinions as to the importance of certain anatomical details for classification, and because many anatomical facts have become known since STEPHENSON wrote his survey in 1928. A forecast of the ideas here proposed by me can be found in several of my previous papers.

The proximal part of the body is either rounded, sometimes more or less distinctly separated from the other parts of the column and forming a physa, or it is flattened, disc like, sometimes passing over into the column without any distinct boundary, and not provided with basilar muscles, which, however, are present in the more differentiated genera, of which the proximal part has formed a pedal disc, distinctly marked off from the column, in order to attach the body more firmly to the substratum.

The rounded proximal part of the body is often provided with apertures, (e. g. in *Edwardsia*, *Halcampoides*, *Halcampa* and *Peachia*) mostly arranged in one or several cycles around a central porus and surrounded by a sphincter. Sometimes, in some species of *Edwardsia*, the endoderm at the apertures forms a mobile stop (CARLGREN 1921 pp. 50, 53). In the fertile Actiniaria the ectoderm of the proximal end of the body has no radial muscles, except as it seems in *Sideractis* (CARLGREN 1921 p. 9), no, or very seldom, [illegible] in the pedal [illegible] often provided [illegible] nerve layer (see [illegible] spirocysts, as well as a [illegible] in the aboral end of A[illegible] may also have had no [illegible] devoid of such muscles. [illegible] Actiniaria is thus a primi- [illegible] 1921 p. 70), however, seemed to [illegible] presence or absence of a definite [illegible] presence of basilar muscles, sometimes [illegible] without basilar muscles together [illegible] (1921 p. 17). I cannot accept [illegible]. The base can vary considerably in [illegible]. Forms with a distinct basal disc are [illegible] to a physa-like shape, on the other hand [illegible] rounded basal end can flatten it out to [illegible] appearance of the basal end is sometimes not a [illegible] species, in opposition to the presence or absence [illegible]. For my part I cannot place species with and [illegible] in one family, and families having or [illegible] near each other. Since the forms having [illegible] modes of life differing from that of the [illegible] it seems to me, that the presence or absence [illegible] an important character of fairly high classi- [illegible] however, that STEPHENSON now agrees [illegible] (see STEPHENSON 1935).

[illegible] of the column agrees in several species more [illegible] tentacles, inasmuch as longitudinal musc- [illegible] nerve layer with nerve-cells are present in both, [illegible] more or less lost in most Actiniaria. As to the longi- [illegible] column, which are always ectodermal, they [illegible] extended over the whole column, now fairly [illegible] *Protanthea*, *Gonactinia*, *Isocorallion* and *Boloceroides*, [illegible] *Ptychodactis*, *Dactylanthus*, *Sideractis*, *Coralli-*[illegible] *Bunodeopsis*. Other genera are provided with such [illegible] the uppermost part of the column. This is the case [illegible] they are well developed, and in *Nevadne*, *Phyllo-*[illegible] *Bartholomea*, *Carlgrenella*, *Heteractis*, *H*[illegible] and possibly *Limnactinia* (I am not sure, that we really [illegible] with such muscles.

McMurrich (1893 p. 113) has also observed ectodermal [illegible] in *Halcurias pilatus*, and FOWLER (1888) in [illegible]. In the case of the former species the statement of McMurrich [illegible] verification, as neither STEPHENSON nor I [illegible] such muscles in other species of *Halcurias* and [illegible] related genera. Concerning *Thoracactis* nothing is known [illegible] description, but I think that the ectodermal muscles [illegible] the somewhat swollen bases of the ectoderm [illegible] R. HERTWIG 1879 p. 15 Pl. III figs. 8, 9). To the [illegible] the ectodermal muscles described in several sticho- [illegible] DUERDEN (1900) may be placed (CARLGREN [illegible]). I have not found such muscles in the column [illegible] examined by DUERDEN. The above named [illegible] ectodermal columnar muscles belong [illegible] Boloceroididae, Ptychodactiidae, [illegible] Aliciidae, Aiptasiidae, Halcampi-[illegible]

[illegible] the presence of ectodermal [illegible] of the opinion that the ancestor of the [illegible]. As to the occurrence of these muscles [illegible] authors regard it as a resurrec- [illegible] retained in the primitive genera of [illegible] while I in 1893, when I tentatively [illegible] at that time only few species [illegible] the column were known- [illegible] these muscles had genetic [illegible] retain my original view in its entirety. I am of opinion that the presence of these columnar muscles is a factor of fairly high classificatory value, but not to be taken alone, but in connection with other primitive characters, as already pointed out by me (1900). Also I think that the use of this factor in classification does not lead to unnatural results. Considering the families having ectodermal muscles in the whole column we find that they all belong to the tribus Protantheae (in my original view) and to Boloceroidaria, a group without basilar muscles, and, to my mind, derived from the family Gonactiniidae (CARLGREN 1924b p. 19). As to the other genera with ectodermal muscles only in the uppermost part of the column, the question is, whether these muscles are new formations or not. Concerning the family Aliciidae it may not be the case, as it is a descendant of the family Boloceroididae, and perhaps it is the same in the Aiptasiidae, which possibly also are descended from a Boloceroides-like form (CARLGREN 1924b p. 19). As to *Halcampa* the weak columnar muscles might be a new formation, but I have already (CARLGREN 1921 p. 117) indicated, that they are possibly prolongations of the muscles of the tentacles and of the oral disc, which is here small. I think that some transformations have taken place here, as the distal part of the small sphincter has entered into the base of the tentacles. It seems to me not impossible to suppose that the small part containing the capitular muscles originally belonged, to an earlier, somewhat wider, oral disc.

The presence of spirocysts in the body wall of many larvae (CARLGREN 1924a, 1931b) indicates that it is an ancestral character in the Actiniaria. Often the spirocysts occur along with the ectodermal columnar muscles, but also in genera devoid of these muscles. The spirocysts are certainly more conservative than these muscles, and are sometimes present in fairly highly organized genera, such as *Actinopsis*, and in the family Aurelianiidae. Solitary or scattered spirocysts one can find in other genera such as *Bolocera*, and in the marginal sphaerules, but usually they are lost in the column.

The column is often smooth without any differentiation, sometimes, however, divisible into a longer proximal part, scapus, and a shorter, distal part, scapulus, the former provided with a cuticle. To these an uppermost thin-walled capitulum can be added (STEPHENSON in CARLGREN and STEPHENSON 1928 p. 16) occurring also without the presence of a cuticularised scapus. The column of the more differentiated genera often has outgrowths of a different appearance. Their use is either as stinging organs or more passive means of protection.

Of stinging organs we can distinguish several sorts:

1) Nemathybomes: Batteries of nematocysts containing microbasic *b*-mastigophors, for the greater part enclosed in the mesogloea of the scapus (in several Edwardsiidae).

2) Marginal sphaerules in the most distal part of the body. They always contain atrichs, usually very numerous, but also basitrichs and spirocysts (in the family Actiniidae incl. Bunodactiidae and Phyllactiidae and in the genus *Nemactis*? (Verrill 1869–71 p. 487)).

3) Marginal pseudospherules, simple or compound, often perforated, vesicula-like outgrowths, forming more or less strong nematocyst-batteries in the most distal part of the body and recalling the marginal spherules, but never provided with atrichous nematocysts (in several Actiniidae).

4) Hollow, simple vesicula-like outgrowths, not situated at the margin, and containing same nematocysts as in other parts of the column (in *Haloclava* and *Dactylanthus*).

5) Hollow, compound outgrowths provided with macrobasic amastigophors (as in the family Aliciidae) or with microbasic amastigophors (as in *Bunodeopsis*).

6) Spots of nematocysts, sometimes also with spirocysts, not situated in special protuberances, or forming small, not hollow, protuberances (in *Fagesia* (*Milne Edwardsia*), *Halcurias*, *Synhalcurias*, *Mena*, *Pelocoetes*, *Halcampogeton* and in the capitulum of *Alicia*).

The passive protective organs of the column are:

1) Hollow verrucae, evaginations of the gastral cavity containing all germ-layers. Their ectoderm consists, in their apex especially, of supporting cells and of fewer gland cells swollen at their base but provided with a very thin efferent duct (in several Actiniidae). The verrucae as well as the formations mentioned below under 2 and 3 serve as attachment for foreign bodies.

2) Spots or small protuberances of the same structure as the verrucae, but not in connection with evaginations of the column (in the species of *Sagartia*).

3) Tenaculi ("*Halcampa*-papillae"), spots or shorter or longer elevations, in which the supporting ectoderm-cells for the most part are chitinized and connected with the cuticle. Between the supporting cells are gland cells (in *Halcampa* and other Athenaria and in several Acontiaria).

4) More or less strong tubercles covered with a weaker or stronger cuticle, as in several genera provided with acontia.

All these formations on the column are adaptations to a certain mode of life and are usually of lesser classificatory value. As to the stinging organs STEPHENSON (1921 pp. 170–71) has, however, pointed out the absence of such organs in the species having mesogloeal sphincter and acontia, and has, among others, taken that as an instance of a relationship between the forms with mesogloeal sphincter and those with acontia. In *Pelocoetes*, a species with acontia, however, stinging warts occur, but they are of simple structure, and according to information—whether correct or not I will leave unsaid—given by VERRILL (1869–71 p. 487) the Sagartiid *Nemactis* has marginal sphaerules. Be this as it may, there are other factors against the idea that the species having acontia, and those having a mesogloeal sphincter but no acontia, make a genetic whole.

The column of the Actiniaria often has apertures, cinclides, corresponding to the apertures of the physa in some genera (p. 78) and provided with a weak sphincter. The cinclides, in some cases principally ectodermal invaginations, in others endodermal evaginations, either only of one sort in a species or of both, are safety-valves against rupture of the column at strong contraction of the body, and widely distributed in the Nyantheae and here present both in several Actinians provided with acontia and in the family Actiniidae (in a wider sense)—the marginal sphaerules and the pseudosphaerules are often provided with a cinclis—but also in some Athenaria as in *Harenactis* and *Eloactis*. In the Thenaria with mesogloeal sphincter but without acontia, they seem to be lacking. As they are present both in those species having as well as in those lacking acontia, it is evident that they stand in no near relation to the acontia (STEPHENSON). Generally they occur in thin-walled species, sometimes also in thick-walled as in *Stephanauge* and Amphianthus, but here reduced in number and at least as a rule only present in the directive compartments, more sparingly in species the column of which has a cuticle (as in *Kadosactis*). That a reduction of cinclides takes place in thick-walled deep-sea species having acontia is very probable—in one species, *Kadosactis* (*Kadosanthus*) *sulcata*, taken by the "Michael Sars" expedition at a depth of 1215 m, the cinclides are arranged in an annulus at the limit between the scapus and scapulus, but their duct is irregular in its course and probably undergoing reduction; on the other hand the cinclides of *Kadosactis* (*Sagartiogeton*) *antarctica* taken at a depth of 1636 m show no traces of reduction—a difference possibly connected with the fact that the mesogloea of *K. sulcata* is considerably thicker than in *K. antarctica*, but whether all thick-walled deep-sea species having acontia formerly had cinclides, which have later been lost, is very questionable. However this may be, the presence or absence of cinclides is of little classificatory importance.

The circular muscles of the uppermost part of the column are often differentiated into an endodermal or mesogloeal sphincter. The endodermal sphincter, transformed into a mesogloeal when passing through the mesenteries—the term endodermal sphincter referring only to the parts of it situated between the mesenteries—is sometimes weak, usually well developed, either diffuse or circumscript, in the latter case either palmate having several or no main-lamellae, or pinnate provided with only one main-lamella. Especially the more strongly circumscript sphincter shows a tendency to be mesogloeal next to the mesenteries, inasmuch as the muscle-folds sometimes fuse together in the interior of the sphincter, and also the diffuse sphincter shows a similar tendency when forming a so-called aggregate sphincter (MCMURRICH 1893 p. 152). For these reasons, and from a theoretical point of view, there is nothing to hinder the supposition that an endodermal sphincter can be transformed into a mesogloeal one, especially in a species where the mesenteries in their uppermost part are thickened, as in the genus *Oractis* (CARLGREN 1931 p. 45). On the other hand a reduction of a mesogloeal sphincter to an endodermal one, or to no sphincter at all, has never been stated. PAX's (1936 p. 86) assertion that the sphincter of *Diadumene* is reduced is only a vague presumption. The endodermal sphincter occurs in several Corallimorphiae (Protostichodactylinae), among the Athenaria in *Oractis* and *Andresia*, and in many families of the Thenaria. As such a sphincter is present in the Corallimorphidae and Discosomidae—a group which was certainly differentiated very early from the other Actiniaria—, and occurs also in certain Zoantharia such as the Madreporaria, the suborders nearest related to the Actiniaria, and having a common ancestor with 8 mesenteries, arranged as the perfect mesenteries of *Edwardsia*, there is no doubt that the endodermal sphincter in the Actiniaria also has at least a diphyletic, but probably a polyphyletic, origin. At least it ought to be remarked that the endodermal sphincter is sometimes so weak that it may be questionable whether it really exists, or is only undifferentiated circular muscles, that is to say no sphincter at all.

The mesogloeal sphincter is generally alveolar, with scattered muscle-meshes and fibrillae, or it may be reticular. Rarely it is very weak, and consists of a single row of meshes formed, as it seems, by endodermal folds growing together and situated immediately outside the endodermal circular muscle, as in *Aiptasia couchii*, sometimes it is fairly weak, but it is usually strong. Often it is separated from the endodermal muscles of the column by a thinner or thicker band of mesogloea, sometimes the sphincter enters without distinct boundary into the circular muscles of the column. Sometimes it shows a more or less distinct tendency to transverse or longitudinal stratification. In rare cases there are two sphincters, either situated not far from each other, as in *Halianthella*, or the lower sphincter has been developed at a distance from the upper one, as in *Mena*. The mesogloeal sphincter never occurs in the Protantheae, s. str., nor in the Corallimorphiae, Ptychodacteae, and Endocoelantheae, but in some Athenaria, in the families Halcampidae, Octineonidae, and Andwakiidae and in the Mesomyaria and most Acontiaria.

There is no doubt, I think, that the mesogloeal sphincter arises partly from an undifferentiated circular muscle layer of the column, partly from a more or less differentiated endodermal sphincter. The sphincter of *Aiptasia couchii* e. g. is certainly developed in the former manner, and possibly this is the case in many species showing a distinct longitudinal stratification of the mesogloeal sphincter. Here we must anticipate that the formation of the longitudinal bands of muscle meshes has taken place independently at different times, each time through a growing together of the folds of the endodermal muscles followed by an increase of the mesogloea in the area of the development. I have pointed out above that the endodermal sphincter sometimes shows a tendency to be somewhat mesogloeal. In the section of the agregate sphincter of *Myonanthus ambiguus* (MCMURRICH 1893 p. 152 Pl. XXII fig. 23), if not taken close to a mesentery but more or less in the middle between the mesenteries, we have already here a mesogloeal sphincter in being. At least some of the mesogloeal sphincters with distinct transverse stratification have certainly arisen from an endodermal sphincter as in *Isosicyonis alba* (CARLGREN 1927 [illegible] *L*[illegible] (CARLGREN 1928 a [illegible]) [illegible] as I have mentioned above, and [illegible] with the fact that in the Zoan-[illegible] as either double or single meso-[illegible] other side with the origin of meso-[illegible] ectodermal muscles of the tentacles and [illegible] Actiniaria (see below p. 80), we must [illegible] genera provided with a mesogloeal sphincter [illegible] whole, in other words the mesogloeal sphinc-[illegible] arisen here in different stages during the evolu-[illegible] Actiniaria. As far as I can conclude STEPHENSON (1921 [illegible]) supposed at least a diphyletic origin of the meso-gloeal sphincter, when he placed together *Halcampa*, with its [illegible] sphincter, and *Halcampoides* with no sphincter. From a phylogenetic point of view I think that STEPHENSON's division (1921 pp. 541–542) of the Thenaria into Endomyaria and Mesomyaria is unfounded, although for the present, the division can be used to a certain extent for classification (see below p. 85–86). Still more is this the case with PAX's division (1925 p. 181, 820, 1926) of the Actiniaria, apart from the Endocoelactaria and Stichodactylinae, into Endomyaria and Mesomyaria: it is only a simple scheme of examination without any traces of an attempt at a division founded on the phylogeny of the Actiniaria.

Almost all Actiniaria are provided with tentacles, only the genus *Limnactinia* lacks them, probably in connection with its mode of living. In some Corallimorphiae, especially the genus *Discosoma*, the tentacles are much reduced and raise themselves hardly above the surface of the oral disc. All other Actiniaria described as lacking tentacles certainly possessed them, but either they have been thrown off or been invaginated into the coelenteric cavity.

The development of the first 12 tentacles takes place mostly after a bilateral type, seldom after a biradial as in *Peachia* and some other Athenaria (CARLGREN 1904 p. 544). Usually a single tentacle stays in communication with each endocoel and exocoel; in most Corallimorphiae (Protostichodactylinae) and in the so-called Stichodactylinae, however, the tentacles are arranged in radial rows, at least in the parts corresponding to the endocoels. The arrangement with a single tentacle from each endocoel and exocoel is more primitive than the arrangement in radial rows. In the primitive Corallimorphiae, *Sideractis* and *Nectactis*, there is also only one tentacle to each endo- and exocoel, and in the genus *Antheopsis*, among the Stichodactylinae, we meet a species the stichodactyline type of which is but slightly indicated. The origin of the stichodactyline arrangement of the tentacles is, in the Actiniaria at least, diphyletic, as the Corallimorphiae (Protostichodactylinae) and the Stichodactylinae are so different in their organization that we must suppose that the stichodactyline arrangement is a parallelism. Such an arrangement of the tentacles occurs moreover in the Ceriantharia.

The tentacles are simple, smooth, more seldom dendritic or [illegible] with [illegible] tentacles (pinnate) knob like elevations or trans-[illegible]. A special form of tentacle is the capitate. Usually [illegible] there are specially differentiated stinging batteries, [illegible] other kind of cnidae than those in the other parts [illegible] Sometimes, as in *Thalassianthus* and *Heterodactyla*, [illegible] differentiated in such a way as to form hemisphaeric stinging [illegible] resembling the marginal sphaerules in their appearance [illegible] Also in the simple tentacles the [illegible] may be collected in spots, e. g. in *Bunodeopsis* [illegible] Aliciidae. Usually the nematocysts are most numerous [illegible] of the tentacle. Sometimes the stinging capsules [illegible] the tentacles are of a special kind, in the catch [illegible] *Di*[illegible] holotrichs and atrichs, in the ordinary [illegible] microbasic amastigophors, in the [illegible] *Stomphia* microbasic b-mastigophors [illegible] genera, *Anthosactis*, *Tealidium* and *H*[illegible] tentacles are, at their bases, provided with a stinging battery with specially large microbasic b-mastigophors. Sometimes the mesogloea of the tentacles is more or less thickened aborally at the base as in *Actinauge*, in many Actinostolidae, and in some species of the genera *Kadosactis*, *Bunodactis*, *Phelliactis*, *Amphianthus* and so on. All these differentiations usually have only lesser classificatory value, but in certain cases, and in connection with other characters, show a near relationship between certain genera. The ectoderm of the tentacles usually contains numerous spirocysts. In the genera *Eloactis* and *Halaclava* the spirocysts seem wholly, in Discosomidae almost, reduced.

The longitudinal muscles of the tentacles vary much as to their place in the tissues. Often they are purely ectodermal, sometimes more or less mesogloeal viz. meso-ectodermal or ecto-mesogloeal, sometimes exclusively mesogloeal. Of two closely related genera one may be provided with ectodermal, the other with more or less mesogloeal tentacle muscles. Exceptionally, as in *Tealia felina*, the muscles vary from ectodermal to almost mesogloeal. The more or less mesogloeal muscles of the tentacles occur in different families having an endodermal, a mesogloeal or no sphincter, as in Actiniidae (in the wide sense), in Actinostolidae and in Condylanthidae. From the above mentioned facts it is clear that the mesogloeal muscles of the tentacles have arisen here and there in the more highly differentiated Actiniaria, and that forms having them do not all have a common ancestor, in other words the origin of the mesogloeal muscles of the tentacles has run parallel in several groups of the higher Actiniaria.

The oral disc of the Actiniaria shows only little differentiation. Exceptionally it is provided with small papillae representing small nematocyst batteries as in *Dofleinia*. In the genus *Limnactinia* the ectoderm of the oral disc is strongly thickened. The place of the radial muscles varies in a manner similar to that of the longitudinal muscles of the tentacles. These more or less mesogloeal radial muscles of the oral disc occur in the more differentiated Nyantheae, in species with or without acontia, as well as in species with an endodermal or a mesogloeal sphincter. Thus there is no reason to anticipate that the species provided with radial muscles more or less enclosed in the mesogloea are descendants of a common ancestor, having a tendency to develop such muscles. The oral disc generally has radial furrows corresponding to the insertions of the mesenteries. Here these muscles are usually weaker than in other parts of the oral disc, but in the genus *Phelliactis* the weakest muscles are over the endocoels. A singular case it met with in *Bathyphellia*, in which the ectodermal radial muscles at the insertions of the mesenteries are enclosed in the mesogloea (CARLGREN 1928 a p. 172 fig. 26).

The actinopharynx usually agrees with the column in its structure. A weak longitudinal muscle layer is not seldom present, and more usual than in the column. Commonly the actinopharynx has two siphonoglyphs combined with two pairs of directives. In several genera, however, there is only one siphonoglyph, apparently always a ventral one if the specimen has arisen by sexual reproduction. Sometimes it is very weak as in *Edwardsia*, sometimes very strong as in *Peachia*, *Eloactis*, *Oractis* and some other Athenaria. Several genera have no distinct siphonoglyphs. Rarely, as in *Thalassianthus* and *Boloceta*, there are several siphonoglyphs not joined to directives. In case of asexual reproduction of a specimen the number of siphonoglyphs varies. If there is only a single siphonoglyph present, as far as we know it is a dorsal one. The siphonoglyphs are often aborally prolonged, and reach farther down than the other parts of the actinopharynx. In *Peachia* the single siphonoglyph is orally prolonged in a more or less lobed conchula.

Since in the primitive Actiniaria the siphonoglyphs are indistinct or weakly developed it is to be supposed that the ancestor of the Actiniaria had no siphonoglyphs (or possibly a very weak ventral one).

The development of the first 8 mesenteries usually takes place more or less simultaneously, the ventrolateral mesenteries, however, apparently, always appear earlier than the others. In the

Edwardsia-stage, provided with only 8 mesenteries, the longitudinal muscles of which are characteristically arranged, no recent Actinian remains, as all species belonging to the family Edwardsiidae have, in addition to their 8 perfect "*Edwardsia*"-mesenteries, at least 4 very weak mesenteries in the uppermost part of the column. These 4 mesenteries, arising in the lateral and ventrolateral compartments as couples, grow, reach in most Actiniaria the actinopharynx, and form pairs with the 4 lateral "*Edwardsia*"-mesenteries. From this stage, the so-called *Halcampula*-stage (VAN BENEDEN), *Halcampoides*-stage (STEPHENSON), characterized by the presence of two pairs of directives and 4 common pairs of mesenteries, or perhaps in a small set somewhat earlier, before the lateral mesenteries have been arranged in pairs, the origin of new mesenteries differs. In this group, the Endocoelantheae, the new pairs, the muscles of which are orientated as in the directives, arise in the much enlarged endocoels, either cyclically or bilaterally, in numerous or few developmental zones (CARLGREN 1918). Judging from the arrangement of the mesenteries and their muscles in the family Minyadidae (CARLGREN 1894 p. 22) the development of the mesenteries has probably taken place in a similar manner. All other Actiniaria establish the new pairs in the exocoels as common pairs with their longitudinal muscles facing inwards, as a rule cyclically, but in the genus *Polysiphonia* bilaterally in a few, 12 or somewhat more, developmental zones, but not until 12 or a few more pairs have originated (CARLGREN 1918 p. 13). Because of the manner of the development of the tentacles, both mesenteries of a pair probably do not usually (never?) appear quite simultaneously in the distal part of the body; this is especially conspicuous in such forms as the Endocoelantheae, *Polysiphonia* and some other forms, in which the two mesenteries of a pair differ in size. Also in forms with a richer development of mesenteries in the basal part than in the distal part, the mesenteries of a pair may arise at different times, as in *Stomphia*, *Actinostola*, *Sicyonis* and others. In the Actiniaria the mesenteries grow either from the oral side towards the base, or the reverse, or from the oral as well as from the aboral end more or less simultaneously. Through arrest and differential growth of the mesenteries a pentamerous or octomerous arrangement instead of a hexamerous comes about in some species. Rarely, as in *Thalassianthus* and *Rivetia*, the directives are absent. As the development of the mesenteries in these genera is unknown, we cannot at present clear up the origin of the radial symmetry. It is hardly to be supposed that this symmetry has arisen here by asexual reproduction, which has, in many cases, caused very different symmetries and irregularities of the mesenterial arrangement, symmetries in many cases identical with those arising sexually, but being of no importance for classification and for the study of the phylogeny.

All the species of Actiniaria, the ontogenetic development of which is known, pass through an *Edwardsia*-stage, and all species having only these mesenteries perfect have been considered as more or less primitive forms. In fact these species often show other fairly primitive characters, only a few forms such as *Halcampa*, *Octineon*, and *Aiptasia* are provided with a mesogloeal sphincter, the two latter also with acontia, indicating a more advanced stage. Although many forms, having only the "*Edwardsia*"-mesenteries perfect, are without doubt primitive, it may be possible that in some of them this stage has arisen secondarily. I am specially thinking of such a species as *Halcampa duodecimcirrata*, which seems at least sometimes to be sexually ripe at a stage with 8 perfect mesenteries, but which later reaches the *Halcampula*-stage with 6 perfect pairs. Either this is the beginning of a reduction of the mesenteries[1]) or the reproductive period has been advanced to an earlier stage in the life of the animal (CARLGREN 1903 p. 23). However this may be, the Actiniaria having only the *Edwardsia* mesenteries perfect, form no genetic whole. The Gonactiniidae, and the above mentioned species belonging to different families of the Athenaria, and an *Aiptasia*[1]), which remain in the *Edwardsia*-stage, show in other characters little or no relation to each other. Thus such a tribus as the Protactiniae (MCMURRICH), based on the presence of only 8 perfect mesenteries, is invalid.

As to the reason why in one case the development of mesenteries takes place in the endocoels, in the other in the exocoels, we know nothing. Moreover we cannot make clear the real cause of the origin of the octomerous or decamerous arrangement, though the transformation of a hexamerous type into a decamerous one is known in a few cases. Sometimes a great increase of certain tentacles seems to influence the arrangement of the mesenteries. Most conspicuous is this in *Neradne*, where a strong growth of the third or fourth order of tentacles seems to cause a doubling of the mesenteries of the third or fourth order (CARLGREN 1925a, PANIKKAR 1937). Also the bilateral development of the mesenteries in *Polysiphonia* and *Actinernus* is probably related to irregular growth of the tentacles (CARLGREN 1918 p. 14, 15). A similar correlation between the origin of the mesenteries and that of the tentacles we find in laceration pieces, where a great increase in size of a directive tentacle may give rise to geminates (double-animals) (CARLGREN 1904a).

The longitudinal mesenterial muscles situated on one side of the mesenteries are sometimes weak, usually more or less strong and forming diffuse, concentrated or circumscript[2]) retractors or pennons. As I have previously pointed out (CARLGREN 1914 p. 15), the strength of the retractors is mostly correlated with the size of the animal. Very elongated Actiniaria as a rule have few mesenteries and strong retractors, usually limited to the macrocnemes, broader species are provided with more numerous mesenteries and mostly weaker retractors. But also in some genera with broad bases, as in *Aureliana*, *Condylanthus*, very strong retractors may appear. A weak longitudinal muscle layer in the mesenteries is more primitive than the presence of a distinct retractor. As I have explained already (1891a p. 89), the ectodermal muscles, present in the column of the most primitive Actiniaria, must be supposed to have been reduced in connection with the appearance of a stronger muscularity in the mesenteries. Nothing contradicts such a suggestion, as almost all species provided with longitudinal muscles in the column have weak longitudinal muscles in the mesenteries. In the few exceptions from the rule the longitudinal columnar muscles are reduced in most part of the column and are only present in the uppermost part of it. Regarding the mesenteries and their longitudinal muscles we can distinguish two types (STEPHENSON 1920 p. 456), one, in which the mesenteries are differentiated into macrocnemes and microcnemes, and another without any such differentiation. In the first type only the macrocnemes, the perfect mesenteries, are provided with retractors, filaments and reproductive organs, in the second there is no distinct difference between the mesenteries, at least as far as the presence of retractors and filaments is concerned. Sometimes, however, transitions between the two types occur. Although STEPHENSON (1920) admits, that the mesenteries of the Actiniaria originally had a weak musculature, he suggests that in the more highly

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[1]) The small oral disc with the few, broad, and densely packed tentacles, makes it possible that a reduction of the size of the oral disc has taken place here. In spite of the fact that the mesenteries of the second cycle are present in the whole length of the body, there are never any tentacles corresponding to this cycle (CARLGREN 1911 p. 23).

[1]) I have previously (1911 p. 21) suggested that the *Edwardsia*-stage sometimes occurring in sexually ripe *Aiptasia* could be a result of asexual reproduction. Although such a supposition is not quite to be excluded, it is, however, hardly probable, because a biradial development of the mesenteries has been described in the case of laceration-pieces of *Aiptasia* (CARLGREN 1904).

[2]) A real circumscript retractor (resp. sphincter) is, to my mind, present only when either the more or less numerous folds of the mesogloea issue from a single main-lamella, as in *Octineon* and *Aureliana*, or the outer and inner lamellar part of the mesenteries are attached to the retractor very close to each other; in other cases, when the retractor in cross-section has a more or less kidney-like appearance, we may rather speak of a concentrated retractor.

[illegible] A [illegible] stage or a predecessor [illegible] H[illegible] with the increase of the [illegible] of the macrocnemes is taken [illegible] 192[illegible] and that there is a [illegible] retractors to become diffuse [illegible]. The further development on [illegible] the loss of these special retractors [illegible] of a larger number of diffuse [illegible] A[illegible] (1911 p. 15, 1924 b p. 19), there [illegible] a theory. It must be remembered [illegible] more or less primitive Actiniaria, the Protan[illegible] and Ptychodacteae, as well as among the [illegible] Boloceroidaria, no species, except those of [illegible] genus *H[illegible]*, has stronger retractors, on the [illegible] longitudinal muscles of the mesenteries form no or [illegible] retractors. Concerning the genera having the strongest [illegible] retractors, such as *Octineon*, *Condylanthus*, *Para*[illegible] *[illegible]*, and *Actinoporus*, the first 4 have a wide basal [illegible] considerably more mesenteries in the proximal than in the distal part of the body. *Octineon* has 8 mesenteries perfect, *Condylanthus* 12, *Paraphellia* 12–21, and *Aureliana* a considerable number. That *Octineon* and *Condylanthus*, in spite of their numerous mesenteries, have retained the strong retractors on the few perfect mesenteries is easily understood, as only the perfect mesenteries and the mesenteries attached to the inner part of the oral disc can move the distal part, but why in *Paraphellia* the circumscript retractors of the 12–21 perfect mesenteries have been retained, and why in *Aureliana*, and still more in *Actinoporus*, which latter has all mesenteries perfect, these retractors have not been transformed into diffuse retractors, is difficult to understand. STEPHENSON (1920 p. 511) explains the retention of the circumscript retractors in *Paraphellia* in the following manner: "*Paraphellia* generally lives on a sandy bottom, and it may need the powerful retractors to help the sphincter to withdraw the tentacular crown very suddenly to avoid its being bitten off by hunting fish in search of such things, or molluscs emerging foot-foremost from the sand. This, or some similar reason, would account for retention or re-development of the circumscribed muscles". I think this explanation rather unsatisfactory. Moreover it must be remarked that the genus *Paraphellia* also lives on other objects than sand. I have examined a species of this genus, possibly identical with *P. [illegible]*, taken on Gorgonids, *Dendrophyllia* and other objects [illegible] Morocco. Can it be probable that the circumscript retractors [illegible] regenerated when new mesenteries in a greater number [illegible] species? There is, I think, nothing in favour of such a [illegible]. On the contrary there is much to be said for the [illegible] that the evolution of the longitudinal muscles of the mesenteries has gone from weaker to stronger muscles in connection [illegible] the form of the body and the mode of life.

The parieto-basilar muscles, in the genera lacking basilar [illegible] been developed in a different way. In the not elong[illegible] with a broad base, Protantheae, Corallimorphiae and P[illegible] as well as in some Athenaria, they are very weak, [illegible] genera of the Athenaria strong, forming, with [illegible] longitudinal mesenterial muscles, a more [illegible] the function of which is to contract [illegible] the contraction of which cannot be performed by [illegible] are separated from the parietal muscles by [illegible] part of the mesentery. Sometimes, [illegible] parietal muscles are more or less prolonged [illegible] Actiniaria the parieto-basilar muscles [illegible] often forming a distinct projec[illegible] as they grow over the trans[illegible]. In such cases parts of the trans[illegible] basilar muscles, are enclosed in [illegible] of the parieto-basilar [illegible] relation to the form of the body [illegible] attachment for the body. As the parietobasilar muscles are very weak in the Zoantharia and Madreporaria and in the primitive Actiniaria, I think a slightly developed parietobasilar muscle to be a primitive character.

As the basilar muscles appear only in connection with the development of a proper pedal disc, the species having basilar muscles represent a secondary stage of evolution.

The filaments of the mesenteries are usually divisible into two portions, a distal one consisting of a middle-tract and two ciliated tracts, separated from each other by an endodermal part, the intermediate tract, and a proximal, the endo-glandular tract, a continuation of the middle tract. In some groups, Protantheae, Corallimorphiae and Ptychodacteae, the ciliated tracts are missing, and the filaments consist of only a single tract. We meet a special differentiation of the filaments in the Ptychodacteae, where the single tract of the imperfect mesenteries is drawn out orally into two lobes, forming together a half-funnel, possibly with the same function as the ciliated tracts. In some genera, *Halcampa* and *Boloceroides*, a closer examination will probably show a similar structure in some other filaments — the ciliated tracts are a little prolonged into the furrows of the intermediate tracts, a structure recalling the filaments of the Zoantharia, though in this group the prolongation of the ciliated tracts is considerably more pronounced. Rarely, in *Isoedwardsia*, *Limnactinia*, and *Scytophorus*, the ciliated tracts are discontinuous, exceptionally the filament itself is interrupted (in the imperfect mesenteries of *Calliactis parasitica*). Whether the presence of a simple tract in the Madreporaria and in the above named Actiniaria is primitive or not, authors somewhat disagree. Almost all authors who have discussed this problem are of opinion that the simple filaments represent an earlier type in phylogeny than those provided with ciliated tracts, only STEPHENSON (1921 pp. 556–558) suggested that the stage with a simple filament has possibly arisen secondarily. Although S. allows "that the ancestor of all Anthozoa was without ciliated streaks", he proposes (p. 557) "that it is likelier that the ancestor of all three groups of Zoantharia, the Edwardsids, the Zoanthids, and the Dodecactiniaria (Actiniaria and Madreporaria) had ciliated streaks perhaps only in a slightly differentiated form, and it is a simpler way of putting things to think of some forms losing them than of three groups joining them". Certainly if there were three groups of Anthozoa with identical ciliated streaks, STEPHENSON's way of thinking could be taken into consideration. Now it is not so. The Edwardsids are no special group comparable with the Actiniaria and Zoantharia, but must be regarded as a relatively highly differentiated family among the Actiniaria, and the ciliated streaks (tracts) of the Actiniaria and Zoantharia are not identical, though resembling each other. Small Zoantharia also have very weak ciliated tracts, according to DUERDEN (1898 p. 464, 1907) none, but I think this statement needs verification. There are ciliated tracts also in Ceriantharia, though different from those of the other groups. Moreover, as the ciliated tracts develop later than the single tract, and the Madreporaria, Protantheae, Corallimorphiae and Ptychodacteae in more than one respect must be regarded as primitive, there is hardly any reason to suggest that the ciliated tracts are reduced in these groups. And how do we explain the origin of the half-funnel-like filaments in the Ptychodacteae according to STEPHENSON's opinion? The ancestor should have had no ciliated tracts, then such organs were to appear, later to be reduced, and at last the half-funnel was to have arisen. I find such a supposition hardly acceptable. It is easier to accept the development of the half-funnels from a simple filament. Moreover, STEPHENSON's supposition that the ciliated tracts have been reduced in the Madreporaria on account of the intercalation of septa keeping the mesenteries apart, and so making the function of the ciliated tracts unnecessary, can just as well be interpreted in the sense that the ciliated tracts, being unnecessary, have never been developed. Also S.'s remarks, that the forms without ciliated tracts have weak or no sphincter in opposition to forms with ciliated tracts having mostly strong sphincters, hardly holds good, as there is a great number of the Actiniaria having no or a weak sphincter, but well developed ciliated tracts. Also the Ceriantharia, which are not provided with a sphincter have, as also S. remarks, well developed ciliated tracts.

Summing up all this there is to my mind nothing in favour of the assumption that a reduction of the ciliated streaks has taken place in the Anthozoa, at least in the groups previously mentioned. Possibly, however, there is a certain reduction of the ciliated tracts in the above mentioned few genera, where the ciliated tracts have been interrupted. This question is on the whole connected with the origin of the ciliated tracts, which is not yet well enough known.

As a special differentiation of the filaments the acontia may be considered, which, at least in many cases, appear so early as in the larvae with only 8 mesenteries (Carlgren 1934). In all Actiniaria having acontia these organs are of a practically uniform structure. The statement of O. und R. Hertwig (1879) that the muscles in *Calliactis* (*Sagartia*) *parasitica* are situated on the same side as the nematocysts is incorrect, in fact the muscles occupy also in this species the opposite side. Curious organs like acontia, but with few nematocysts, are present in the genus *Nemanthus* (Carlgren 1940b). The nematocysts of the acontia are, however, different in structure and size in the different families. According to some authors the acontia are rudimentary in some species. Although it is possible that such statements are correct in a few cases, I think, however, that most of them are false, and due to bad preservation of the material examined, and that an examination of better preserved specimens would give other results. The occurrence of rudimentary acontia gave Stephenson (1920 p. 498, 504) the idea, already put forward by Verrill (1899 p. 143) that all Thenaria having a mesogloeal sphincter originate in forms provided with acontia and cinclides. Stephenson thus suggested (l. c. p. 505) that the loss of activity and slower metabolism of deep-water forms may cause a degeneration of the cinclides and acontia in these forms. As to the cinclides it is probable that a degeneration has sometimes taken place (see above p. 79), but, considering the variability in the appearance of the cinclides—of genera closely related to each other one may be provided with cinclides, another not—it is not likely that the ancestor of all genera provided with a mesogloeal sphincter have had cinclides, the more so as pores occur in so different places, such as in the physa, in the body-wall, in the marginal sphaerules and pseudo-sphaerules, and in many of the genera having an ectodermal or no sphincter. Now as to the reduction of the acontia, Stephenson, as above mentioned, suggested that the acontia have been reduced in deep-sea forms. Before discussing this question we may make clear the primitive function of the acontia. Are they in the first place developed as defensive arms, and to be used outside the animal, or is their primitive function to kill the booty, which has been put into the coelenteron alive? I think the latter function the more primitive. If not it seems to me difficult to understand why the acontia are not reduced in forms lacking cinclides, for an ejection of the acontia from the mouth certainly usually has only a slight effect as defensive arms. Accepting my interpretation as to the primitive function of the acontia, a reduction of these organs in species having once obtained them is not easily cleared up. It is untrue that many (most?) deep-sea Actiniaria having a mesogloeal sphincter are devoid of acontia, on the contrary there are several forms living the deep-sea, which have well developed acontia, for instance *Phelliactis*, *Kadosactis* (*Kadosanthus*), *Chondrophellia*, and other Hormathiidae. Moreover there are many genera living in shallow water and provided with a mesogloeal sphincter but no acontia. A positive instance of degeneration of acontia in deep-sea forms is as yet unknown. The specimens of *Liliella* (Stephenson 1918a p. 33) were badly preserved, so that a renewed examination of this species is desirable[1]). The matter stands somewhat differently, if *Stephanauge* (*S. nexilis* and *acanellae*) should prove to lack acontia[1]), this genus is certainly related to *Amphianthus*, which has acontia. But also with this single instance of reduction of the acontia, it is not permissible to generalize so as to say that all genera now devoid of acontia, but provided with a mesogloeal sphincter, have their origin in a form with such organs, the more so as it is certain (see p. 80) that the sea-anemones provided with a mesogloeal sphincter are not descendants from a common ancestor. So I cannot endorse Stephenson's opinion that the family Actinostolidae (the former family Paractiidae) has arisen from a form having acontia. Moreover it is questionable if in fact, all sea-anemones with acontia have a common ancestor. The presence of acontia even in the genera lacking basilar muscles, shows that the first appearance of these organs is to be found in a rather primitive stage of the Nynantheae. Among the Athenaria there are 3 families, Halcampactiidae, Andwakiidae and Octineonidae, all having acontia, the first family without a sphincter, the other two with a mesogloeal one. The family Halcampactiidae is the most primitive, and from it the two other families can be derived, and from a prae-*Halcampactis*-stage, with weak retractors perhaps, several families of the Actiniaria with basilar muscles have arisen. But, as I have suggested, (1924b p. 19), there is possibly another line going from forms lacking basilar muscles to forms having these, that is to say from the Boloceroidaria, or forms allied with this group, to such genera as *Aliceia* (from here to perhaps the Diadumenidae) which has retained several primitive characters. But the question whether the sea-anemones provided with acontia have a monophyletic or a di-(poly-)phyletic origin is in reality very difficult to clear up. It seems to me, however, that the acontia-like organs developed in the family Nemanthidae (Carlgren 1940b) indicate a di- or polyphyletic origin of the acontia. The presence of different types of nematocysts in the acontia (see Carlgren 1940 p. 50 note 1, in which a lapsus pennae is to be corrected—Acontiferidae instead of Acontiophoridae)—need, however, not render necessary a polyphyletic origin for many of the Acontiaria, if they originate from a form having only microbasic b-mastigophors in its acontia (see schedule p. 55 Carlgren 1940), as is the case with *Metridium*, which has sometimes only these nematocysts in its acontia, while other varieties of it are provided also with microbasic amastigophors. It is, however, to be suspected that the amastigophors have been reduced in the acontia of some forms of *Metridium*. Finally we have to consider the cnidae. The distribution of the spirocysts has been dealt with above. According to Weill (1935) we have to deal with 6 categories of nematocysts in the Anthozoa, viz. atrichs, holotrichs, microbasic mastigophors, microbasic and macrobasic amastigophors, and basitrichs. Because of the different appearance and distribution of the microbasic mastigophors in the Anthozoa, I have divided them into *b*- and *p*-mastigophors, thus, to my mind, 7 categories occur. There is, so far as we at present know, no genus provided with all types of nematocysts. In the genus *Dactylanthus* s. str., however, all types, apart from the microbasic *b*-mastigophors, are present. Usually only two types, microbasic *p*-mastigophors and basitrichs, occur in the Actiniaria, sometimes there are 3, rarely one or four (see Weill 1935 and Carlgren 1940). I have above remarked that there are certain types of nematocysts in the marginal sphaerules, in the tentacles of some genera, and in the acontia of different families, all certainly of systematic value. Moreover there is no doubt that the knowledge of the cnidom, i. e. the types of cnidae occurring in a species or genus, is generally valuable in finding out its relationship to other genera, though an agreement in the cnidom between two species does not indicate an absolute relationship, because the development of the types of nematocysts from more primitive types to more advanced ones has evidently ceased in some types, or in other words it is a parallelism of development (see Carlgren 1940). For instance

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[1]) The presence of acontia has been stated here (Carlgren & Stephenson, Actiniaria. Australasian Antarctic expedition 1911–1914. Ser. C. 9. P. 2. 1929).

[1]) According to Verrill (1922 p. 99 Pl. XXII fig. 6, 8), [illegible] has acontia, but apparently few.

[illegible] the entire cnidom, [illegible] that it may be [illegible] each other. The distribu- [illegible] that some genera or [illegible] nematocysts and at the [illegible] type, for instance the family [illegible] *[illegible]morpha* have atrichs and [illegible] basitrichs and *p*-mastigophors, [illegible] as above mentioned, all types [illegible] see further CARLGREN 1940). The [illegible] genus is however undoubtedly valu- [illegible] its relationship, though one must [illegible] conclusion from an agreement of the cnidom [illegible] are related to each other.

[illegible] of the organs of the Actiniaria have, [illegible] following directions.

1) [illegible] part of the body was primitively a basal plate, [illegible] without basilar muscles, and with [illegible] structure as the column. This plate has either developed [illegible] physa or been enlarged and eventually provided [illegible] muscles. Perhaps also the physa can form a distinct [illegible] flattening and by getting basilar muscles.

2) The column was primitively provided with ectodermal [illegible] muscles and spirocysts, which, in primitive sea- [illegible] are more or less retained, but in more differentiated [illegible] wholly reduced. The spirocysts are more conserva- [illegible] sometimes present in highly different- [illegible]. A resurrection of the longitudinal muscles, if once [illegible] does not (or exceptionally, in *Limnactinia*?) take place.

3) The ancestor of the Actiniaria had no sphincter. The circular [illegible], by folding into the distal part of the column, [illegible] endodermal or mesogloeal sphincter. This latter [illegible] either directly from the circular muscles or passed [illegible] an endodermal sphincter stage. There is no reason to [illegible] ancestor on one side for the forms having a [illegible] or circumscript sphincter and, on the other, for those pro- [illegible] a mesogloeal sphincter. A reduction of a mesogloeal [illegible] has not been stated.

4) The longitudinal muscles of the tentacles and the radial [illegible] the oral disc were, in the primitive stage, ectodermal. [illegible] enclosing, meso-endodermal, endo-mesogloeal and [illegible] muscles arise in different species which often [illegible]

5) The ancestor of the Actiniaria probably had no siphono- [illegible] a weak ventral one. A single, ventral siphono- [illegible] developed, is present in some genera; whether [illegible] is questionable. In many other species [illegible] occurs but always in connection with asexual [illegible] caused by regeneration. Usually a dorsal siphono- [illegible]

6) [illegible] the Actiniaria was probably provided with 8 [illegible] arranged as the macrocnemes in *Edwardsia* [illegible] No recent Actiniarian remains at this stage. [illegible] couples of mesenteries have arisen forming [illegible] and ventrolateral couples. From this [illegible] before the mesenteries have been [illegible] of development have originated, one [illegible] forming in the endocoels new [illegible] longitudinal muscles orientated [illegible] forming new pairs in the [illegible] muscles facing inwards.

[illegible] 12 mesenteries new mesenteries grow [illegible] especially in forms with a [illegible] upwards (especially in species [illegible] the limbus and margin nearly [illegible] of the column. The number of [illegible] retractors are connected, [illegible] of the body. Elongated species with a cylindric body usually only form relatively few mesenteries and strongly concentrated or circumscript retractors on the macrocnemes, broader and lower species usually numerous mesenteries, not differentiated into macrocnemes and microcnemes, and usually diffuse retractors. No reduction of the strong retractors of the macrocnemes takes place in connection with the increase in the number of mesenteries.

8) The filaments of the Actiniaria originally consist of a single tract. To this later come two ciliated tracts in the upper part of the filaments, or the single tract may, but rarely, form curious half-funnel-like organs in its upper part. A total reduction of the ciliated tracts, a regression to a stage with a single tract, can hardly be imagined, though the ciliated tracts or the whole filament may sometimes be reduced in certain places and thus become discontinuous.

9) The acontia are a differentiation of the filaments, originating, as far as is yet known, before the ciliated tracts of the filaments arise. Their origin is probably not monophyletic, because, among others, organs like acontia but with few nematocysts occur. The acontia are provided with nematocysts, which are of different types in certain families, but probably can be derived from microbasic *b*-mastigophors, though these nematocysts are rarely present in the acontia.

10) The knowledge of the cnidom of a genus is of importance in order to clear up its relationships. If two species have the same cnidom, it is, however, not certain that they are related to each other, because the types of nematocysts have changed more or less parallel with the development of other organs during evolution. The ancestor of the Actiniaria had at least atrichs, probably also holotrichs and microbasic *b*-mastigophors, perhaps also *p*-mastigophors, in its cnidom.

We now proceed to the classification of the Actiniaria.

It is relatively easy to arrange the genera in families, considerably more difficult, however, to arrange the families in larger groups. The cause is that the Actiniaria are relatively simply constituted, and that their development has certainly been parallel in several cases, as already announced by myself (1914 p. 28). There are, however, some groups, which are distinctly separated from the other Actiniaria, viz. the Ptychodacteae (Ptychodactylinae). The Corallimorphiae (Protostichodactylinae) and the Endocoelantheae. Some authors, e. g. STEPHENSON and WEILL, consider the Corallimorphiae (Asclerocorallia) members of the Madreporaria. In some papers (1924 c p. 180 and 1940 pp. 57–59) I have pointed out my view about the place of this group. I cannot find any real argument for placing it in the Madreporaria, in which, as far as we know at present, it would be wholly isolated. Evidently the presence of numerous holotrichs in the Corallimophiae as well as in the Madreporaria has been of great importance in the theory of their relationship. But as holotrichs have now been found in *Dadumene*, a form provided with acontia, and in a larva the ripe form of which is unknown, there is a difference in quantity but not in quality as to the holotrichs between the Madreporaria and the Actiniaria proper. But specially regarding the presence of certain types of nematocysts and removing the Corallimorphiae from the other Actiniaria, we must for even more reasons also remove the Ptychodacteae, the cnidom of which consists of only atrichs and few spirocysts, and which moreover in their organisation considerably deviate from the typical Actiniaria. For this reason I, in 1940, proposed to give the Ptychodacteae and Corallimorphiae a higher rank, and coordinate them with the Actiniaria and Madreporaria, as I find such an arrangement acceptable. The Ptychodactiaria are certainly a group which has separated early from the other Actiniaria and gone their own way, and the Corallimorpharia have run through a development fairly parallel with the Madreporaria. As to the Endocoelantheae they belong to the Actiniaria proper, but are a very homogenous group, characterized, among other features, by the curious origin of their mesenteries. If we go further to the primitive Actiniaria proper, we first have to consider the Protantheae, a group to which I, in earlier papers, reckoned the above mentioned groups to belong. I now agree with Stephenson and include in the Protantheae only the family Gonactiniidae, characterized by the presence of longitudinal columnar muscles, by the absence of ciliated tracts of the filaments, and of basilar muscles. Undoubtedly this family is very primitive, only the presence of microbasic amastigophors suggests a more advanced stage. As coordinated with Protantheae and Endocoelantheae I have proposed the group Nynantheae, provided with ciliated tracts of the filaments in agreement with the Endocoelantheae. Among the Nynantheae we can distinguish three groups, the two first, the Athenaria or Abasilaria, and the Boloceroidaria without basilar muscles, the third, the Thenaria or Basilaria with basilar muscles. The Athenaria are usually provided with a physa and commonly have a very elongated body, and their mesenteries, as a rule, are divisible into macro- and microcnemes; some of the Athenaria also have acontia. The Boloceroidaria have a different exterior and agree more with the common Actiniaria. They are certainly derived from the Protantheae (Carlgren 1924b p. 19, 1940 p. 30, Panikkar 1937a p. 87) and separated from them only by the presence of ciliated tracts of the filaments and the absence of atrichs; in all other characters such a form as *Boloceroides* agrees with *Protanthea*. As to the forms with basilar muscles, the Thenaria, Stephenson (1920-22) has divided my group at once into Endomyaria and Mesomyaria, the latter group including also forms with acontia, a subdivision, however, which is not succesful, as he counted in with the Mesomyaria also some forms having acontia but no sphincter. It is also very difficult to classify the Actiniaria which are provided with basilar muscles, and possibly it would be most suitable, at present, not to divide them into larger groups. It is not certain that all forms with no sphincter, or with an endodermal sphincter, genetically belong together. The same holds good also of the forms with a mesogloeal sphincter. It is true that the family Actiniidae and the stichodactyline families show a near relationship, but the family Aliciidae, having no sphincter but provided with macrobasic amastigophors, is an aberrant family not related to the family Actiniidae. In fact, I think the origin of this family is to be sought not far from the Boloceroididae, the microbasic mastigophors of which (Carlgren 1940 figs. 1, 3, 5, 7) seem to me to be a prestadium of the macrobasic amastigophors. Moreover the basilar muscles of the Aliciidae show all transitions from very weak to strong ones, in the genus *Alicia* they are only indicated, in *Lebrunia* they are very strong. As to the forms with acontia there are several difficulties concerning their classification, some of them have no basilar muscles, a few have no sphincter, and most have a mesogloeal one. The genera placed here below with the Athenaria have the same cnidom in the acontia as two groups provided with basilar muscles. Very different from the others is the family Diadumenidae (the three species of the genus *Diadumene*), which has no sphincter, but is provided with all types of nematocysts apart from the microbasic *b*-mastigophors, including atrichs, holotrichs, and macrobasic amastigophors. It is not probable that the family has been developed from the same line as the other forms provided with acontia, but from a line not far from that of *Alicia*, for it must be remarked that only the families Aliciidae and Diadumenidae have macrobasic amastigophors — as far as we at present know. Possibly the family Aiptasiidae has its origin not far from the Diadumenidae. If we retain for the present Stephenson's groups Endomyaria and Mesomyaria, it is, however, necessary to separate the forms with acontia from the Mesomyaria (see above). So I have proposed a new sub-tribus, the Acontiaria, coordinated with the Endomyaria and Mesomyaria (see Stephenson 1935 p. 181). The erection of these groups, however, has to my mind only a temporary value.

Stephenson has (1920-21) made an attempt to give an evolutionary history of the families of the Mesomyaria and Endomyaria. Issuing from an *Eosagartia* provided with acontia, he thinks, among other theories, that the families now lacking acontia previously had such organs, but later lost them. I find nothing to support such a supposition (see p. 83), and Stephenson's scheme of the evolution of the Mesomyaria is to my mind invalid. Nor can I accept his scheme for the evolution of the Endomyaria. When going into details there is much more to be discussed about Stephenson's classification of 1920-22, but as space is limited in this paper I cannot enter into a closer discussion here.

The genera can, to my mind, at present be arranged in the following manner. Several genera, the anatomy of which is quite unknown, have not been included here. The names of a few others are somewhat dubious, as their synonymy is not satisfactorily cleared up.

Sub-order **Ptychodactiaria.**

Fam. Ptychodactiidae. Genera: *Ptychodactis* App., *Dactylanthus* Carlg.

Sub-order **Corallimorpharia** (Asclerocoralliae).

Fam. Sideractiidae. Genera: *Sideractis* Dan., *Nectactis* Gray.

Fam. Corallimorphidae. Genera: *Corallimorphus* Mosel., *Isocorallion* Carlgr., *Corynactis* Allm.

Fam. Discosomidae. Genera: *Discosoma* Leuck., *Paradiscosoma* Carlgr., *Orinia* Duch. & Mich., *Rhodactis* Milne-Edw. & Haime, *Actinotryx* Duch. & Mich., *Ricordea* Duch. & Mich.

Sub-order **Actiniaria** (proper).

Tribus **Protantheae.**

Fam. Gonactiniidae. Genera: *Protanthea* Carlgr., *Gonactinia* Sars.

Tribus **Endocoelantheae.**

Fam. Halcuriidae. Genera: *Halcurias* McMurr., *Carlgrenia* Steph.

Fam. Actinernidae. Genera: *Actinernus* Verr., *Synhalcurias* Carlgr., *Synactinernus* Carlgr., *Isoactinernus* Carlgr.

Tribus **Nynantheae.**

Sub-tribus Boloceroidaria.

Fam. Boloceroididae. Genera: *Bolocerodes* Carlgr., *Boloceractis* Panik., *Bunodeopsis* Andr.

Fam. Nevadneidae. Genus: *Nevadne* Steph.

Sub-tribus Athenaria or Abasilaria.

Fam. Edwardsiidae. Genera: *Edwardsia* Quatr., *Isoedwardsia* Carlgr., *Fagesia* Delphy (*Milne-Edwardsia* Carlgr.), *Paraedwardsia* Carlgr., *Nematostella* Steph.

Fam. Limnactiniidae. Genus: *Limnactinia* Carlgr.

Fam. Halcampoididae. Genera: *Halcampoides* Dan., *Halcampella* (Andr.) R. Hertwig, *Synhalcampella* Carlgr., *Pentactinia* Carlgr., *Acthelmis* Lutk., *Scytophorus* R. Hertw., *Halcampogeton* Carlgr.

Fam. Haloclavidae. Genera: *Haloclava* Verr., *Anemonactis* Andr. (*Eloactis* Andr.), *Peachia* Gosse, *Mesacmaea* Andr., *Oractis* McMurr., *Harenactis* Torr., *Siphonactinopsis* Carlgr.

Fam. Halcampidae. Genera: *Halcampa* Gosse, *Parahalcampa* Carlgr., *Halcampaster* Carlgr., *Cactosoma* Dan., *Halianthella* Kwietn., *Mena* Steph.

Fam. Octineonidae. Genus: *Octineon* Fowl.

Fam. Andwakiidae. Genus: *Andwakia* Dan.

Fam. Halcampactidae (perhaps two families). Genera: *Halcampactis* Farq., *Pelocoetes* Ann., *Phytocoetes* Ann., *Phytocoetopsis* Panik., *Stephensonactis* Panik., *Haliactis* Carlgr.

Sub-tribus Endomyaria.

Fam. Aliciidae. Genera: *Alicia* Johns., *Phyllodiscus* Kwietn., *Lebrunia* Duch. & Mich.

Fam. Condylanthidae. Genera: *Condylanthus* Carlgr., *Charisea* Torr., *Macrocnema* Carlgr.

[illegible] Duch. &
[illegible] McMurr., [illegible]
[illegible] Risso,
[illegible] Carlgr.
[illegible] Carlgr., [illegible]
[illegible] R. Hertw.,
[illegible] McMurr., [illegible] Verr.,
[illegible] Duch. & Mich., [illegible]
[illegible] Carlgr., [illegible]
[illegible] Gosse, [illegible] Carlgr.,
[illegible] McMurr., [illegible] Verr.,
[illegible] Milne-Edw., [illegible] Milne-
[illegible] Milne-Edw. & Haime, [illegible]
[illegible] McMurr., [illegible] Lager.
[illegible] Gosse, [illegible] Duch. &
[illegible]

Fam. [illegible] Genus: [illegible] Brandt.
Fam. [illegible] Genera: [illegible] Hadd., *Radianthus* [illegible]
Fam. [illegible] Genus: [illegible] Duerd.
Fam. [illegible] Genera: [illegible] Milne-Edw., *Heteran-* [illegible]
Fam. [illegible] Genera: *Thalassianthus* Leuck., *Hetero-* [illegible] Klunz., *Actineria* Blainv.
Fam. [illegible] Genera: *Actinodendron* Blainv., *Megalactis* [illegible] Kwietn.
Subtribus [illegible]
Fam. [illegible] Genus: [illegible] Steph.
Fam. [illegible] Genus: *Aiptasiomorpha* Steph.
Fam. [illegible] Genus: *Acontiophorum* Carlgr.

Fam. Aiptasiidae. Genera: *Aiptasia* Gosse, *Heteractis* Milne-Edw., *Bartholomea* Duch. & Mich., *Carlgrenella* Watzl.
Fam. Metridiidae. Genus: *Metridium* Oken.
Fam. Bathyphelliidae. Genera: *Bathyphellia* Carlgr., *Aeraspedanthus* Carlgr., *Phelliogeton* Carlgr., *Daontesia* Carlgr.
Fam. Hormathiidae. Genera: *Hormathia* Gosse, *Actinauge* Verr., *Phellactis* Simon, *Paraphellactis* Carlgr., *Chondrophellia* Carlgr., *Cataphellia* Steph., *Paraphellia* Hadd., *Allantactis* Dan., *Calliactis* Verr., *Paracalliactis* Carlgr., *Adamsia* Forb., *Cricophorus* Carlgr., *Stephanauge* Verr., *Amphianthus* R. Hertw.
Fam. Sagartiidae. Genera: *Sagartia* Gosse, *Cereus* Oken, *Sagartiogeton* Carlgr., *Kadosactis* Dan., *Actinothoe* Fisch., *Anthothoe* Carlgr., *Choriactis* McMurr., *Artemidactis* Steph., *Phellia* Gosse.
Fam. Isophelliidae. Genera: *Isophellia* Carlgr., *Litophellia* Carlgr., *Decaphellia* Bourne, *Flosmaris* Steph., *Telmatactis* Gray.
Fam. Sagartiomorphidae. Genus: *Sagartiomorphe* Kwietn.
Fam. Nemanthidae. Genus: *Nemanthus* Carlgr.
Subtribus Mesomyaria.
Fam. Isanthidae. Genus: *Isanthus* Carlgr.
Fam. Actinostolidae. Genera: *Paranthus* Andr., *Actinoscyphia* Steph., *Antholoba* R. Hertw., *Actinostola* Verr., *Paractinostola* Carlgr., *Stomphia* Gosse, *Anthosactis* Dan., *Tealidium* R. Hertw., *Hormosoma* Steph., *Bathydactylus* Carlgr., *Cnidanthus* Carlgr., *Sicyonis* R. Hertw., *Parasicyonis* Carlgr., *Isosicyonis* Carlgr., *Synsicyonis* Carlgr., *Antiparactis* Verr., *Epiparactis* Carlgr., *Pycnanthus* McMurr., *Ophiodiscus* R. Hertw., *Isoparactis* Steph.
Fam. Exocoelactiidae. Genus: *Exocoelactis* Carlgr. (= *Polysiphonia* R. Hertw.).

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[illegible] Representant [illegible] Bergens Mus. Aarbog [illegible]

[illegible] Bergens [illegible]

[illegible] *Halcampoides* [illegible]

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ACTINIARIA. Part II (1942)

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Fig. 1. [illegible] $^1/_2$. Trondhemsfjord.

2. *H*[illegible], $^1/_1$. N.W. to W. of Højen, Skagerrak. [illegible]

3. *H*[illegible] upon *H*[illegible], about $^1/_2$. Iceland.

4. *P*[illegible], $^1/_1$. Ingolf exp. St. 95.

5. *H*[illegible], about $^1/_1$. Kattegat 10 $^1/_4$ miles N.W. to W. of Kullen.

6. *H*[illegible], $^1/_1$. Skagerrak. 11 miles N.W. to W. of Højen, [illegible] m.

Fig. 7. *Paraphelliactis spinosa*, almost nat. size. Ingolf exped. St. 95.

8. *Hormathia digitata*, about nat. size. Norway. Finmarken, Rognsund.

9. *Phelliactis robusta*, almost nat. size. Ingolf exp. St. 10.

10. *Chondrophellia coronata*, a little magnified. Ingolf exp. St. 18.

11. *Hormathia digitata*, $^1/_1$. West Greenland. Ingolf exp. St. 29.

12. *Phelliactis robusta*, $^1/_1$. Ingolf exp. St. 32.


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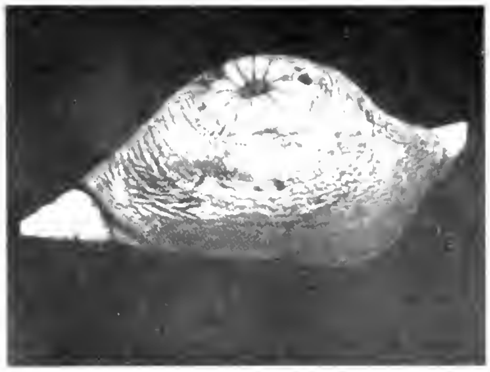
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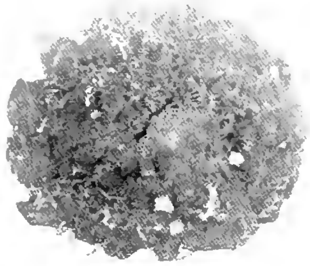
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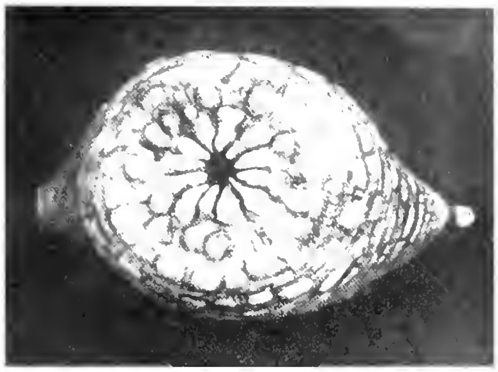
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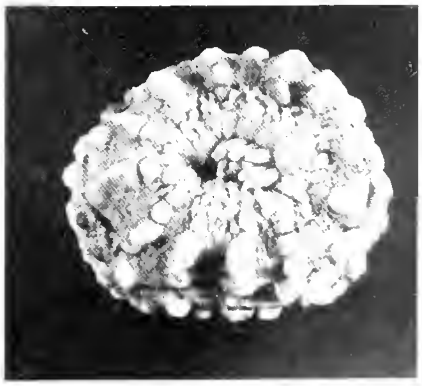
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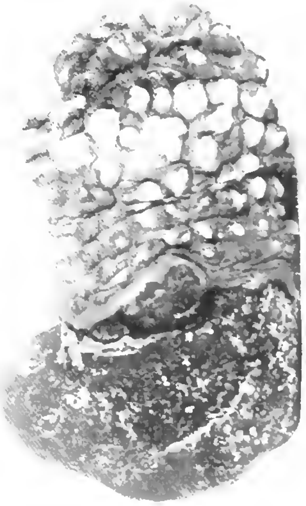
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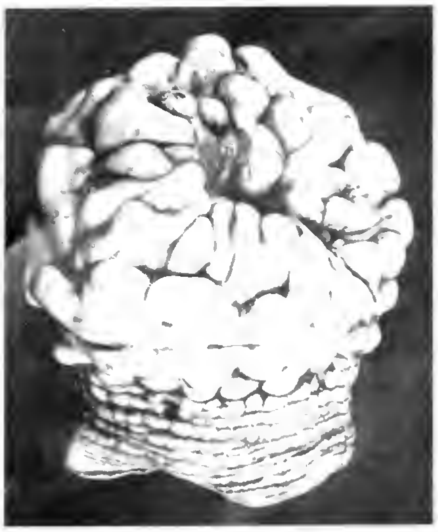
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Plate II.

Actinauge verrilli.

Fig. 6. A little reduced. Godthaab exp. St. 61.
7. $^1/_1$. Tjalfe exp. St. 100.
8. A little reduced. Godthaab exp. St. 77.
9. A little reduced. U.S. Fish Com. 40°03′ N. 70°28′ W.
10. A little reduced. Godthaab exp. St. 77.


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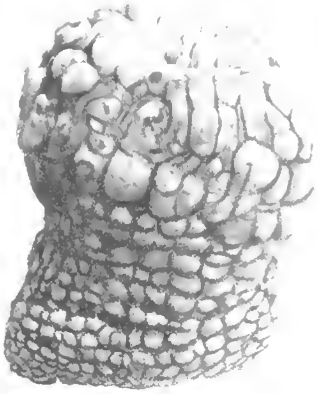
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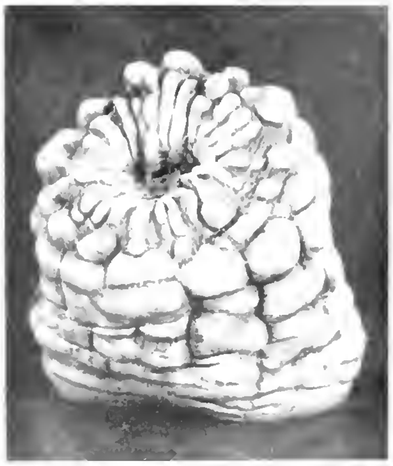
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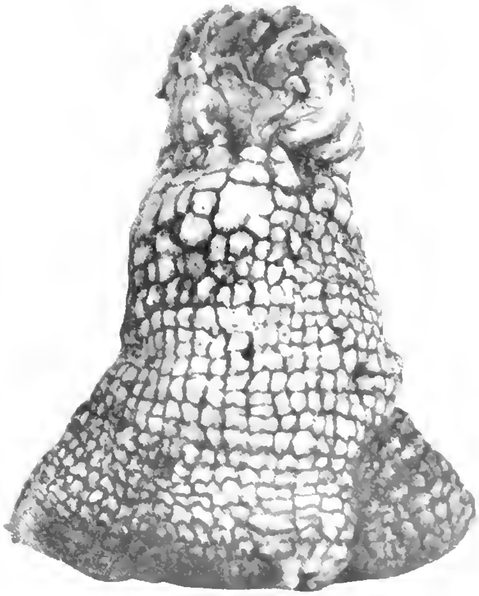
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Plate III.

Fig. 1. *D*[illegible] $^2/_1$. [illegible]

2. *H*[illegible] $^1/_1$.

3. *H*[illegible] $^1/_1$.

4. *K*[illegible], about $^2/_1$. Norway, Hjeltefjord.

5. *I*[illegible], $^1/_1$. Jæderen, Norway.

6. *I*[illegible], $1^1/_2$. Trondhemfjord.

7. *I*[illegible] $^1/_1$ [illegible] Bergen, Norway.

8. *S*[illegible], $1^1/_2$. Rockall.

9. *H*[illegible] var. [illegible], about $^2/_1$. Kara Sea.

Fig. 10. *Bathyphellia margaritacea*, $^2/_1$.

11. *Hormathia digitata* var. *coque*, $^1/_1$. E. of Tajmyr Peninsula, Siberia.

12. *Hormathia digitata* var. *coque*, $^1/_1$. Blischni, Siberia.

13. *Sagartiogeton laceratus*, $^1/_1$. The Sound.

14. *Allantactis parasitica*, $^1/_1$. E. of Tajmyr Peninsula, Siberia.

15. *Sagartiogeton undatus*, $^1/_1$. The Sound.

16. *Sagartiogeton undatus*, $^2/_1$. Marstrand.


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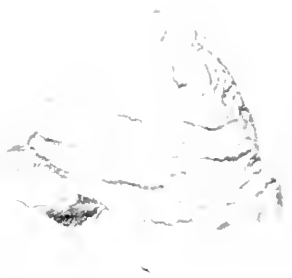


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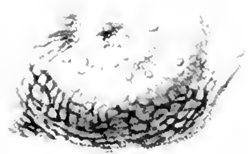
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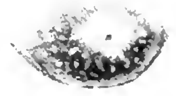
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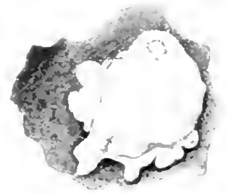
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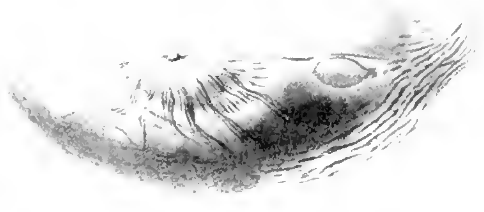
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Plate IV.

Fig. 1. [illegible] A little magnified. Michael Sars exp. [illegible]

2. [illegible] $^1/_1$. Heltefjord. Bredholmen. Nor-[illegible]

3. [illegible] A little magnified. Trondhemfjord.

4. *P*[illegible] $^1/_1$. Ingolf exp. St. 40.

5. [illegible] var. [illegible], about $^1/_1$. Finmarken. [illegible]

Fig. 6. *Hormathia nodosa.* $^1/_1$. Faroe Isl.

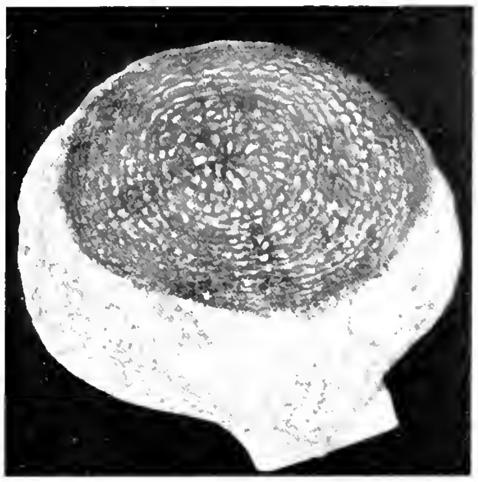
7. *Andvakia parva.* Very much magnified.

8. *Phellactis robusta.* About $^1/_1$. Sofia exp. 1883.

9. *Allantactis parasitica.* About $^3/_4$. East Greenland.

10. *Hormathia nodosa.* $^1/_1$. Hammarfest.

11. *Phellactis hertwigi.* $^2/_3$. Ingolf exp. St. 64.



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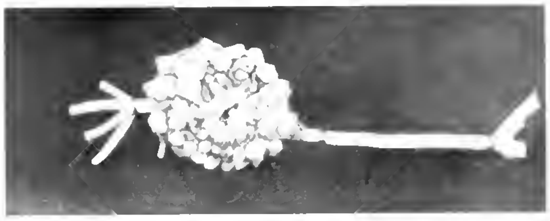

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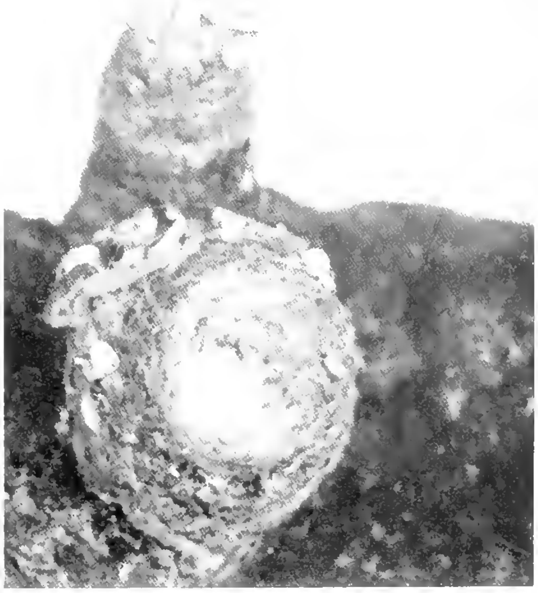

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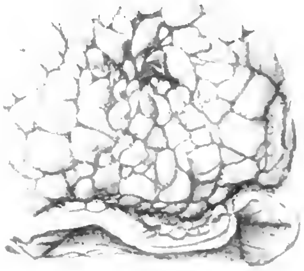

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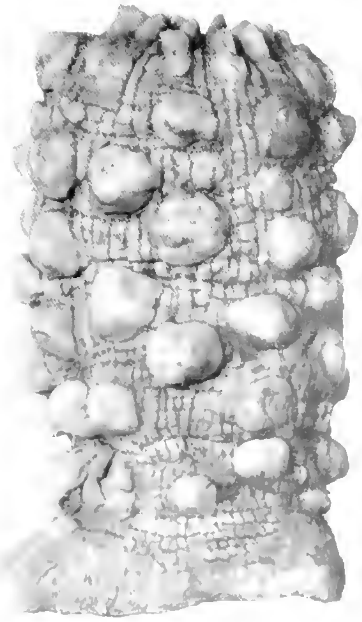

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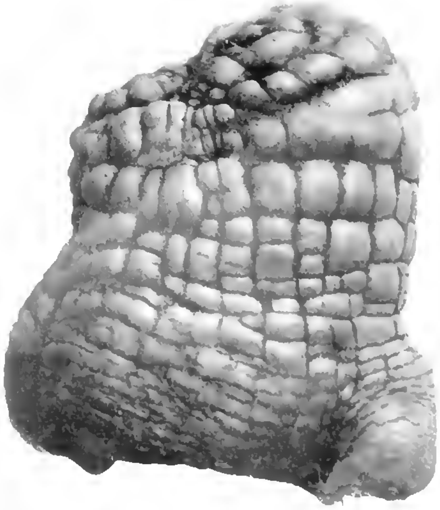

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Plate V.

Fig. 1. *D[illegible]* Section of the scapus showing tenaculi.

2. *P[illegible]gata.* Section of the scapus with tenaculum.

3. *S[illegible]* Section of the scapus with a tena-[illegible]

Fig. 4. *Hormathia digitata.* Kvanefjord. W. Greenland. Section of scapus showing islets of parasites in the mesogloea.

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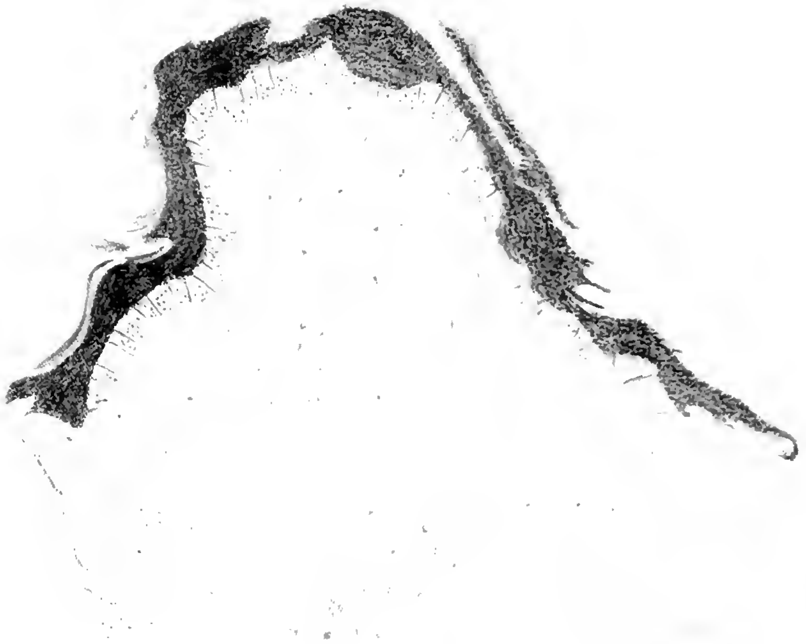

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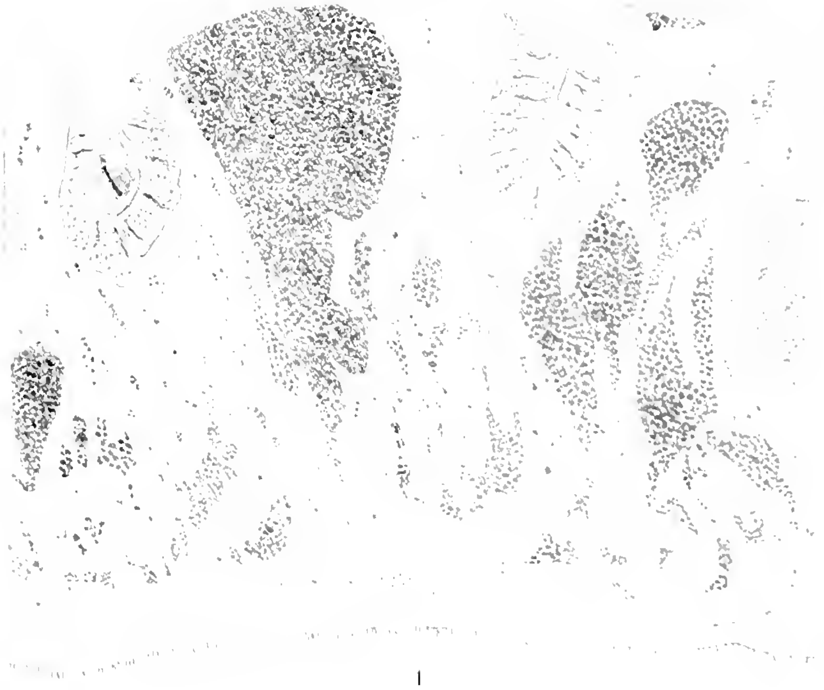

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Plate VI.

Fig. 1. [illegible] Section of the scapus showing a [illegible]

2. [illegible] Parasites in the mesogloea of [illegible]

3. [illegible] Section of the column showing a [illegible]

Fig. 5. *Hormathia digitata* var. *regia*. Section of the scapus.

6. *Sagartiogeton undatus*. Section of the column showing two tenaculi (t.).

7. *Andvakia parva*. About $^2/_1$.

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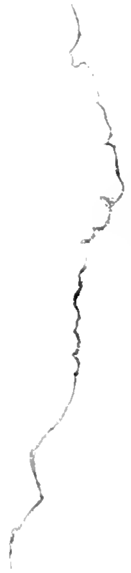

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THE INGOLF-EXPEDITION

1895—1896

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.	Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.	Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.
	1895												1896				
1	11 - V	62 30′	8 21′	249	7 2	24	25 - VI	63 06′	56 00′	2258	2 4	45	11 - V	61 32′	9 43′	1211	4 17
2	12 -	63 04′	9 22′	493	5 3	25	26 -	63 30′	54 25′	1096	3 3	46	- -	61 32′	11 36	1356	2 40
3	- -	63° 35′	10° 24′	512	0 5			63 51′	53 03′	256		47	12 -	61 32′	13 40′	1789	3 23
4	13 -	64 07′	11 12′	446	2 5	26	- -	63 57′	52 41′	64	0 6	48	- -	61 32′	15 11′	2165	3 17
5	- -	64 40′	12 09′	292				64 37′	54 24′	205		49	13 -	62 07′	15 07′	2109	2 91
6	16 -	63 43′	14 34′	170	7 0	27	1 - VII	64 54	55 10′	740	3 8	50	- -	62 43	15 07	1921	3 13
7	17 -	63 13′	15° 41′	1130	4 5	28	- -	65 14′	55 42′	791	3 5	51	15 -	64 15′	14 22	128	7 32
8	19 -	63 56′	24 40′	256	6 0	29	5 -	65 34′	54 31′	128	0 2	52	- -	63 57′	13 32′	791	7 87
9	20 -	64 18′	27 00′	555	5 8	30	10 -	66 50′	54 28′	44	1 05	53	16 -	63 15′	15 07′	1497	3 08
10	- -	64 24′	28 50′	1484	3°5	31	11 -	66 35′	55 54′	166	1 6	54	18 -	63 08′	15 40′	1301	3 9
11	21 -	64 34′	31° 12′	2448	1 6	32	11 -	66 35′	56 38′	599	3 9	55	19 -	63 33	15 02	595	5 9
12	22 -	64 38′	32 37′	1958	0°3	33	12 -	67 57′	55 30′	66	0 8	56	- -	64 00	15 09′	128	7 57
13	- -	64 47′	34 33′	1171	3 0	34	18 -	65 17′	54 17′	104		57	20 -	63 37	13 02	659	3 4
14	- -	64 45′	35 05′	331	4 4	35	- -	65 16′	55 05′	682	3 6	58	- -	64 25	12 09	397	0 8
15	4-VI	66 18′	25 59′	621	0 75	36	28 -	61 50′	56 21′	2702	1 5	59	- -	65 00	11 16	584	0 4
16	5 -	65 43′	26 58′	471	6 1	37	29 -	60 17′	54 05	3229	1 4	60	21 -	65 09	12 27	234	0 9
17	16 -	62 49′	26 55′	1403	3 4	38	30 -	59 12′	51 05′	3521	1 3	61	- -	65 03′	13 06	104	0 4
18	17 -	61 44′	30 29′	2137	3 0	39	9-VIII	62 00′	22 38	1629	2 9	62	31 -	63 18	19 12	136	[illegible]
19	18 -	60 29′	34° 14′	2949	2 4	40	- -	62 00′	21 36	1591	3 3	63	1 - VI	62 40	19 05	1566	4 0
20	20 -	58 20′	40 48′	3192	1 5	41	12 -	61 39′	17 10′	2345	2 0	64	- -	62 06	19 00	1960	3 1
21	21 -	58 01′	44 45′	2505	2·4	42	14 -	61 41	10 17	1177	0 4	65	2 -	61 33	19 00	2051	[illegible]
22	22 -	58 10′	48 25′	3474	1 4	43	- -	61 42	10 11	1215	0 05	66	-	61 33	20 13	2124	3 [illegible]
23	24 -	60 43′	56 00′	Only the Plankton-Net used		44	- -	61 42	9 36	1026	4 8	67	3 -	61 30	22 30	1836	3 0

		Station Nr.	Date	Lat N	Long W	Depth in m	Bottom-temp.	Station Nr.	Date	Lat N	Long W	Depth in m	Bottom-temp.
[illegible]	[illegible]	92	[illegible]	64 44	[illegible] 52	2838	1.4	118	24-VII	68 27	8 20'	1996	1.0
[illegible]	[illegible]	93	26	64 24	[illegible] 14	1444	1.46	119	25 -	67 53'	10 19'	1902	1.0
[illegible]	[illegible]	94		64 56	30 19	384	1.1	120	- -	67 29	11 32'	1666	1.0
87				65 31	30 45	401		121	- -	66 59'	13 11'	996	0.7
21	6.7	95	27 -	65 14	30 30	1416	2.1	122	26 -	66 42'	14 44'	217	1.8
[illegible]	4.5	96	28 -	65 24	29 00	1384	1.2	123	28 -	66 52	15 40'	273	2.0
[illegible]	3.2	97	- -	65 28	27 30	847	5.5	124	- -	67 40	15 40'	932	0.6
[illegible]		98	-	65 38	26 27	260	5.9	125	29 -	68 08'	16 02'	1373	0.8
1561		99	7-VII	66 14	25 53	352	6.1	126	- -	67 19'	15 52'	552	0.5
1469	4.5	100	9 -	66 23	14 02	111	0.4	127	2-VIII	66 35'	20 05'	83	5.6
1518	4.1	101	10 -	66 23	12 05	1011	0.7	128	- -	66 50'	20 02'	365	0.6
1791	[illegible]	102	-	66 23	10 26	1412	0.9	129	3 -	66 35'	23 47'	220	6.5
1565	4.5	103	- -	66 23	8 52	1090	0.6	130	8 -	63 00'	20 40'	636	6.55
1239	4.4	104	11	66 23	7 25	1802	1.1	131	- -	63 00'	19 09'	1314	4.7
1761	4.0	105	- -	65 34	7 31	1435	0.8	132	- -	63 00'	17 04'	1407	4.6
913	6.1	106	12	65 34	8 54	842	0.6	133	9 -	63 14	11 24'	433	2.2
1552	4.1			65 29	8 40	578		134	-	62 34	10 26	563	4.1
1717	[illegible]	107		65 5[illegible]	10 28'	926	0.3	135	10 -	62 48'	9 48'	508	0.4
889		108	13 -	65 [illegible]	12 00	183	1.1	136	-	63 01	9 11'	482	4.8
750		109	18	65 29	13 25	72	1.5	137	- -	63 14'	8 31	559	0.6
[illegible]	4.8	110	19	66 44	11 33	1171	0.8	138	- -	63 26	7 56	887	0.6
620		111	20	67 14	8 48	1619	0.9	139	-	63 36	7 30	1322	0.6
143		112		69 57	6 44	2586	1.1	140	11 -	63 29	6 57'	1469	0.9
[illegible]		113	21	69 31	7 06	2465	1.0	141	-	63 22	6 58	1279	0.6
[illegible]	6.9	114	22	70 56	7 29	1456	1.0	142	- -	63 07	7 05	1105	0.6
3	8.4	115	23	70 50	8 29	162	0.1	143	- -	62 58	7 09	731	0.4
7	4.4	116		70 05	8 26	600	0.1	144	-	62 49	7 12	520	1.6
	2	117	24	69 1[illegible]	8 2[illegible]	1889	1.0						

THE DANISH INGOLF-EXPEDITION

VOLUME V

13

OCTOCORALLIA

(STOLONIFERA TELESTACEA XENIIDEA ALCYONACEA GORGONACEA)

BY

F. JENSENIUS MADSEN

WITH 1 PLATE AND 53 FIGURES IN THE TEXT

COPENHAGEN
PRINTED BY BIANCO LUNO A/S
1944

Contents.

Introduction.

The present paper is a systematic-geographical treatment of the recent Octocorals, apart from the Pennatulacea, from the North-Atlantic Ocean north of about 50° latitude and adjacent seas. It should, however, be noted that species which apparently have their northernmost limit in the Lusitanian area, at the latitudes of Ireland and England, are not discussed here. (A list of these species: *Ceratoisis grayi*, *Chelidonisis aurantiaca*, *Corallium johnsoni*, *Stachyodes verluysii* etc. is to be found in Stephens' paper 1909).

The material of northern Octocorals in the Zoological Museum of Copenhagen which forms the basis of this paper was mainly collected by the Danish "Ingolf" Expedition, but amongst other also the Danish research steamers "Thor" and "Dana" collected several specimens. The Pennatulacea of the "Ingolf" Expedition were described in 1904 by the late Professor, Dr. H. F. E. Jungersen, who also in various papers from 1915–1917 several times announced the report of the other Octocorals from the "Ingolf" Expedition as being in preparation. Jungersen died, however, in 1917 before this work was finished, leaving no written notes apart from a manuscript on *Anthomastus*, on which species he in 1916 at the sixteenth Scandinavian Naturalists' meeting had read a small paper, published in the Danish language in 1918. The larger posthumous manuscript was published in 1927 under edition of Hj. Broch. In three other papers from 1915–1917 Jungersen dealt with the Octocorals from the waters around Greenland and the Octocorals taken in the Norwegian Sea by the Norwegian research steamer "Michael Sars". These papers include many zoogeographical remarks and very extensive synonym-lists, but they contain neither closer discussion of the systematics nor descriptions of the material, and the only new species mentioned, *Stenogorgia borealis*, was but a nomen nudum. *Stenogorgia borealis* was, however, described in 1930 by Kramp who in various papers has dealt with the Octocorals of the Faroe- and Icelandic-shelf and from the Davis Strait. Broch (1928) treated the northern Nephthyidae, but since Jungersen no authors have dealt more thoroughly with the northern deep-sea Octocorals. And though more than 25 years have elapsed since the death of Jungersen, the great material still is of the same importance as in 1916 and the three species, which Jungersen on the labels considered new ones, are still undescribed.

Jungersen had before his death sorted out and provisionally labelled most of the large collection of Octocorals preserved in the Zoological Museum at his time; only the material of small stoloniferous forms was mostly marked with queries or not sorted out at all. The three species which Jungersen designated as new were *Chrysogorgia campanula*, *Primnoella jungerseni* (named in this way as the name *gracilis* proposed by Jungersen for this delicate little species had later been used by Molander for another species of *Primnoella*), and the Stolonifera *Clavularia griegii*. Moreover, the material of small stoloniferous specimens included four other species new to science, two of them of the greatest interest as the one evidently represents a new genus, and the other belongs to a very little known genus which without doubt should be ranged in a new family, though at present it is impossible with certainty to state to which order this family belongs.

There are only some few of Jungersen's determinations which the author has not been able to confirm. The *Radicipes* specimens which were secured by the "Ingolf" were by Jungersen identified with *Strophogorgia challengeri* Wright & Studer, to which species Jungersen with a query also referred *Lepidogorgia gracilis* Verrill (Jungersen, 1915, p. 1183). This, however, is clearly contradicted by the material which includes two different species, the one, only represented by one specimen, identical with *R. challengeri*, the other, represented by several specimens, identical with *R. gracilis*. Beyond doubt, however, Jungersen himself would have discovered and corrected this lapsus during the closer examination and preparation for the intended manuscript. Jungersen also (1917) united *Paramuricea placomus* (L.) and *P. kükenthali* Broch, but in some of the material of the latter species he had on the labels written *P. placomus* f. *kükenthali*. Finally, the present author disagrees with Jungersen in the view upon the northern Nephthyidae with retractile anthocodiae, as he arrived at the conclusion that among these only one species can be distinguished, whereas Jungersen in his papers (1915–1917) maintained two species in the group.

Among the authors who have contributed to our knowledge of the northern deep-sea Octocorals may be mentioned M. Sars, Danielssen, Grieg and of more modern students besides Jungersen, Molander and Broch. A general account of the northern Octocorals has not yet been given, Jungersen, as mentioned, has in 1904 treated the Pennatulacea monographically, and Molander (1915) gave a survey of the Alcyonacea s.lat. Though in this paper stress is laid upon the deep sea species, short references have been made to the other species at present recognized in the area, and thus the reports of the "Ingolf" Expedition give a synopsis of the hitherto known northern Octocorals.

As to the taxonomic arrangement the author has followed a system such as proposed by Hickson (1930), however, with the emendation that the family Xeniidae is regarded as a distinct order (cf. Bock 1938). Thus, as also the Tubiporidae should most conveniently be regarded as a special order (cf. Bock 1938), the following eight orders[1] are recognized within the Octocorallia:

Stolonifera,
Telestacea
Xeniidea,
Alcyonacea,
Tubiporidea,
Helioporidea,
Gorgonacea { Scleraxonia,
Holaxonia,
Pennatulacea.

Of these orders only the Tubiporidea and the Helioporidea have not hitherto been found in the northern seas.

As to the terminology, the author hopes to have used it in such a way that confusion may not arise as often has been the case in the literature on Octocorals. Explanations of most of the terms used may be found in Hickson's paper (1930) or in the list of "Technical Terms" in Deichmann's paper (1936 p. 28–29). The signification of other terms used is thought to appear directly from the use.

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[1] The six first-mentioned orders are by Bock regarded as suborders of the order Alcyonaria; it seems however more convenient to regard them as orders coordinate with the Gorgonacea and Pennatulacea.

Ordo: Stolonifera Hickson 1883 emended.

[illegible] Hickson 1930 p. 238 [illegible] two families, viz. the Cornulariidae, [illegible], and the Clavulariidae with a calcareous skeleton. In the northern seas only the latter family is represented. (A form *Cyathopodium* of doubtful systematic position is provisionally ranged in the order in a family of its own).

Family Clavulariidae Hickson 1894 emended.

[illegible] the groups of Octocorals the Stolonifera is [illegible] the most heterogenous, which is due to [illegible] forms of species of the groups of fleshy [illegible] of the Gorgonacea may occasionally be [illegible] Kükenthal and Molander, conse- [illegible] order and distributed its genera over [illegible] two orders which, apart from the [illegible] within the Octocorallia, viz. the [illegible] Gorgonacea. Hickson, however, disagrees with [illegible] 1930 he proposed the system, which [illegible] has been followed in this paper. Hick- [illegible] partly an artificial one. It is, however, [illegible] followed by Kükenthal and his [illegible] more convenient.

[illegible] difficult or quite impossible to ascertain [illegible] known with membranous growth, [illegible] the order Alcyonacea or the order Gor- [illegible] of such a form to any distinct family [illegible] It is therefore convenient to [illegible] doubtful membranous forms may be [illegible] point of view, adopted by most authors, [illegible] a sort of lumber room, since [illegible] species which undoubtedly correctly [illegible] genera and species whose right places in the [illegible] From time to time, however, [illegible] their right systematic place. [illegible] important paper on the mem- [illegible] with the northern forms. The only [illegible] Clavulariidae by Molander [illegible] Alcyonaria are *Clavularia* [illegible] (Koren & Danielssen), [illegible] Verrill (Molander, 1929 [illegible] for some diverging [illegible] for this see under the [illegible] *catenatum* Forbes [illegible] to belong to the family [illegible] Koren & Danielssen and *A. fallax* [illegible] *Anthelia grandiflora* [illegible] supposed to belong [illegible] right when he [illegible] Stolonifera group, he [illegible] two species which [illegible] *Anthelia pauli-* [illegible] in the system [illegible] of *[illegible]thoporpa*. On the other hand *Clavularia stormi* (Koren & Danielssen) is without doubt a membranous specimen of *Paramuricea placomus* (L.), as stated by Broch in 1935.

In this paper both *Anthelia borealis*, *A. fallax*, *Clavularia alba* and *Sarcodictyon catenatum* are retained besides *Clavularia arctica* in the order Stolonifera in the family Clavulariidae. Besides, three new species are described, all referred to the genus *Clavularia*, though the one, *C. grieqi*, probably belongs somewhere in the Gorgonacea. The two species which Broch (1912 d) ranged in the genus *Anthelia*, as they apparently have no retractile anthocodial part, are also here placed in this genus, whereas all the other species which have a retractile anthocodia have been ranged in the genus *Clavularia*. This, however, is certainly not quite correct; it is evident that the new species *Clavularia lecdensis* and *C. venustella* described here in reality should not be placed in the same genus as *C. arctica* which has a distinct thick-walled anthostele. However, no attempts have been made here to deviate from the general course followed by the systematists of the Octocorals, but a renewed revision of the genera Stolonifera is much needed. A thorough study of the skeletal structure of the zooids and more importance attached to this as a systematic character may undoubtedly be of value. Most unfortunately, however, most species of the Clavulariidae are insufficiently described.

The author hopes later to be able to revert to this problem, and here only the following remark may be made. Broch (1939 p. 5–8, figs. 2–5) described a new species of Stolonifera, *Clavularia* (?) *diademata*, from Table Bay, South Africa, which species is distinguished by having a 16-pointed anthocodial crown, on account of which Broch supposes that it might be regarded as a new genus. A similar arrangement of the sclerites in the anthocodial head is also found in a small membranous colony taken by the "Albatross" (St. 2669, 30°09' N, 79°33'30" W., 641 m) and given to the Zool. Mus. of Copenhagen by the U. S. Nat. Mus. This colony, however, is by Deichmann identified with Verrill's *Cornulariella modesta* and, as she may have had material determined by Verrill for comparison, the correctness of the identification can hardly be doubted. The features of the specimen are, however, exactly corresponding to those described by Broch for *C. diademata*, it has exactly the same 16-pointed anthocodial crown and the same long, slender, needle-like and spinous sclerites, and if not the two forms belong to the same species they are, in any case, very closely related. The only difference between them seems to be the size of the anthostelae, which in the colony from the "Albatross", St. 2669, are considerably larger than those in the colony from Table Bay, measuring up to 23 mm.

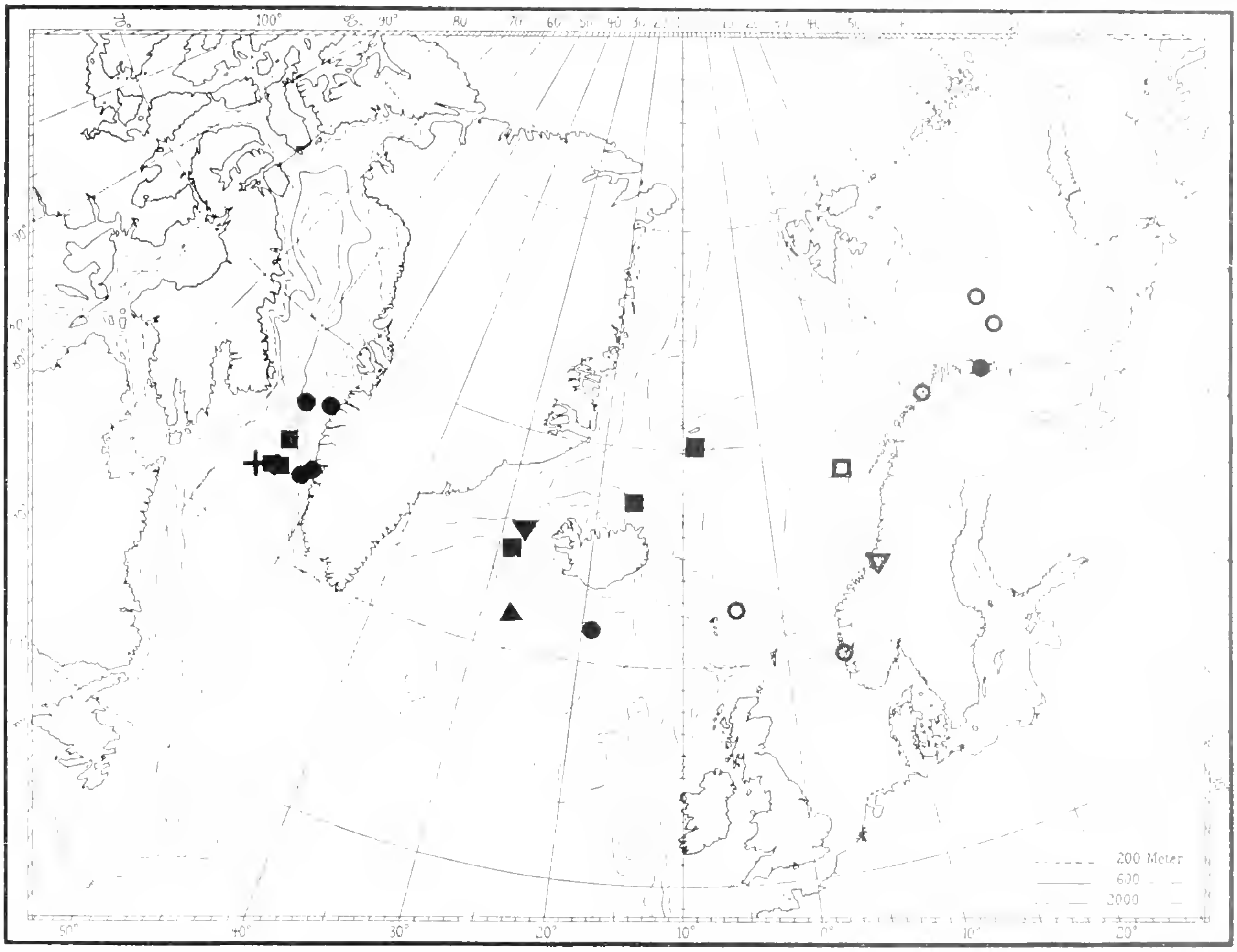

Fig. 1. ● *Clavularia arctica* (M. Sars). ■ *Clavularia alba* (Grieg). ▲ *Clavularia griegii* n. sp. + *Clavularia tridens* n. sp. & *Cl*[illegible] n. sp. ▼ *Anthelia borealis* (Koren & Danielssen). Black figures: localities represented in the Zoological Museum of Copenhagen. Open figures: localities recorded in the literature.

If thus Deichmann's identification of the specimen is correct, it may be said that Verrill's description of the species only gives a poor idea of it, and the generic name would then have to be retained for such species which have a 16-pointed anthocodial crown as described by Broch and then can not be used for the northern *Clavularia arctica* as Molander does in 1929.

It may be noted that all the species mentioned in the Clavulariidae in this paper have pinnate tentacles, which, apart from the unpaired tip, have only one single row of pinnulae on each side.

Genus **Clavularia** Quoy & Gaimard 1830.

Clavularia arctica (M. Sars 1860).

Rhizoxenia arctica M. Sars, 1860, p. 2.
Clavularia arctica Koren & Danielssen, 1883, p. 12, pl. 3 figs. 25-35.
Clavularia arctica Broch, 1912 *c*, p. 3-8, figs. 1-3.
Jungersen, 1915, p. 1161.
1917, p. 1-5.
Rylov, 1926 *b*, p. 237-239, 243-244, fig. 3.
J. A. Thomson, 1927, p. 7.
Cornulariella Molander, 1929, p. 23.
Clavularia Kramp, 1932, p. 16, 19.

For further references vide Broch 1912 *c* and Jungersen 1917.

Description: Vide Broch 1912 *c*.

Material:

Vadsø (Varangerfjord, northern Norway) 95-110 m. Cotypes of *Clavularia arctica* Koren & Danielssen.
Store Hellefiskebanke (N. of Holstensborg, W. Greenland) [illegible] "Fylla" 1881. 1 colony.
Davis Strait 188 m. "Fylla" 1884. Several colonies.
63°56' N, 53°12' W. 215 m. Wandel 1889. 1 colony.
66°19' N, 56°28' W. 150 m. Wandel 1889. 1 colony.
61°33' N, 19°00' W. 2051 m, 3° C. "Ingolf" St. 65. 1 colony.
Godthaabsfjord (W. Greenland) "Tjalfe" St. 52. 1 colony.

Remarks: The material consists of ribbon-like, sometimes anastomosing stolons, creeping upon stones, hydroids, sponges, barnacles, polyzoan colonies, or mollusc shells.

In most of the specimens the zooids are placed at fairly regular intervals of a few millimetres. In one colony (the "Tjalfe" St. 52) the more than half a hundred zooids are, however, so densely crowded that there are no spaces between them. Most zooids are more or less contracted and nearly all have the anthocodiae retracted into the anthostele. The largest zooids, which are those from the type locality Vadsø, have an anthostele which measures about 13 mm in height, having a diameter of about 5 mm. In the other colonies the zooids are somewhat smaller, the largest anthostele measures in some of the colonies from the Davis Strait about 10 mm in height, whereas in other specimens from the same locality it measures but 5 mm. Broch states for the largest extended zooids in his material a "16 mm hohem Kelch" by 2.5-3 mm in breadth.

The spiculation agrees in all the specimens, apart from that [illegible] description [illegible] being [illegible] sclerites [illegible] St. 6[illegible], however, is [illegible] in this [illegible] 1.5 mm in diameter [illegible] the inconvenience [illegible] of corresponding [illegible] however, no doubt [illegible] the type of sclerites, [illegible] agrees well with Broch's [illegible] anthostele a few sclerites may [illegible] 0.5 mm.

[illegible] the above-mentioned localities, [illegible] Sea and the type locality Varanger [illegible] from the Hardangerfjord (southern [illegible] Norway and east of the Faroes. [illegible] two localities in the Barents [illegible] N. along the meridian of Kola and finally [illegible] 1927 recorded the species from two localities [illegible] and 1710 m respectively. Chart of distri[illegible]

[illegible] 75–2050 m.

Clavularia alba (Grieg 1888)

[illegible] Grieg 1888, p. 7, 15, pl. 1 figs. 1–34.
[illegible] Hickson 1894, p. 356.
[illegible] May 1900, p. 383.
[illegible] Jungersen 1915, p. 1162.
[illegible] (M. Sars) Molander 1915, p. 28.
[illegible] Kükenthal 1916, p. 161.
[illegible] Molander 1918 b, p. 11–19.
[illegible] Molander 1929, p. 18, 36–37, pl. 3 fig. 9.
[illegible] Kramp 1932, p. 4.

[illegible] Grieg 1888 and Molander 1918 b.

M[illegible]

[illegible] N. [illegible] W. 1484 m, 3.5 C. "Ingolf" St. 10. Some colonies.
[illegible] N. [illegible] W. 1096 m, 3.3 C. "Ingolf" St. 25. Some colonies.
[illegible] N. [illegible] W. 740 m, 3.8 C. "Ingolf" St. 27. 1 colony.
[illegible] N. [illegible] W. [illegible] "Ingolf" St. 116. A few [illegible]
[illegible] N. [illegible] W. 752 m, [illegible] C. "Ingolf" St. 126. Some [illegible]
[illegible] W. 1200 m, 3.28 C. "Godthaab" St. 179. 1 colony.

[illegible] comprises both colonies with membr[illegible] ribbon-like stolons extended [illegible] and those from the "In[illegible] *Ocnophe conchylega* M. Sars, [illegible] N. 9 11 E. 1159 m. [illegible] scattered, however, in the [illegible] St. 179 collected in groups of four [illegible] a few mm high, but [illegible] specimen was col[illegible] small piece of stolon [illegible] no doubt belonging to [illegible] has an anthostele [illegible] Octocorals with [illegible] was stated as [illegible] St. 126 were described by [illegible] mentioned above [illegible] 1928 considered the species synonymous with *Anthothela grandiflora* (M. Sars), by a re-examination in 1918 he, however, changed his view and now regarded the species as a membranous form of *Gersemia fruticosa* (M. Sars). There is, however, no doubt that *Rhizoxenia alba* is a distinct species which is neither identical with *Anthothela grandiflora* nor with *Gersemia fruticosa*, and to this conclusion MOLANDER also arrived in his paper of 1929 where on p. 36–37 he withdraws his previous statements, holding that the species should be regarded as a membranous species of the genus *Anthothela*, though not identical with *A. grandiflora*.

When DEICHMANN in 1936 enumerated *R. alba* in the synonym list of *Anthothela grandiflora* it was on the basis of MOLANDER'S statement, since no specimens were examined, and KÜKENTHAL, who in 1919 mentions *R. alba* among the synonyms to *Anthothela grandiflora*, in 1924 omitted it here.

Distribution. Besides the above-mentioned localities the species is only known from the type locality. Its distribution comprises thus the Norwegian Sea, Danmark Strait, and Davis Strait in depths from 552–1484 m. Chart of distribution, fig. 1.

Clavularia griegii n. sp.

Material:
61 44 N. 27 00 W. 913 m, 6.1 C. "Ingolf" St. 81.

Diagnosis: Membranous Octocorals with zooids distinctly divided into a rigid, thick-walled anthostele and an entirely retractile anthocodia. Size of verrucae up to 2 mm in height by 3.5 mm in diameter at the base. Sclerites of stolon warty, pointed spindles of two types, the most common, slender ones measuring about 0.4 × 0.03 mm, and scattered among these some larger ones measuring about 0.6 × 0.075 mm. Sclerites of anthostele warty and pointed spindles measuring up to 1.1 mm in length, and besides a few which have an upper more irregularly formed end, sometimes giving the sclerite a "club" shaped appearance. Sclerites of the anthocodia in the lower part scattered, transversally arranged, straight, slender spindles, in the upper part somewhat larger and often club-shaped ones, measuring up to about 0.8 mm, arranged en chevron and continuing uninterruptedly in the sclerite rows of the tentacle dorsa. In the lower part of tentacle dorsum club shaped sclerites arranged in a double row with the blunt ends pointing outwards. In the outer part small, flat, transversally arranged rods. In pinnulae numerous small, flat sclerites.

Types. In the Zoological Museum of Copenhagen.

Description. The material consists of some small fragments of stolon which are attached to polyzoan colonies and a dead fragment of *Lophelia*. Altogether fifteen zooids are preserved

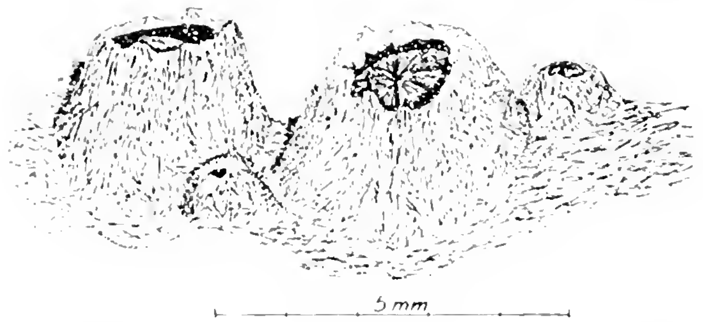

Fig. [illegible] *Clavularia griegii* n. sp. Sketch of a fragmentary colony showing the crater-shaped verrucae which are formed when the anthocodiae are retracted into the anthostelae.

The largest fragment of a stolon is 13 mm in length measuring, where it is broadest, about 4 mm in width. The stolon is branched, the side branch measuring about 5 mm in length, and it is provided with eight rather closely placed zooids. The largest interval between two zooids is about 4 mm. Another fragment of a stolon (fig. 2) measures about 9.5 mm in length and 3 mm in width, being provided with four zooids, which all have the anthocodia retracted into the anthostele. The two largest anthostelae measure 2 mm in height and 3 and 3.5 mm respectively in diameter at the base. The interval between them is scarcely 0.3 mm. The smaller zooids which are placed close at each other have anthostelae about 0.75 mm high.

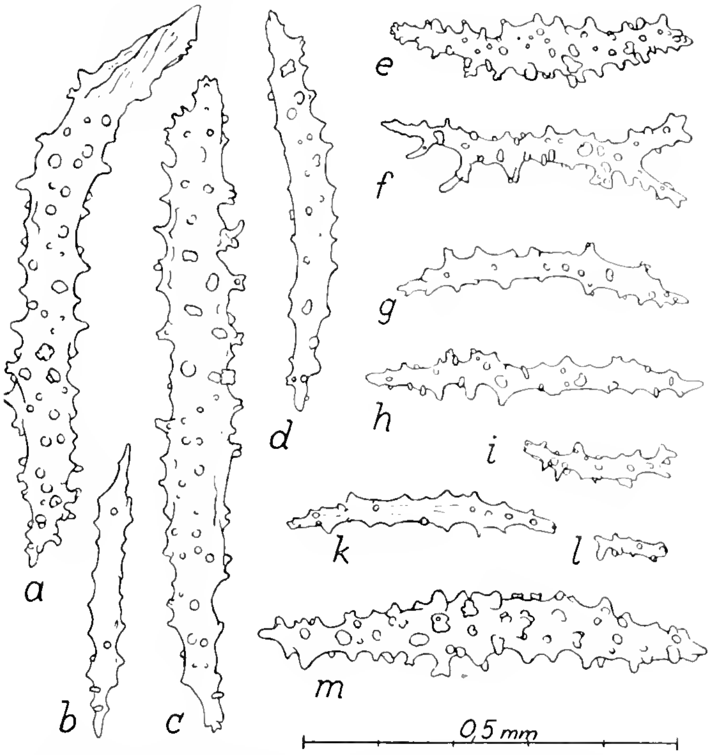

Fig. 3. *Clavularia griegii* n. sp. *a–d*, sclerites of anthostele. *e–m*, sclerites of stolon. *g–k*, of the usual slender type. *e*, *m*, of the larger and more seldom type. *m*, of the usual size. *f*, a branched sclerite from the stolon.

In none of the stolon-fragments the zooids are placed in a single row, and as moreover the stolons are somewhat extended here and there, it is most probable that the stolon in larger specimens is membranous. The verrucae measure from 0.5–2 mm in height.

When alive the specimens were stated to be straw-coloured and they are now in alcohol greyish white.

The sclerites in the stolon are warty spindles crosswise placed, though mostly in a longitudinal direction (fig. 3 *e–m*). The great majority of them are slender, straight or somewhat curved, generally measuring 0.35–0.45 × about 0.03 mm (fig. 3 *g–l*); scattered among these are, however, a few considerably stouter and also more strongly warted ones in average measuring 0.6 × 0.075 mm (fig. 3 *m*). A few slightly branched spindles may be found (fig. 3 *f*), and in a small fragment of a stolon which is supposed to be of the same species, though most unfortunately all the zooids have been worn off, most of the spindles are of this type, several of them even much more branched.

The zooids have entirely retractile anthocodiae and are provided with a distinct, thick-walled anthostele in which the sclerites are mostly closely and irregularly placed in a longitudinal direction though often indistinctly arranged in eight converging double rows. At the base the sclerites are arranged more transversally.

The sclerites of the anthostele are warty, straight or curved spindles with both ends pointed (fig. 3 *b–d*). The largest measured is 1.1 mm in length, but else their length only seldom exceeds about 0.8 mm. Numerous smaller sclerites occur among the larger ones, and in the younger zooids all the sclerites are small and of about the same size. Besides the pointed spindles there may be, in each of the eight double rows, a few, usually curved, sclerites which have the upper end more irregularly formed, without warts, provided with ridges, often flattened and blunt and sometimes slightly protruding (fig. 3 *a*). Sometimes these sclerites may have the appearance of clubs.

The sclerites in the lower part of the anthocodia are slender and usually straight spindles, which are transversally and fairly scatteredly arranged and generally measure less than 0.5 mm in length (fig. 4 *m–o*). The sclerites in the upper part of the anthocodia are arranged en chevron in eight double rows (fig. 4 *p*). They are curved, warty spindles which measure up to 0.2 mm. Those lowermost in the anthocodial crown have both ends pointed whereas the uppermost have a blunt and irregularly formed upper end (fig. 4 *i*, *k*) and resemble the corresponding type of the anthostele. The points of the anthocodial crown continue uninterruptedly in the rows of sclerites in the tentacle dorsa. In the tentacle base the sclerites (fig. 4 *h*) resemble those of the anthocodial crown, but else the sclerites in the lower part of the tentacle dorsum are about 0.4 mm long, curved clubs which are arranged in a double row with their blunt ends pointing outwards (fig. 4 *f*, *g*). The upper part of the tentacle dorsum is provided with irregularly transversally arranged, generally flattened rods measuring about 0.2 mm (fig. 4 *b–e*), and also the pinnulae which number about 8–10 pairs are strongly armed with numerous small, flat sclerites (fig. 4 *a*).

The anthocodia retracts into the anthostele in a similar manner as that described below for *Clavularia kerdensis*. The very rigid anthostele may, however, not be drawn together above the te-

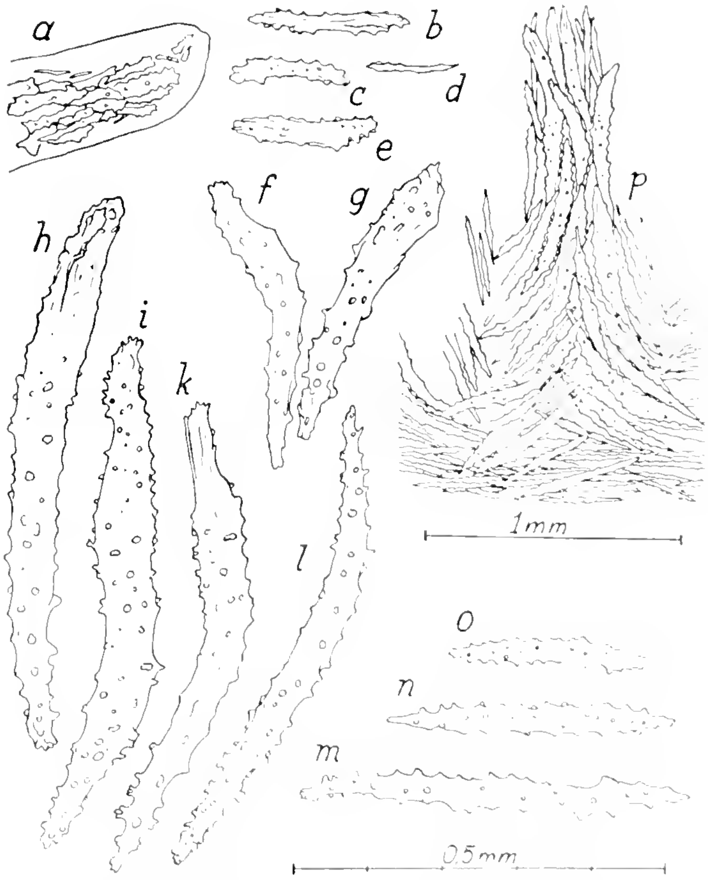

Fig. 4. *Clavularia griegii* n. sp. *a*, a pinnule with sclerites. *b–e*, sclerites of outer part of tentacle. *f*, *g*, sclerites of lower part of tentacle. *h*, sclerite from tentacle base. *i–l*, sclerites of anthocodial crown. *m–o*, sclerites of lower part of anthocodia. *p*, upper part of anthocodia showing the sclerites in natural position in one of the eight points of the anthocodial crown and the tentacle base.

[illegible] used [illegible] referred to the [illegible] ttered, larger [illegible] the double [illegible] of the tentacle, [illegible] may yield this [illegible] (Broch) [illegible] colony will be described [illegible] clubs, the two forms of [illegible] arrangement of the clubs in the [illegible] is a distinct species.

[illegible] bles the *Clavularia* like species [illegible] VERRILL (1922 p. 37, pl. 7, figs. [illegible] *Telestula rudis* and which species [illegible] may be a membranous form of [illegible] from VERRILL's somewhat [illegible] identification of his new species with [illegible] not probable. The species bears, [illegible] *C.* [illegible]. The size of the sclerites [illegible] two species, and VERRILL's figures show [illegible] found both in the anthocodia and [illegible] branched sclerites in the coenenchyma. [illegible] the two species is not possible. VERRILL [illegible] sclerites in the coenenchyma. The inner [illegible] VERRILL's figures, mainly composed of small [illegible] Such are not found in *C.* [illegible] and this [illegible] to separate the two species. The [illegible] are too insufficiently described to [illegible]

[illegible] studies will show that both *T. rudis* [illegible] have been placed among the Stolonifera [illegible] membranous forms of upright branched Gor[illegible]

C. [illegible] is at present only known [illegible] water southwest of Iceland. Chart of [illegible]

Clavularia levidensis n. sp.

[illegible] 2 [illegible] Ingolf St. 24. About 50 [illegible]

[illegible] 20 mm in height when [illegible] but thin walled in their [illegible] between anthostele and [illegible] slightly spinous. In the main [illegible] horizontally arranged, in [illegible] however, arranged en chevron [illegible] uninterruptedly in the rows of [illegible] of sclerites in the [illegible] lower part of tentacles [illegible] arranged. In outer part of [illegible]

[illegible]

[illegible] about fifty single [illegible] small worm [illegible] however, [illegible] has the [illegible]

[illegible] corre[illegible] of the highest [illegible] a diameter [illegible] the contrary [illegible] zooid body only 7 mm high. Most zooids are somewhat smaller than those of which the measures are given here.

The colour of the specimens in alcohol is greyish or light brown.

The sclerites of the species are almost needle-like and slightly spinous. They are in the lower part of the zooid body typically horizontally placed (fig. 5 *a*) become, however, in the more extended zooids more irregularly arranged, often in fan-shaped groups (fig. 5 *c*). In most zooids the sclerites measure generally 0.2–0.3 mm × 0.015 mm (fig. 6 *a*). The sclerites in some specimens may, however, have a somewhat larger average size, the maximum size of them being about 0.6 mm × 0.03 mm, and whereas the sclerites generally are almost straight, with blunt ends and about the same diameter in their whole length, those of the larger size are more pointed and often slightly curved (fig. 6 *b*).

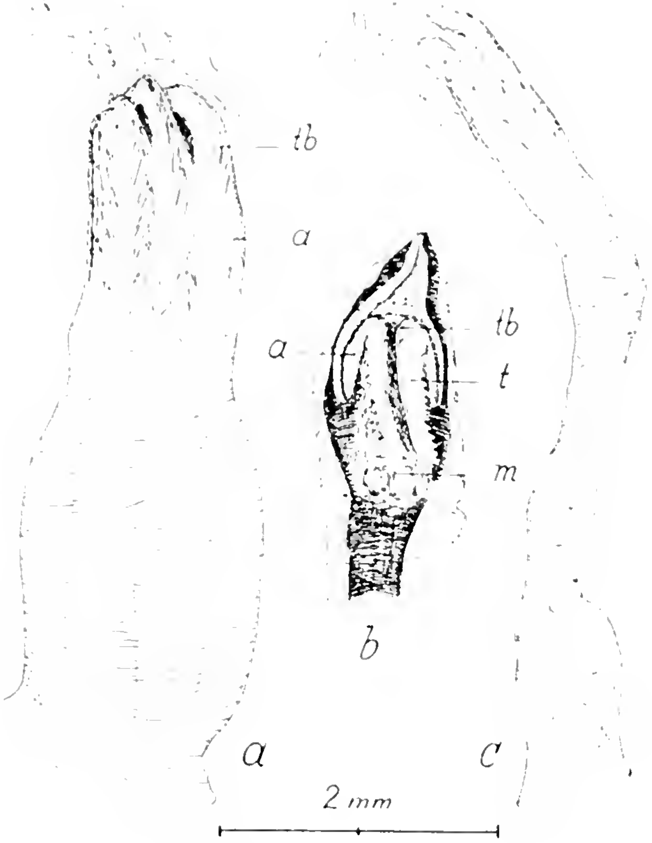

Fig. 5. *Clavularia levidensis* n. sp. *a*, *c*, sketches of two zooids, *c*, younger than *a* (compare the size of the anthocodial crowns) but more extended. *b*, zooid with retracted anthocodia shown in longitudinal section. *m*, mesenteric filaments, only indicated. *t*, tentacles. *tb*, tentacle base. *a*, anthocodial crown.

In the upper part of the zooid body the sclerites are arranged en chevron in eight intermesenterial double rows. The number of sclerites in the rows increases considerably with the age of the specimens. These sclerites are slightly curved and measure in average about 0.3 × 0.01–0.015 mm (fig. 6 *c*), and also in those specimens with larger sclerites in the lower part of zooid body their maximum size does not seem to exceed about 0.4 mm.

The eight rows of sclerites continue uninterruptedly in those of the tentacle dorsa. At the tentacle base the sclerites are likewise arranged en chevron whereas in the lower part of the tentacles they are longitudinally arranged. They here reach a length of about 0.2 mm and are fairly strongly warty (fig. 6 *d*). In the outer half of tentacles the sclerites decrease in size and are scattered and more transversally arranged (fig. 6 *e*, *f*).

The pinnulae number about 12 pairs in each tentacle and are devoid of sclerites.

The specimens are probably all fairly young ones as generally there is no trace of a stolon. However, the zooids are mostly not juvenile as in some of them fairly large eggs were found. In a few zooids the base is somewhat extended and flattened down upon the foraminiferans. In these rudiments of stolon the sclerites are of the same type as in the zooid body.

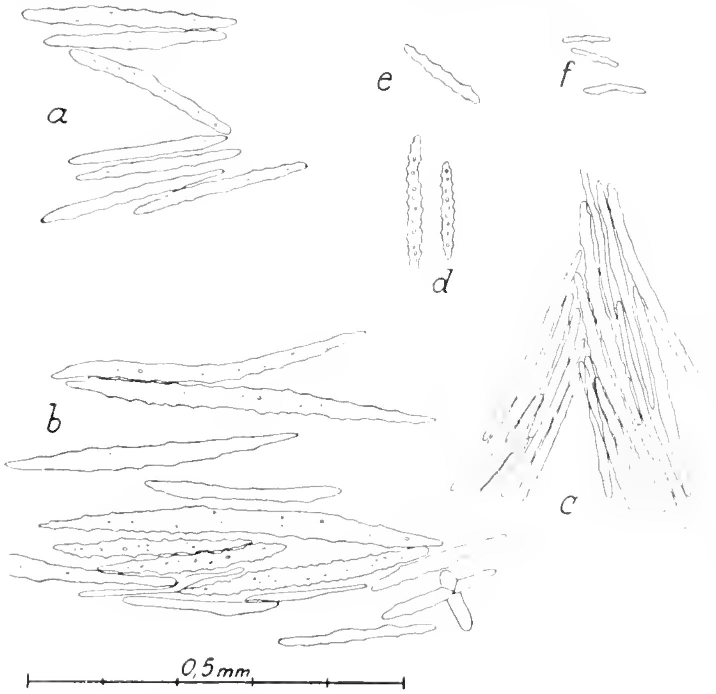

Fig. 6. *Clavularia levidensis* n. sp. *a*, *b*, sclerites from lower part of body wall (anthostele) in natural position. *a*, sclerites of the usual size. *b*, sclerites of the largest type. *c*, sclerites of anthocodial crown in natural position. *d*, longitudinally arranged sclerites from lower part of tentacle. *e*, sclerite from outer part of tentacle. *f*, sclerites from outermost part of tentacle in natural position.

The zooids are thin-walled in their whole length, and thus it is not possible to distinguish clearly between an anthostele and an anthocodia; and if the upper part in one of the fifty specimens had not been retracted the species should probably erroneously have been described as non-retractile. The dissection of the only retracted specimen shows (fig. 5 *b*) that, by retraction, the upper part of the zooid with the crown of sclerites is simply withdrawn into the coelenteric cavity, whereas the upper part of that portion of the zooid body which is armed with transversally arranged sclerites (i. e. the lower part of the anthocodia) closes about and above it. The tentacles are not inverted when retracted, but simply put down into the coelenteric cavity.

Discussion: See under the following species.

Distribution: Davis Strait, 2258 m. Chart of distribution, fig. 1.

Clavularia venustella n. sp.

Material:
63°06′ N., 56°00′ W., 2258 m, 2.4° C. "Ingolf" St. 21. About 100 zooids.

Diagnosis: Zooids small, less than 10 mm high, with retractile upper part, but thin-walled in their whole length. Stolon ribbon-like, branched at varying angles and sometimes anastomosing. Sclerites of stolon longitudinally arranged, warty spindles about 0.3–0.4 mm in length. Sclerites of lower part of zooid body transversally arranged, warty, often somewhat flattened rods, size generally 0.2–0.3 mm. Sclerites of upper part of zooid body warty spindles, maximum size about 0.1 × 0.03 mm, arranged en chevron in eight double rows which continue uninterruptedly in the rows of sclerites in the tentacle dorsa. The lower part of tentacle dorsum provided with longitudinally and closely placed fairly short, warty spindles. The outer part provided with small and flattened, often transversally arranged sclerites.

Type: In the Zoological Museum of Copenhagen.

Description: The material consists of about a hundred zooids distributed on several colonies, many of these consisting of only one zooid and a small stolon.

The stolon is flat and creeps on sand incrusted foraminiferans and small worm tubes. It has a width varying from 0.7–1.2 mm and may be somewhat branched at varying, sometimes right, angles. Also anastomoses may occur. From the stolons the zooids arise at varying intervals, generally 1–5 mm, but the interval between them may be only about 0.5 mm. The largest observed interval between two zooids was about 7 mm, none of the preserved stolons or fragments of stolon are, however, now more than about 14 mm long.

The largest zooid measures from stolon to base of tentacles about 8 mm and has a diameter of about 1.5 mm. Most of the zooids are, however, considerably smaller, their average size being about 4 × 1 mm. The largest zooids have often a diameter of about 2 mm and are generally placed at the bifurcations of the stolon. The shape of the zooids are somewhat varying, many

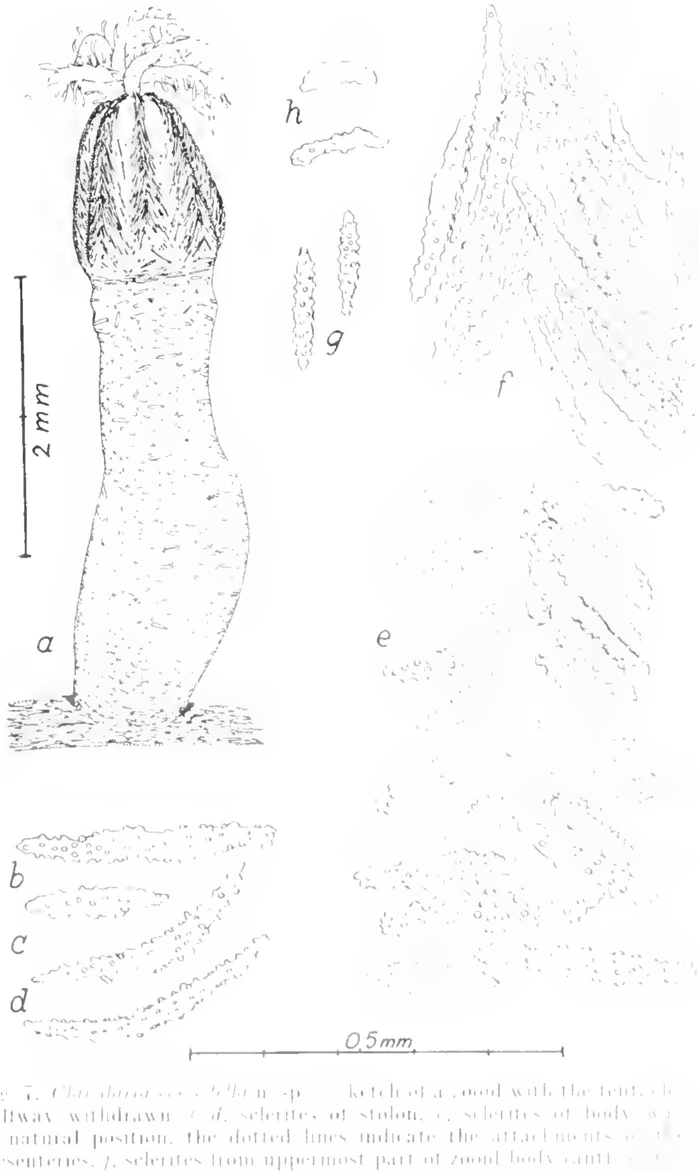

Fig. 7. *Clavularia venustella* n. sp. *a*, sketch of a zooid with the tentacles halfway withdrawn. *b–d*, sclerites of stolon. *e*, sclerites of body wall in natural position, the dotted lines indicate the attachments of the mesenteries. *f*, sclerites from uppermost part of zooid body (anthocodial crown) in natural position. *g*, longitudinally arranged sclerites from lower part of tentacle. *h*, sclerites from outer part of tentacle.

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[illegible] **Anthelia**

Genus **Anthelia** Savigny 1816.

Anthelia borealis (Koren & Danielssen 1883).

Clavularia borealis Koren & Danielssen, 1883, p. 11–12, pl. 5, figs. 16–30.
Anthelia borealis Broch, 1912 *d*, p. 9–13, figs. 1–4.
Anthothela grandiflora var. borealis Molander, 1918 *b*, p. 8–10, 11–14, fig. 2.
Anthothela grandiflora var. borealis Molander, 1929, p. 18, 36.

Diagnosis: Vide Broch 1912 *d*.

Material. 65°28' N, 27°39' W, 847 m, 5.5° C. "Ingolf" St. 97.

Description. The material consists of a small stolon creeping on a polyzoan colony and with but one zooid, which with tentacles retracted, only measures about 2.5 mm (fig. 8 *h*).

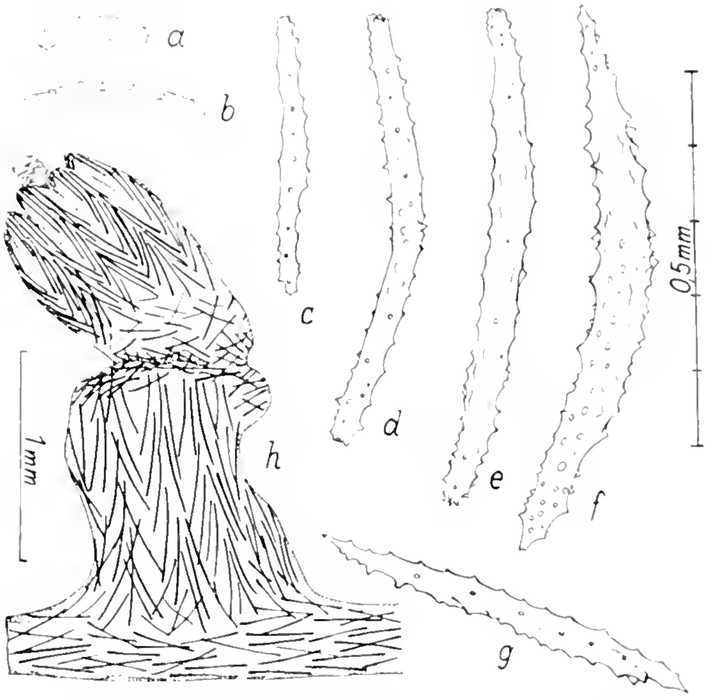

Fig. 8. *Anthelia borealis* (Koren & Danielssen). *a*, — sclerites from tentacles, *b*, from the side, *c*, sclerite from tentacle base, *d*, sclerite from anthocodial crown, *e*, *f*, sclerites from lower part of zooid body, *g*, sclerite from stolon, at larger size, *h*, sketch of the specimen.

The sclerites of the stolon are irregularly but mainly longitudinally arranged, spinous spindles (fig. 8 *g*); they reach a length of about 0.55 mm and their average size is about 0.35 mm.

The zooid is thin walled in its whole length and the type of sclerites is almost identical in the lower and the upper part of the zooid body. In the lower part of the zooid the sclerites have a tendency to be arranged in eight distinct double rows converging towards the tentacles. They are large and spinous, generally somewhat curved spindles usually with blunt ends (fig. 8 *e*), the largest, however, pointed (fig. 8 *f*). Their average size is about 0.65 — 0.05 mm, their maximum size about 0.75 — 0.075 mm.

In the lower part of the zooid the eight rows of sclerites do not continue directly in the eight rows of sclerites in the anthocodial crown, but are interrupted somewhat below these by a zone with somewhat smaller and more transversally disposed sclerites.

The sclerites in the anthocodial crown are curved spindles with blunt ends as the usual type from the main zooid body. They reach a length of about 0.6 mm, and like those in the lower part of the zooid they are arranged en chevron in eight double rows which uninterruptedly continue in the rows of sclerites in the tentacle dorsa.

The sclerites in the basal part of the tentacles are longitudinally arranged straight spindles (fig. 8 *c*). The sclerites in the outer part of the tentacles are flattened and transversally arranged. Due to the scarcity of material the spiculation of the pinnulae was not studied.

Discussion: The specimen described above has been referred to *Anthelia borealis* as in all essentials it is well in accordance with BROCH's description of this species. In any case it is impossible to point out any distinguishing character of greater value. It may be admitted that the sclerites of the zooid body, judging from BROCH's figure 2, may be stouter in the specimens from the Trondheim Fjord than they are in that taken by the "Ingolf" Expedition, but this may be due to individual variation. The size of the specimen described here is considerably shorter than that stated for the largest zooids of the specimens from the Trondheim Fjord, but it must be remembered that the described specimen is juvenile.

The specimen taken by the "Ingolf" Expedition resembles also *Anthelia armata* J. A. Thomson 1927 (p. 9) from off Madeira in 2380 m depth, which species apparently has a similar arrangement of the sclerites in the zooid body, although J. A. THOMSON writes about the sclerites: "Ceux de la partie inférieure du polype sont plutôt disposés horizontalement que longitudinalement, mais avec une tendance à former 8 crêtes longitudinales." In J. A. THOMSON's species the largest stated size of sclerites is about 0.5 mm.

Anthelia borealis from the Trondheim Fjord, the specimen from the "Ingolf" St. 21, and J. A. THOMSON's *A. armata* are apparently very closely related and may prove to belong to the same species. J. A. THOMSON's description is, however, not very thorough and no figures are given of the sclerites.

Distribution: *Anthelia borealis* is previously known from Trondheim Fjord in depths of 200 400 m. If the identification of the specimen described above is correct, and there is no evidence that it is not, the species is also found in the Danmark Strait west of Iceland at 817 m, which also favours the supposition that it has been found at Madeira in 2380 m depth under the name *A. armata*. Chart of distribution, fig. 1.

Anthelia fallax Broch 1912.

Anthelia fallax Broch, 1912 *d*, p. 13 16, figs. 5 8.
Anthothela grandiflora var. fallax Molander, 1918 *b*, p. 10 11, fig. 3.
Anthothela grandiflora var. fallax Molander, 1929, p. 36.

Diagnosis: Vide BROCH 1912 *d*.

Material:
Fragment of the type specimen from Trondheim Fjord

Remarks. It seems worth noting that the spiculation of the zooid body in this species much resembles that of an *Acanthogorgia*, especially in the arrangement of the peculiarly bent sclerites (cf. fig. 23 *b*); however, also in the spiculation below and at the tentacle base, where the sclerites are a little protruding although in *A. fallax* they do not have a distinctly protruding, smooth ray. No doubt MOLANDER is wrong in referring *A. fallax* to *Anthothela grandiflora* (see further BROCH 1935 p. 56), and if the species should be removed from the Stolonifera and placed among the Gorgonaceans it may undoubtedly be in the vicinity of the family Acanthogorgiidae.

Distribution: At present only known from Trondheim Fjord in depths of 300 500 m.

Genus **Sarcodictyon** Forbes 1847.

Sarcodictyon catenatum Forbes 1847

Sarcodictyon catenata Forbes, in Johnston 1847, p. 179, pl. 33 figs. 4 7.
Rhizoxenia filiformis M. Sars, 1856, p. 65 67, pl. 10 figs. 13 17
Sarcodictyon catenata Herdman, 1883, p. 31 51, pl. 1 3
Rhizoxenia filiformis Appelof, 1895, p. 11.
Sarcodictyon catenata Stephens, 1909, p. 4.
Evagora catenata Aurivillius, 1926, p. 114
Sarcodictyon catenatum J. A. Thomson, 1927, p. 8 9
Carlgren, MS.

Description: Vide HERDMANN 1883

Material:
Hjeltefjord (Norwegian coast near Bergen), 55 m, 1 colony

Distribution: This insignificant little species is not actually known from the area investigated by the "Ingolf" Expedition but it is very likely that it sooner or later will prove to occur here.

The species has been recorded from the Irish and Scottish Atlantic coasts in depths down to about 900 m, and under the name *Rhizoxenia filiformis* from Scandinavia from Mangerfjord and Herlofjord near Bergen, in the vicinity of which the above mentioned specimen was taken, it has further been mentioned from the Skagerrak from Gullmarfjord by AURIVILLIUS (1926) and from Kosterfjord and Seghsfjord by CARLGREN (MS.). The species is also recorded from the English Channel and the Mediterranean. Probably it has a very vide distribution.

Bathymetrical distribution: About (20) 50 856 m

Family: **Cyathopodidae** n. fam.

Genus **Cyathopodium** Verrill 1868.

This genus was proposed by VERRILL (1868 *b*, p. 115) for a small stoloniferous coral from the Paumotu Archipelago which DANA in 1846 described and referred to the extinct genus *Aulopora*.

The author has not had access to DANA's original large paper, but has seen the original atlas and the synopsis of the species from the original paper which DANA published in 1859. DANA writes (p. 126) about the family IV Tubiporidae (of the suborder II Alcyonaria) the following: "Coralligenous Alcyonaria: coralla tubular, calcareous or semicalcareous; tubes not striate within. Genus 1. *Aulopora*. Non-acrogenous Tubiporidae, budding from a creeping filiform stolon, Coralla calcareous, tubular, incrusting, often reticulately anastomosing; cells subremote, sometimes a little prominent. *Aulopora tenuis* (Dana). Red, tubular corallum filiform, reticulate, mostly $^1/_3$ of a line broad, cells circular not prominent."

VERRILL (1868 *b*, p. 115) refers the species to a new genus *Cyathopodium* with the following words: "This new genus is proposed for the remarkable little polyp, rightly described by Prof. DANA as closely allied to *Tubipora*. It is in fact a *Tubipora*-like polyp, with short cup-shaped tubes, connected by narrow calcareous stolons which correspond to the transverse plates of *Tubipora* and from which new buds arise."

Neither DANA's nor VERRILL's descriptions are thus very distinct and the genus was therefore in many years by students of the Stolonifera group considered a very doubtful one. DEICHMANN (1936 p. 58) describes, however, a new species from the West Indies and refers it on the authority of VERRILL to the genus *Cyathopodium*. DEICHMANN further tells that VERRILL in his not published notes had placed the genus *Cyathopodium* in the family Telestidae and this may, as it will follow below, be an important information.

DEICHMANN refers the genus *Cyathopodium* to the Tubiporidae [illegible] are [illegible] mesh [illegible] scattered to a [illegible] loosely with

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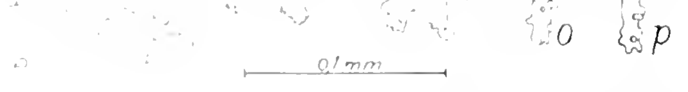
Cyathopodium ingolfi n. sp.

[illegible] W. Lat [illegible] Ingolf St. 51

[illegible] Stolon-forming Octocorals with ribbon-like, flat, [illegible] stolons which also sometimes may [illegible] section. Zooids distinctly divided into a [illegible] retractile anthocodia which by maximal re[illegible]. Sclerites of two about equally common [illegible] simple rods or quadruplet formations of the [illegible] in anthocodial part of zooid body, [illegible] of tentacles, and stomodaeum. Size about 7 [illegible] Sclerites of anthostele branched, simple rods or [illegible] about 0.2–0.3 mm and closely placed in a [illegible]. Sclerites of the main part of antho[illegible] [illegible] calcareous meshwork, thus forming [illegible] calcareous tube. Sclerites in outer wall of stolon [illegible]. Sclerites in inner part of stolon free [illegible] quadruplets are rather common. Lower part of [illegible] of a calcareous skeleton in the coelenteric [illegible] developed to a sort of stem.

[illegible] Zoological Museum of Copenhagen.

[illegible] The material consists of several fragments of [illegible] thirteen very small stones, and all the [illegible] supposed originally to have been of one set.



[illegible] tentacle [illegible] of the largest [illegible] simple rod and qua[illegible] [illegible] stomodaeum.

[illegible] in diameter. The [illegible] from 0.8–1.75 mm [illegible] of the zooids. It is [illegible] are very frequent [illegible] and sometimes [illegible] at the points of bifurcations of the stolon. The largest interval between two zooids in the material is 7 mm.

The colour of the specimens in alcohol is pure white.

The species is very brittle and the material is consequently very damaged. Nearly all the zooids have been broken off just at their base and only a few of them are preserved. This is highly to be regretted as there are several interesting problems concerning the structure of the zooid, which now can not be cleared up, but only can be indicated.

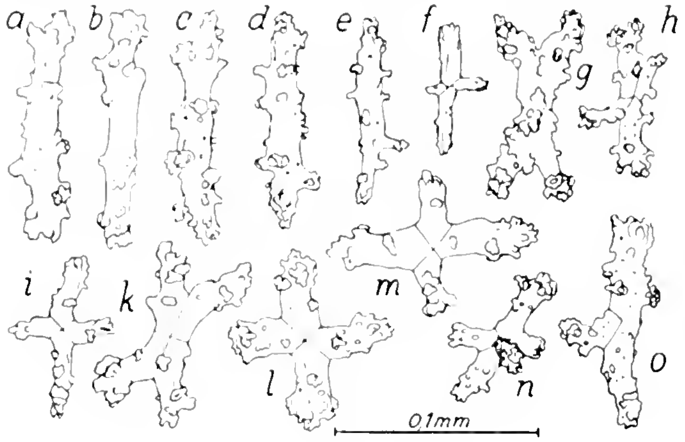


Fig. 10. *Cyathopodium ingolfi* n. sp. Sclerites from the anthocodia, various simple rods and quadruplets, *n*, a quintuplet.

The largest of the preserved zooids has its tentacles partially retracted and is shown in fig. 13 *a*. It issues obliquely from a small stolon which partly has been free (s_1) and partly (s_2) creeps upon a little stone. The anthostele measures about 1 mm in height by about 1.75 mm in diameter. The other zooid examined is much smaller and entirely retracted (fig. 11 *a, b*). By the maximal retraction both the anthocodial part of the zooid body and the tentacles are entirely inverted as it appears from the longitudinal section of the specimen (fig. 11 *c*).

A closer study of the zooid fig. 13 gave the following results. The tentacles, which are provided with about 8–12 pairs of pinnulae, are fairly strongly armed both on their dorsal and lateral sides with a rather close layer of sclerites, and also on the oral side of the tentacles a few sclerites may be found. The sclerites are small, flattened, somewhat warty rods, either transversally arranged simple ones (fig. 9 *a–f*) or more irregularly arranged quadruplet formations (fig. 9 *i–n*), and the latter are just as common or even more common than the former. The largest simple rods (fig. 9 *d, g*) measure about 0.1 × 0.03 mm. Some few (fig. 9 *f*) may be found which are larger, up to 0.13 mm, but these are then only about 0.015 mm broad. The average size of the simple rods may be about 0.08 × 0.02 mm. The quadruplets are generally symmetrically developed, their diameter does not exceed the length of the largest rods and may measure 0.07–0.08 mm in average. Similar sclerites may also be found in some pinnulae.

The sclerites in the anthocodial part of the zooid body are rods provided with fairly great, often compound warts (fig. 10), and the quadruplets are here, as in the tentacles, just as common as the simple ones. The largest simple rods measure about 0.13 × 0.02 mm, and also the largest quadruplets reach a diameter of about 0.13 mm.

In the contracted anthocodia the sclerites are fairly closely and irregularly arranged, and they are especially much crowded in eight intermesenterial rows which continue uninterruptedly in the sclerites of the tentacles.

In the wall of the stomodaeum there are likewise a rich spiculation with simple rods or quadruplets, which, however, mostly are very small, yet the largest (fig. 9 *o, p*) may measure about 0.08 mm.

The transition from the anthocodia to the anthostele appears, by slight magnification, rather indistinct. Microscopic examination shows, however, that in the spiculation there is a very strong distinction between the lower part of the anthocodia and the upper part of the anthostele. In the latter the sclerites are considerably larger and have a somewhat different appearance.

The sclerites in the upper part of the anthostele are closely placed in a few layers. They are either fairly smooth and generally richly branched simple rods, measuring 0.2–0.3 mm in length, or quadruplet formations of the same. Uppermost in the anthostele most of the sclerites are free (fig. 11 *a–d*), several of them, however, fuse together (fig. 11 *e*), and the main anthostele is in this manner developed into a very solid, calcareous tube, the walls of which are formed by a close calcareous meshwork (fig. 12) built of fused simple rods and quadruplets arranged in a layer about two to three sclerites thick.

The outer walls of the stolons are built in the same manner. They are, however, usually somewhat stouter than the figured section of an anthostele, formed by somewhat thicker sclerites. The inner part of the stolons is for the most part filled with free sclerites, which are considerably smaller than those which build the outer wall, and among which sixtuplets with a diameter of about 0.1 mm are rather frequent. The outer calcareous meshwork in the stolon is separated from the inner skeleton by a delicate, foliated and perforated horny or chitinous membrane.

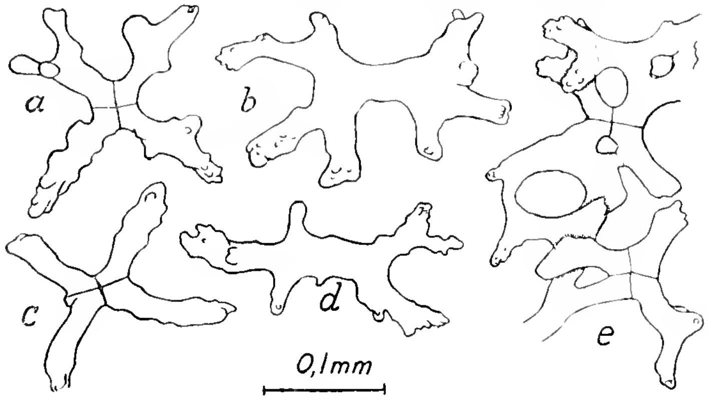


Fig. 11. *Cyathopodium ingolfi* n. sp. Solitary simple sclerites (*b*, *d*) and quadruplets (*a*, *c*) from the upper part of the anthostele, compare fig. 13 *b*, zone *as*$_1$. *e*, some of the fused sclerites from the same part of the zooid.

Due to the scarcity of the material it has not been possible to ascertain whether in the body wall of the zooid an inner horny meshwork is present, the occurrence of which Deichmann (1936) uses as a diagnostic character for the genus *Cyathopodium*; as, however, such an inner horny layer exists in the stolons it is almost certain that a similar layer may be found in the zooids.

The zooids are provided with a, sometimes fairly thick, horny or chitinous cuticula.

The fragmentary basal part of a zooid, which is figured in fig. 11 *f*, shows a very interesting feature, viz. that a calcareous skeleton divides the coelenteric cavity into eight main longitudinal canals separated by tiny calcareous walls, forming in the centre of the zooid a more irregular meshwork with smaller canals, the structure of this inner calcareous skeleton is the same as in the outer walls of the anthostele. The height of this fragmentary zooid is about 1.5 mm, and the diameter is about 1 mm, i. e. of about the same size as in the small zooid figured in fig. 11 *a–e* and considerably smaller than in the above described zooid (fig. 13) in which no trace of such an inner skeletal structure was seen.

An intrusion in the basal part of the coelenteric cavity of a very loose calcareous meshwork was, however, observed in a very damaged zooid about 3 mm long in contracted state and scarcely 1 mm in diameter, but due to the bad state of preservation it was not possible to state anything definite about this calcareous meshwork, e. g. whether it was situated in the mesenteries, which probably has been the case, which a comparison with the Telestacean species *Pseudochladochonus hicksoni* Versluys 1907 might indicate, or not. See further the discussion on the following species. It is the comparison with Versluys' description of *Pseudochladochonus* which justifies the description of the fragment in fig. 11 *f* as an anthostele. As it is seen from fig. 11 *e* a similar anthostele may be found also in smaller zooids.

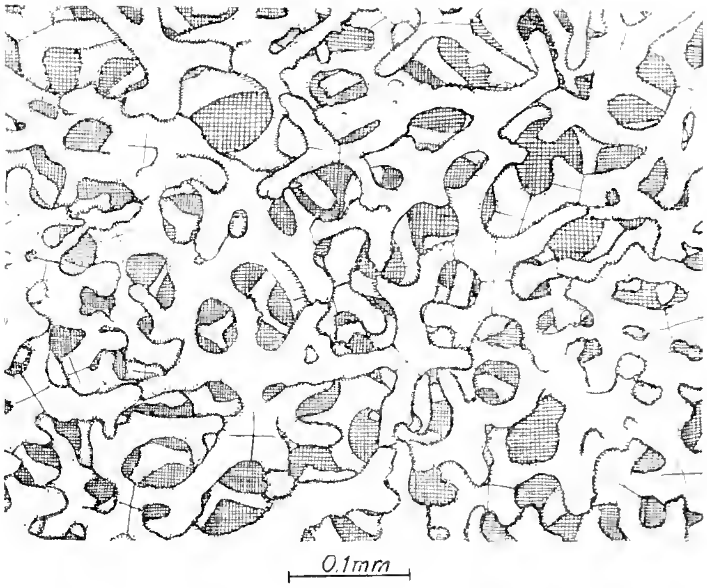


Fig. 12. *Cyathopodium ingolfi* n. sp. Section of the calcareous skeleton in the main part of the anthostele, compare fig. 13 *b*, zone *as*$_2$.

The basal part of the specimen in fig. 13 (on the figure marked s_1) has, on the contrary, been described as a stolon, and it is

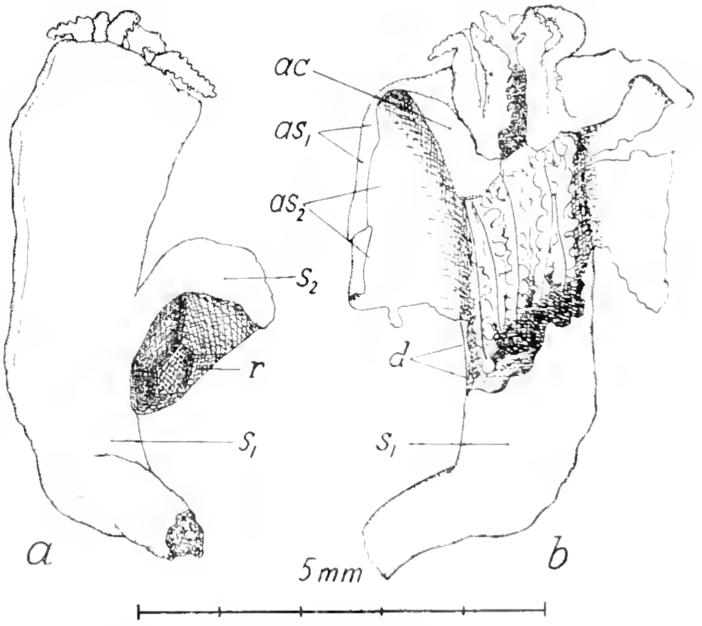
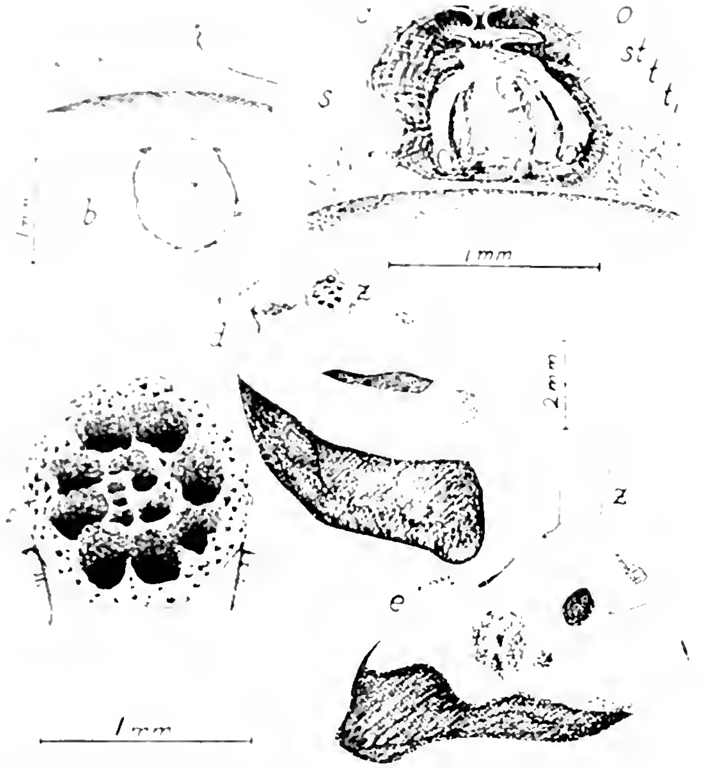


Fig. 13. *Cyathopodium ingolfi* n. sp. *a*, small fragmentary, partly free stolon with a single zooid. *b*, the same specimen from the opposite side; the small piece of rock *r* with the stolon attached to it s_2 has been removed and the zooid opened. The mesenteries with the mesenteric filaments are only indicated, the dorsal ones are shown at the left. There is no development of a skeleton in the mesenteries and no distinct canals issue from the bottom of the coelenteric cavity. *r*, a small piece of rock. s_1, free stolon. s_2, creeping stolon. *d*, the scar where the creeping stolon has been broken off. *ac*, the anthocodia with free sclerites fig. 10. *as*$_1$, the upper part of the anthostele with free sclerites and rigid calcareous skeleton fig. 11. *as*$_2$, the main part of the anthostele with the calcareous skeleton fig. 12.

[illegible] as to that described [illegible] close, crest calcareous [illegible] those in the anthostele



[illegible] sp. [illegible] small contracted zooid shown [illegible] from above, [illegible] the same zooid shown in section. [illegible] the inverted tentacle t_1 the not inverted tip of tentacle. [illegible] piece of an inverted tentacle [illegible] the stomodaeum. [illegible] fragmentary colony on a stone drawn to show the frag- [illegible] from above and from the side respectively, [illegible] more [illegible] drawing of the zooid [illegible] seen from above, showing the thick [illegible] network in the outer body wall and the eight distinct canals [illegible] by [illegible] calcareous septae. This zooid was covered with a [illegible] of chitinous colourless cuticula.

[illegible] round, and when it has given off the zooid it continues [illegible] of the figure marked s_2, which creeps on a small [illegible] course part s_1 might have been described as an antho- [illegible] s_2 as a distal stolon given off from the zooid, but as [illegible] the above mentioned this would have been erro- [illegible] present material it is also in some cases seen how a flat stolon, which creeps upon a small stone, leaves this, then rounds off and for a time grows as a free stolon, round in section, before it again becomes attached to a small stone and again flat in section. The whole material of this species is also supposed to have belonged to one single colony, and the connections between the fragments have without doubt partly been constituted by such free stolons.

Discussion. It is for the present impossible to state anything definite about the systematic position of the family Cyathopodiae, as the structure of the zooids is not sufficiently cleared up. Some remarks may, however, be made. DANA in 1846 placed the genus in the Tubiporidae, and the same is done also by VERRILL (1868 *b*) and DEICHMANN (1936). In fact, however, there seems to be no closer relation between the Cyathopodidae and the Tubiporidae. In the period between VERRILL's paper of 1868 *b* and DEICHMANN's of 1936 *Cyathopodium* has, on account of DANA's original description, been regarded as a very doubtful species in the Clavulariidae. In the present paper it is also provisionally placed in the order Stolonifera, partly as it is most convenient to refer a stoloniferous species to this group, and partly because the order Stolonifera already before hand is a sort of lumber-room. It is, however, most probable that the real systematic place of the Cyathopodidae is in the order Telestacea, which point of view is supported by the above described anthostele. It may also be supposed that similar conditions in the *Cyathopodium elegans* Deichmann induced VERRILL in his not published manuscript to place the genus among the Telestidae. As, however, secondary zooids have not yet been observed in any of the species referred to the genus *Cyathopodium* it has not been found convenient for the present to refer the Cyathopodidae to the order Telestacea, in which precisely the principal character is the occurrence of secondary zooids.

Cyathopodium ingolfi is in the colourless sclerites distinguished from *C. tenue* which probably has light red sclerites, and *C. elegans* which has lemon-coloured or yellow sclerites. The structure of the zooid in *C. tenue* is not known. The zooid of *C. elegans* is in contrast to *C. ingolfi* provided with an operculum, and DEICHMANN also states the occurrence of a collaret below the tentacles. In *C. ingolfi* nothing corresponding is found. The shape of the sclerites and the abundant occurrence of quadruplets in *C. ingolfi* yield also useful distinguishing characters, and it may be doubtful whether *C. elegans* and *C. ingolfi* in reality should be placed in the same genus.

Distribution. South of Iceland at about 1300 m. Chart of distribution, fig. 15.

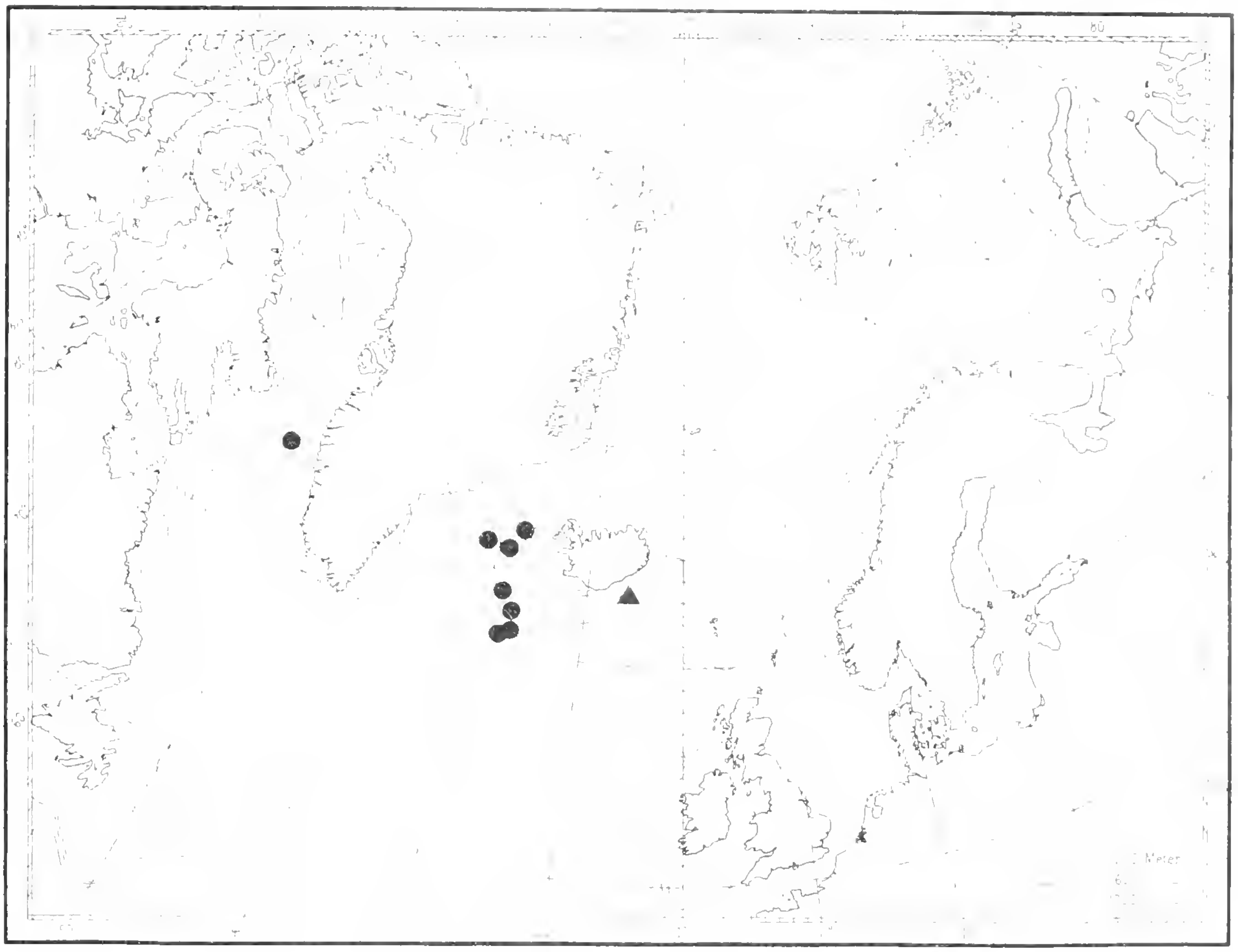


Fig. 15. ▲ *Cyathopodium ingolfi* n. sp.
● *Telestula septentrionalis* n. sp.

Ordo: Telestacea Hickson 1930.

Diagnosis. Stoloniferous, branching Octocorals, where in the monopodial species stem and branches and in the sympodial species stem- and branch-sections each is formed by one single zooid. The secondary zooids only at their base connected with the primary ones, their coelenteric cavities connected with that of the primary zooid through canals in the body wall of this latter. Sclerites numerous and sometimes fused into a calcareous meshwork. In some genera the lower part of the coelenteric cavity partially filled out with a mesogloeal tissue containing numerous often fused sclerites.

Family: Telestidae Milne Edwards 1857

Diagnosis. The same as for the order.

Remarks: In the order Telestacea only one family, viz. Telestidae, is recognized at present. This family comprises, with the diagnosis above, both the monopodial branching genera of the usual *Telesto* type, viz. *Telesto* Lamouroux, *Coelogorgia* Milne Edwards, and also *Pseudogorgia* Kolliker, and the sympodial branching and differing *Pseudocladochonus* Versluys and the new genus *Telestula* described below, which occupies an intermediate position between the usual *Telesto* type and *Pseudocladochonus*.

Some authors have also in the Telestidae included *Scleranthelia* Studer, which genus Studer, however, placed among the Clavulariidae, which point of view seems to be the most convenient, though Molander (1929 p. 31) by a re-examination of the genus arrives at the conclusion that *Scleranthelia* belongs to the genus *Parisis*.

Also another genus has been reckoned to the *Telestidae*, viz. *Clavularia* sensu Molander 1929. In Molander's much emended sense *Clavularia* (diagnosis Molander 1929 p. 19) comprises only the following species: *C. viridis* Quoy & Gaimard, *C. violacea* Quoy & Gaimard, *C. inflata* Schenck and *C. coronata* Burchardt. Molander's conclusion that these species should be included in the *Telestidae* is based partly on observations of young zooid buds directly upon elder zooids in some of the species and partly on some observations on the anatomy of *C. viridis*. Hickson (1930) however, dissents emphatically from this conclusion and [illegible] wal [illegible] from the [illegible] with his

Telestula [illegible]

[illegible] having small [illegible] down to the stolon [illegible] lower part of the coelenteric [illegible] zooids being partially filled [illegible] part of the zooid thus [illegible] constitute the largest [illegible] secondary zooids may rise, [illegible] zooids being developed in [illegible] reach a certain size. Secondary [illegible]

Genotype: *T*[illegible] n. sp.

Telestula septentrionalis n. sp.

[illegible] N [illegible] W 1184 [illegible] "Ingolf" St. 40. Some colonies.
[illegible] N [illegible] W 2118 [illegible] "Ingolf" St. 41. Some frag[illegible]
[illegible] N [illegible] W 7[illegible] "Ingolf" St. 27. Fragments of [illegible]
[illegible] N [illegible] W [illegible] "Ingolf" St. 76. 1 colony.
[illegible] N 27 [illegible] W [illegible] "Ingolf" St. 78. 1 fragmentary
[illegible] N 27 [illegible] W [illegible] "Ingolf" St. 81. Several broken
[illegible] N [illegible] W 1717 [illegible] "Ingolf" St. 83. 1 fragmentary
[illegible] N 27 [illegible] W [illegible] "Ingolf" St. 97. 2 fragmentary

[illegible] Zooids distinctly eight [illegible] of about 1 mm in their whole [illegible] occurring. Anthocodial part of [illegible] about 2.5 mm in length [illegible] up to 35 mm. The mesenteries [illegible] zooids with an anthostele less [illegible]. In larger zooids the lower part of [illegible] with a mesogloeal tissue [illegible] Sclerites in anthocodia warty, [illegible] about 0.08 mm. In outer wall [illegible] flattened ones with a granulated [illegible] measuring about 0.25 [illegible]. In inner part of [illegible] with larger warts

[illegible] Museum [illegible] Copenhagen.
[illegible] the north-western part of [illegible]

[illegible] from the stolons [illegible] and generally [illegible] of the stolon [illegible] and the zooids [illegible] scattered. The [illegible] 20 mm [illegible] being about [illegible] about 1 mm [illegible] though with [illegible] of the zooid

The zooids are distinctly eight ribbed having an entirely retractile anthocodial part, which is retracted in nearly all the specimens of the material.

The colour of the specimens from the "Ingolf" St. 81 was stated to be white when alive, and the colour of the specimens in alcohol is now either white or yellow brown.

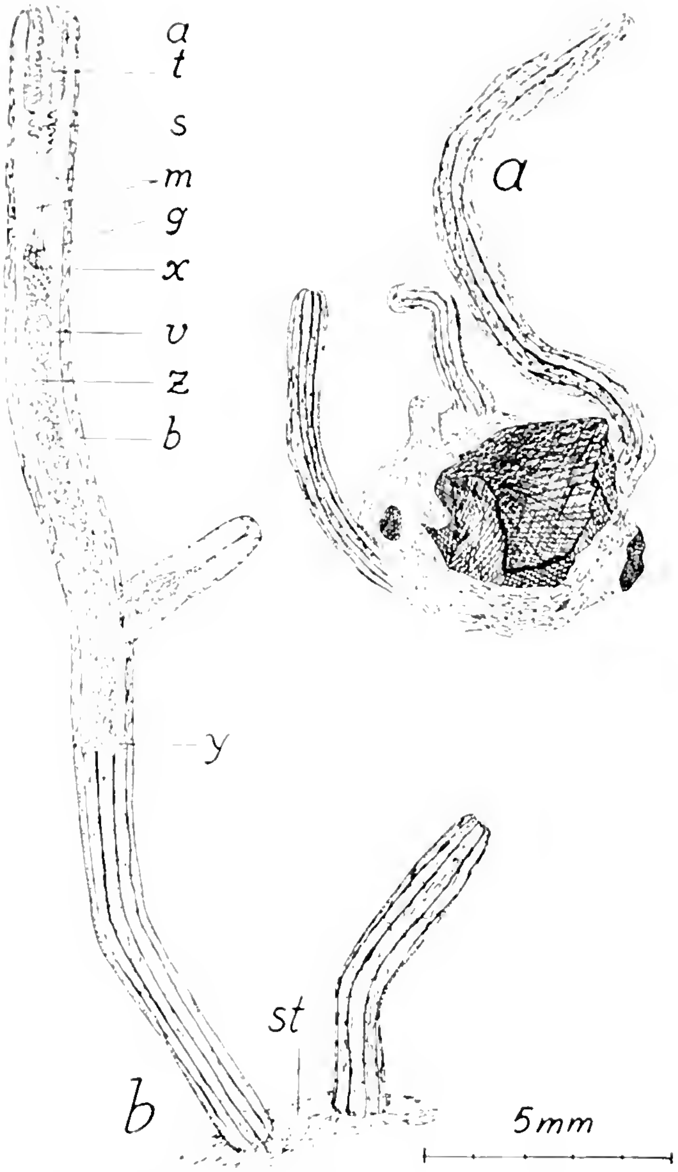


Fig. 16. *Telestula septentrionalis* n. g., n. sp. *a*, a small colony on a stone showing zooids of various size in contracted state. *b*, a part of a larger colony with two primary zooids one of which with a secondary one. The upper part of the branched one is shown in longitudinal section and is somewhat schematized. In the primary zooid the anthocodiae is not quite retracted as is the case in the secondary one. *t*, tentacles, *a*, anthocodia, *s*, stomodaeum, *m*, mesenteries, *g*, gonads, *x*, the limit between the gastral cavity of the zooid and the "stem", *v*, the longitudinal canals in the "stem" representing the rest of the coelenteric cavity, *z*, the mesogloeal tissue in the "stem" with sclerites of the type fig. 18 [illegible], *b*, the body wall of the zooid with sclerites of the type fig. 18 [illegible], *y*, transverse section through the stem, compare pl. I fig. 4, *st*, stolon.

The horny or chitinous cuticula is very conspicuous in several zooids.

The zooids are very brittle and the colonies are therefore for the most part much damaged having only in a few cases the zooids intact.

Both stolons and zooids are very strongly spiculated. In the stolon the sclerites are of two types. The one type (fig. 18 *a*–*c*) is an oblong, flattened sclerite with blunt ends and granulated surface, often also with scattered larger warts and usually with a rather irregular outline. The largest may measure about 0.35 × 0.15 mm, most of them are, however, about 0.25 × 0.07 mm. These sclerites are longitudinally placed and form a very dense covering of the stolon. Below this sclerite mail, in the inner and lowest part of the stolon, there is a loose skeleton formed by the other, somewhat different, type of sclerites (fig. 18 *k*–*m*), which are rod- or spindle-like with large warts and often branched. They are smaller than those of the other type, generally less than 0.15 mm, and have a less granulated surface. Sometimes some are fused together.

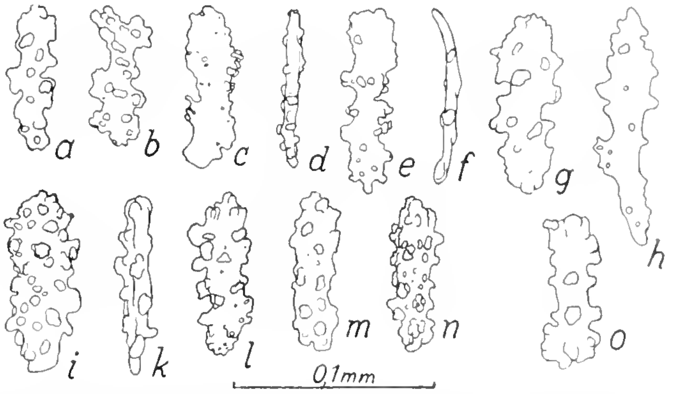


Fig. 17. *Telestula septentrionalis* n. g., n. sp. *a*–*h*, sclerites of tentacles, *a*–*g*, of the usual type, *h*, an extraordinarily large one, *d*, *f*, shown from the side. *i*–*n*, sclerites of anthocodia, *k*, shown from the side, *n*, a not flattened one from the lower part of anthocodia. *o*, sclerite from the stomodaeum.

The sclerites in the body wall of the anthostele resemble those of the outer part of the stolon, but are more warty and generally more regularly shaped than these. Two sclerites of the typical shape are shown in fig. 18 *o*, *p* from above and from the side respectively. Their average size is generally about 0.35 × 0.13 mm, but several smaller ones also occur. Besides some larger sclerites may be found, in the smaller zooids and the upper part of the more lengthened ones measuring about 0.15 × 0.25 mm, in the lower part of the longer zooids, however, some may measure up to 0.7 × 0.33 mm. The sclerites are longitudinally and very closely arranged, placed in the furrows of the zooid in a layer, mainly only one sclerite thick, in the ridges of the zooid, however, somewhat more crowded (compare the transverse section pl. I fig. 3). The largest and most irregularly formed sclerites are found in the ridges.

Twins and quadruplets may be rather common both in the anthostele and the stolon.

The sclerites in the anthocodial part of the body wall are much smaller, warty, rod-like, and flattened ones, all of about equal size, i. e. about 0.08 × 0.025 mm. It seems, however, as if those of the uppermost part of the anthocodia are generally more flattened than those from the lower part. They are mostly irregularly obliquely or transversely placed, probably all becoming longitudinally arranged in the entirely expanded anthocodia, and mainly restricted to eight intermesenterial ridges which form a continuation of the ridges of the anthostele. As only very few sclerites occur outside these rather narrow rows, an almost complete contraction of the lower part of the by retraction inverted anthocodia is made possible (compare pl. I fig. 1).

The transition from the anthostele to the anthocodia is fairly smooth. In the anthocodia the rows of sclerites are, however, interrupted a little below the tentacles.

The tentacles, which in full-grown zooids measure 1.6–1.8 mm in contracted state, are strongly armed on all sides with a dense layer of transversely arranged sclerites (fig. 17 *a*–*h*) which resemble those of the anthocodia though being somewhat more flattened (fig. 17 *d*, *f*), generally less warty and also a little more varying in shape and size. Average size about 0.08 mm, maximum size about 0.12 mm. Also the pinnulae, which number about 10–12 pairs and in the contracted state are very short, are well provided with small sclerites (compare pl. I fig. 3).

The stomodaeum, which in comparison with the mesenteries is fairly long, is provided with rather numerous and transversally arranged sclerites of the same type as those from the tentacles (fig. 17 *o*).

Most zooids in the present material measure less than 7–8 mm in height in contracted state and in these the dorsal mesenteries extend down to the stolon. In the larger zooids, however, the basal part of the coelenteric cavity is filled with a loose skeleton of warty and often branched sclerites (fig. 18 *s*–*y*) resembling those from the inner part of the stolon but of a larger size, measuring up to about 0.3 mm in length. By the intrusion of these sclerites into the coelenteric cavity the lower part of the longer zooids is developed into a sort of stem which may constitute the greater part of the zooid.

The following measures may be given. In a zooid, which measures 8 mm with tentacles extended, no sclerites in the coelenteric cavity were noticed. In a 10.5 mm long contracted zooid the "stem" constitutes 4 mm; and the "stem" is 18 mm long in the zooid, fig. 16 *b*, which in contracted state measures about 24 mm. In this last-mentioned zooid the diameter at the stolon is about 1 mm, whereas at the tip of the anthostele it is about 1.4 mm. The anthocodia without tentacles measures about 2.5 mm and is not completely retracted. The tentacles measure about 1.8 mm. Several single zooids are found in contracted state measuring more than 20 mm in height.

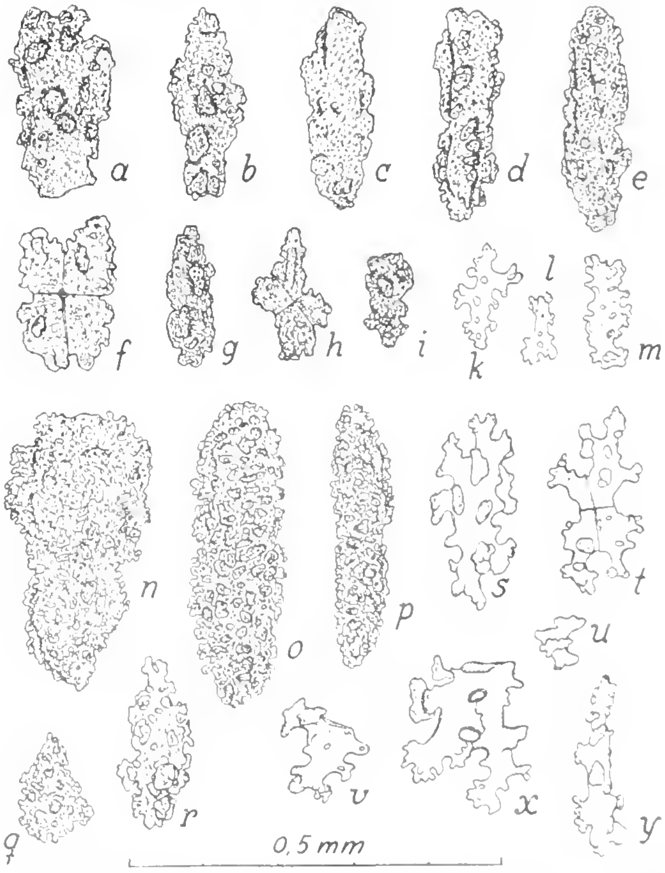


Fig. 18. *Telestula septentrionalis* n. g., n. sp. *a*–*m*, sclerites of stolon; *a*–*i*, from the outer wall of the stolon, *k*–*m*, from the inner part of the stolon. *n*–*r*, sclerites of zooid. *n*–*p*, sclerites of body wall, *p* shown from the side. *s*–*y*, sclerites from the inner part of "stem". *t*, *x*, fragments of fused sclerites.

The development of the "stem", in the lower part of which [illegible] spiculated ridges [illegible] regularity.

[illegible] that in the "stem" eight [illegible] distinguished which re- [illegible] Generally, these canals [illegible] often a few of them may [illegible] part of the "stem" and thus only [illegible] "stem" canals may be distinguished [illegible] also give off branches, and [illegible] part of the "stem" small endodermic [illegible] between the sclerites in the middle. [illegible] sclerites in the inner part of the "stem" [illegible] and sections through this part of the [illegible] which is without canals and has been oc- [illegible] fused sclerites, and in a circle around this [illegible] canals and other endodermic canals. In this [illegible] the "stem" canals are fairly small, whereas [illegible] other endodermic canals are comparatively large [illegible] not to distinguished from the "stem" canals. [illegible] several mesogloeal cell canals besides the [illegible] canals are found, and such are also present in the [illegible] of the zooids, compare pl. 1 fig. 2.

[illegible] zooids [illegible] about 10 % of the material, secondary [illegible] arise from the "stem" of the primary ones (fig. 16 *b*). A [illegible] 35 mm long zooid with a diameter of [illegible] in its whole length may probably have had two [illegible], for otherwise only one secondary zooid is [illegible] ones.

[illegible] zooids resemble the primary ones, and when [illegible] exceeds about 6 mm they have their lower part [illegible] "stem" similar to that of the primary zooids.

[illegible] The above described species should be placed [illegible] among the Telestidae on account of the occurrence [illegible] zooids, however scarce they are. If, however, the [illegible] these zooids with secondary ones, the [illegible] probably have been given a doubtful position [illegible]. It is also probable that some of the hitherto [illegible] of *Clavularia* should be referred to *Telestula*, [illegible] are identical with *Telestula septentrionalis*. It may [illegible] that there is no closer relationship between [illegible] *Clavularia* sensu Molander, the latter having distal [illegible] zooids and a quite differing spiculation.

[illegible] *Telestula* resembles the genus *Telesto* very [illegible] distinct longitudinal furrows and the horny or [illegible] are common to both genera and also the scle- [illegible] are of about the same type as in *Telesto*.

[illegible] differs from *Telesto* in that lateral [illegible] generally occurring. As mentioned above [illegible] found in about 10 % of the zooids in [illegible] of the eight stations from which the [illegible] species branching zooids are found only [illegible] 97. Another species, which without doubt [illegible] the genus *Telestula*, viz. *Pseudoclado-* [illegible] & Dean, shows, however, externally the [illegible] *Telesto* colony. See further below.

[illegible] distinguishes *Telestula* from [illegible] the erection of the new genus is the [illegible] of a mesogloeal, sclerite- [illegible] part of the coelenteric cavity of the elder [illegible] the much larger *Telesto* [illegible] down to the stolon (Lanckmann 1946 [illegible] 12). Lanckmann, it is true, in [illegible] *Telesto* [illegible] found an intru- [illegible] the coelenteric cavity, divid- [illegible] Lanckmann 1946, p. 66, pl. 7 [illegible] of elder colonies of *Telesto* [illegible] exceptionally may be found there is still a primary difference, as the "stem" in *Telestula* is a normal formation which starts its development as soon as the anthostele of the zooid reaches a length of about 6 mm, and also are found in the secondary zooids when they exceed the same size.

The "stem" might also have been described as a vertical stolon, but such a point of view is contradicted by comparison with the long primary zooid in *Telesto* and also by comparison with the development of the "stem" in the Pacific genus *Pseudocladochonus*, excellently described by Versluys in 1907. In *Pseudocladochonus* the sclerites in the zooid, apart from the anthocodia, are fused together in such a manner that a solid, perforated, calcareous tube is formed. The calcareous skeleton of the zooid extends also in the basalmost part of the mesenteries, and Versluys' preparations showed that the mesenteries in the lower part of the coelenteric cavity meet and fuse in the centre, in which way eight "stem" canals and the mesogloeal filling in the "stem" are formed (Versluys 1907, pls. 2, 3). The "stem" canals are, however, in *Pseudocladochonus* considerably larger in comparison with the mesogloeal tissue than in *Telestula*, and the conditions as they are figured for *Pseudocladochonus* by Versluys (pl. 3 fig. 13) much resemble those found in the anthostele of *Cyathopodium riegolfi* (compare fig. 11 *f*).

The branching of the zooids in *Pseudocladochonus* differs principally from that in *Telestula*, as the lateral zooids issue from the body wall of the others, above the "stem" (Versluys 1907, pl. 13 fig. 11), whereas in *Telestula* they issue from the "stem" (fig. 16 *b*). In *Pseudocladochonus* the branching is sympodial, all the zooids being equal, whereas in *Telestula* it is monopodial with a long primary zooid and shorter secondary ones. In *Pseudocladochonus* the lower part of all the zooids is developed into a "stem".

Versluys' figures 2, 3 and pl. 3 fig. 11 show that the tentacles in *Pseudocladochonus*, by retraction of the anthocodia, are bent down, whereas in the specimens examined of *Telestula* they point upwards also in retracted state (compare fig. 16 *b*), probably, however, this is of no systematic value.

It may be remarked that J. A. Thomson & Dean (1931) have referred two new species to the genus *Pseudocladochonus*, which, however, apparently differ too much from the type described by Versluys to be placed in the same genus as this. Due to the scarcity of their material Thomson & Dean have not been able to give a fully exhaustive description of the structure of the colonies. There seems, however, to be no doubt that one of the species, viz. *P. mosaica* Thomson & Dean 1931, p. 216, pl. 15 figs. 5, 9, pl. 27 fig. 7 (9°00'3" S, 126°24'5" E, 112 m) belongs to the genus *Telestula* and is very closely related to *T. septentrionalis*.

Telestula mosaica (Thomson & Dean) agrees with *T. septentrionalis* as regards the spiculation of the anthostele, and the sclerites in the two species are much alike, though it seems as if those of the inner part of the "stem" in *T. mosaica* are longer and more slender than the corresponding from *T. septentrionalis*. At present the occurrence of numerous tertiary zooids in *T. mosaica* probably yields the best distinguishing character between the two species.

The other species *P. versluysi* Thomson & Dean (1931, p. 217, pl. 2 fig. 7, pl. 25 figs. 9 a, 9 b) is after the description difficult to place in the system. In outer habitus the species differs considerably from *P. hicksoni* Versluys, it is much more robustly built, it does not show the zigzag arrangement of the zooids, which all are arranged close together about the end of the primary one, and the sclerites are not fused. All this favours the supposition that *P. versluysi* Thomson & Dean is far more closely related to the genus *Telestula* than to *Pseudocladochonus*, and if it should not be placed in a genus of its own, which seems probable, it may most conveniently be ranged in the genus *Telestula*. It would be very interesting to know whether the secondary zooids bud from the "stem" of the primary one as in *T. septentrionalis* or from the body wall above the "stem" as in *P. hicksoni*.

The genus *Telestula* described here bears resemblance both to the usual *Telesto* type and to *Pseudocladochonus*, it is, however, without doubt most closely related to the former. When the previous family Telestidae in agreement with HICKSON (1930) is raised to the rank of an order, it is also the most convenient to remove *Pseudocladochonus* from the Telestidae sensu stricto and place it in a family of its own, which may be named

Pseudocladochonidae n. fam.

comprising but one genus with only one species. VERSLUYS' excellent description includes all the facts which speak for including the species in the order *Telestacea* and for excluding it from the family Telestidae s. str. from which it differs principally in the equal zooids and the sympodial branching.

Distribution. *Telestula septentrionalis* was taken by the "Ingolf" Expedition in the North Atlantic Ocean southwest and west of Iceland, in Danmark Strait and Davis Strait at depths from 740–2448 m. Probably it is a common species in the deeper parts of the North Atlantic Ocean. Chart of distribution fig. 15.

Ordo: **Xeniidea** Bock 1938.

[illegible] flesh Octocorals which have com[illegible] of contractility and mainly by their [illegible] are distinguished from the other [illegible] Octocorals. In the order only one family is [illegible]

Remarks. It may be noted that KÜKENTHAL (1902, 1906) and HICKSON (1931), as a diagnostic character for this group, use the feature that the zooids only possess one pair (the dorsal pair) of mesenteric filaments. In *Ceratocaulon wandeli*, however, mesenteric filaments are present on all the mesenteries.

Family **Xeniidae** Verrill 1866.

[illegible] this group are for the most part shallow water [illegible] two deep-water forms which are known at [illegible] occurring in the North Atlantic Ocean, belong [illegible]

Genus **Ceratocaulon** Jungersen 1892.

[illegible] Xeniidae with monomorphic zooids and a distinct [illegible] surrounded by a conspicuous [illegible] cuticula. The anthocodiae set in a fairly distinct [illegible] retractile.

Ceratocaulon wandeli Jungersen 1892.

[illegible] W[illegible] Jungersen 1892, p. 231–242, figs. 1–4.
[illegible] Kükenthal 1906 *a*, p. 21–22.
Molander 1915, p. 30.
[illegible] Wandeli Jungersen 1917, p. 8–9.
[illegible] Hickson 1931, p. 154.

M[illegible]

[illegible] N [illegible] W [illegible] 0.2° C. Wandel. The type specimen.
[illegible] N [illegible] W 621 m [illegible] 0.75° C. "Ingolf" St. 15. 1 colony.
[illegible] N [illegible] W 751 m [illegible] 0.1° C. "Ingolf" St. 143. 1 colony.
[illegible] N [illegible] W 750 m [illegible] 0.38° C. "Michael Sars" St. 96.

[illegible] W [illegible] 0.5° C. 750 m. "Thor" St. 255 (01).

[illegible] row of pinnulae latero[illegible] N[illegible] about 20 pairs. The [illegible] smooth. The upper part [illegible] retraction into the cuticular [illegible] surface and a [illegible] 0.1 mm, present in a [illegible] stalk, anthocodial [illegible] Mesenteric filaments [illegible]

M[illegible] of the species [illegible] tentacles with two [illegible] row [illegible]

[illegible] fairly well pre[illegible] The largest specimen is fairly well extended and measures 45 mm in height, and of this the stalk makes out 25 mm. The smallest specimen measures about 20 mm, and of this the stalk is about 12 mm. The diameter of the cylindric stalks are 8 mm and 5 mm respectively. The largest specimen has about 25 zooids, the smallest about 11 zooids.

The cylindric stalks are often somewhat narrowed just above the base which is slightly expanded and has been attached to stones or similar solid objects. The stalk is surrounded by a very conspicuous, fairly thick, firm and smooth, brown, horny or chitinous cuticula, which, towards the cluster of anthocodiae, gradually becomes thinner and a little below these is not discernible any more. In the largest and most extended specimen the cuticula disappears about 5 mm below the anthocodiae. In the type specimen, which measures about 25 mm, it disappears about 1 mm below the anthocodiae.

The specimens all have a single stalk; JUNGERSEN (1917, p. 8) says, however, about a specimen from the museum of Bergen that "the thick "horny" stem divides into two equal, short and clumsy, branches, each covered with its cuticular sheath and terminating with its cluster of polyps."

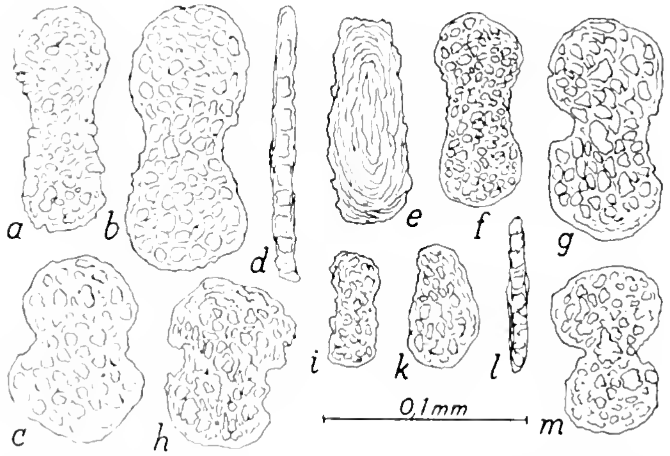


Fig. 19. *Ceratocaulon wandeli* Jungersen. *a*, sclerite from tentacle dorsum. *b–d*, sclerites from anthocodia, *d*, shown from the side. *e–m*, sclerites from stalk. *l*, shown from the side.

The colour of one of the specimens when alive was for the stalk stated as brown, horn-coloured, a colour still retained in the cuticula of the preserved specimen. The cluster of antho-

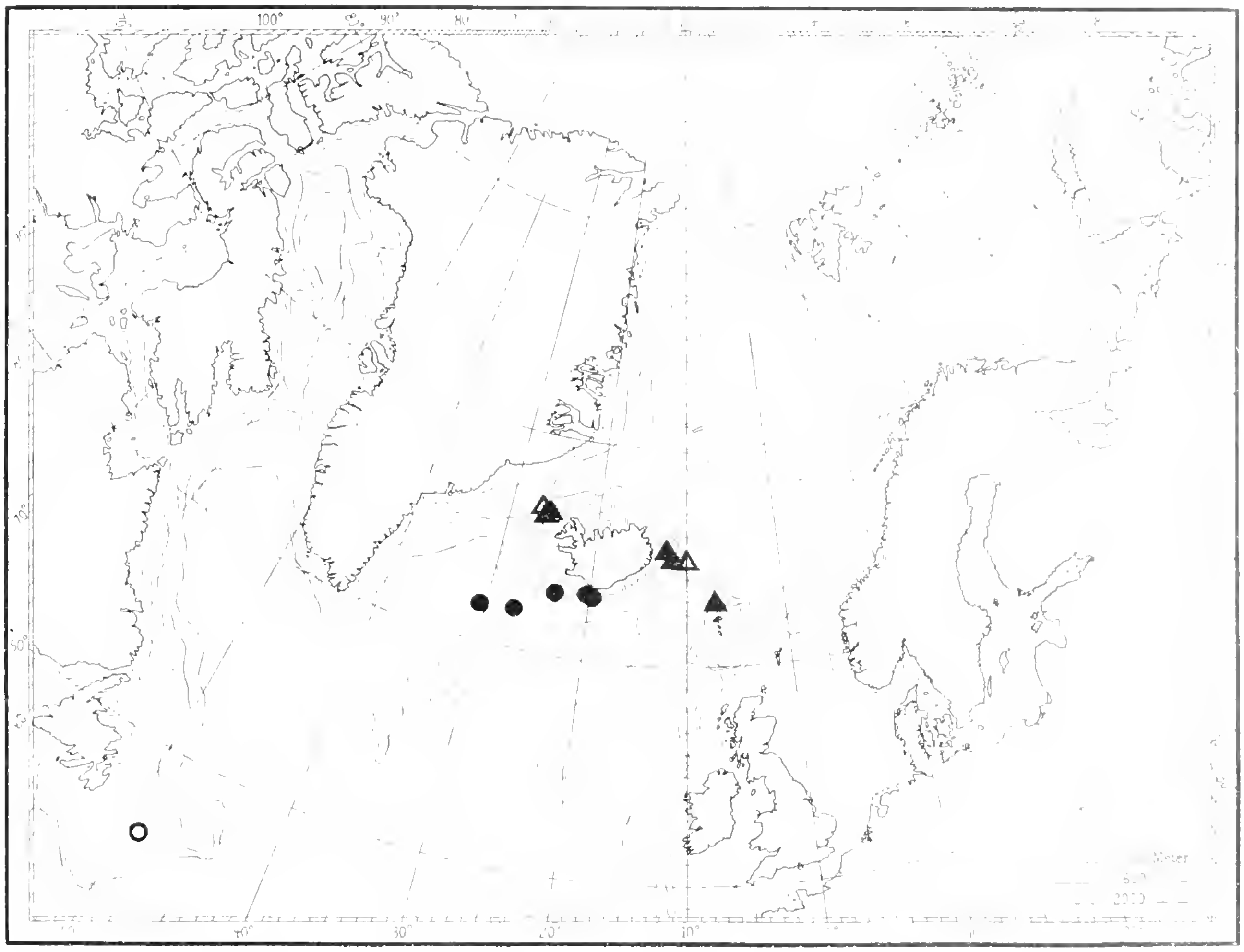


Fig. 20. ▲ *Ceratocaulon wandeli* Jungersen.
● *Acanthogorgia armata* Verrill.

codiae was described as distinctly pale-red, their colour in the specimens in alcohol is now greyish or light brown.

In contracted specimens the anthocodiae are apparently closely set in equal height. In more extended specimens, however, the stalk is lengthened, especially in the centre of the colony, and the anthocodiae are then placed more scattered. The lowest and outermost placed anthocodiae are moreover also the shortest, and thus in the most extended specimens the tentacle crowns become quite free of each other.

The largest anthocodiae measure about 11 mm in height, the largest tentacles a little more than 3 mm. Latero-ventral on each side of the tentacle there are about twenty slender pinnulae in a single row.

The anthocodiae of the Xeniidae are usually described as non-retractile, a statement which often also is used in the diagnosis of the family. HICKSON (1931 p. 138) states, however, about the anthocodiae that "there can be no doubt that they all possess considerable powers of contraction." This species shows power of complete retraction of the anthocodiae and also a considerable power of contraction of the entire colony. In one of the present colonies thus most of the anthocodiae are completely retracted, and JUNGERSEN (1917 p. 9) writes about the specimens from the Bergen Museum that "in two cases the upper naked part of the stem with all its polyps was found retracted into and concealed in the "horny" part," a very interesting statement which has been quite overlooked by the later students of the Xeniidea. Probably the retraction of the anthocodiae in *C. wandeli* is a very slow process only taking place when exposed to very strong influences. By retraction the anthocodiae are entirely inverted.

The stalk of the species is composed of the anthostelae of the zooids which reach down nearly to the base of the colony. The zooids are arranged with their dorsal sides towards the axis of the colony and the mesogloeal tissue is but poorly developed.

The sclerites are, as is usual in the Xeniidea, of a very uniform type. They are minute, flat, oblong disks with a rugged surface, rounded ends and generally a constricted middle. The largest measure 0.13 × 0.06 mm, most are, however, somewhat less than 0.1 mm (fig. 19).

The spiculation of the specimens is very varying, thus one of the specimens is apparently entirely devoid of sclerites, this may of course be due to bad preservation, but in another specimen where sclerites are found in the stalk such are almost quite absent in the anthocodiae, and a specimen with fairly richly spiculated anthocodiae has a stalk only poorly provided with sclerites. In the most spiculated specimen the sclerites of stem are closely crowded in a rather thick layer and in the anthocodiae they are closely and crosswise arranged in eight broad intermesenterial rows which also continue uninterruptedly in the dorsum of the tentacles. In the tentacles the sclerites are longitudinally arranged. The row of sclerites is at the tentacle base about three to four sclerites broad, becomes, however, in the upper part of the tentacle, rapidly only one sclerite broad. Besides the interseptal rows of sclerites a few sclerites are found along the attachments of the mesenteries in the uppermost part of the zooid body. Sclerites may also be found in the stalk in the walls between the coelen [illegible] were observed [illegible] parts of the round [illegible] two dorsal mesen- [illegible] whereas [illegible] down into [illegible] have a length of [illegible]

[illegible] the type specimen [illegible] M. Sars St. 96 taken in July [illegible] respectively.

[illegible] was not by KÜKEN- [illegible] as a distinct genus, but only as [illegible] comprising also *Nidalia antarctica* [illegible] 1922, p. 1 [illegible] pl. 5 figs. 22–24). The [illegible] is, however, not followed here, as, in reality, the horny cuticula, the comparatively large sclerites, the presence of eight mesenteric filaments, and the whole primitive character of *C. wandeli* speaks for placing it in a distinct genus. To this genus should also be reckoned the only other known deep-water species of Nemidea, viz. *N. antarctica* Kukenthal from the Bouvet Island at 457 m depth.

C. antarctica has, as distinct from *C. wandeli*, the oral side of the tentacles provided with numerous small warts. *C. antarctica* has further the horny cuticula incrusted with foreign bodies. The absence of sclerites in *C. antarctica* is, however, of no distinguishing value as such may apparently be absent also in *C. wandeli*.

Distribution: The species is found in the Norwegian Sea in several localities just north of the Wyville Thomson Ridge from the Faroes to the Danmark Strait at depths from 540–850 m. Chart of distribution, fig. 20.

Ordo: **Alcyonacea** Verrill 1866 emended.

Family: **Alcyoniidae** Verrill 1865.

Subfamily: **Alcyoniinae** Kükenthal 1906.

Diagnosis: Vide KÜKENTHAL 1906 *a*, p. 28.

Genus: **Alcyonium** Linné 1758 emended.

Diagnosis: Vide KÜKENTHAL 1906 *a*, p. 28.

Alcyonium digitatum Linné 1758.

Alcyonium digitatum Broch, 1912 *d*, p. 27–31, figs. 18–23.
norvegicum Broch, 1912 *d*, p. 21–26, figs. 11–17.
digitatum Molander, 1915, p. 36–42, fig. 11, pl. 2 figs. 21–26.
Jungersen, 1917, p. 5–8.
(?) Deichmann, 1936, p. 18–19.
– norvegicum, Pax 1936, p. 223–225, figs. 117–149.
Carlgren, MS.

For further references vide JUNGERSEN 1917.

Description: Vide BROCH 1912 *d* and MOLANDER 1915.

Remarks: Of modern authors BROCH (1912 *d*) has tried to distinguish the northern *Alcyonium* into two different species, i. e. besides the typical *A. digitatum* L., in a form which always has membranous growth and is identical with *Sympodium norvegicum* Koren & Danielssen 1883. MOLANDER in 1915 recognized only one species, however divided into two varieties, viz. *A. digitatum* var. *norvegicum* and *A. digitatum* var. *digitatum*, both varieties typically of the usual clumsy, lobular shape, but sometimes also found in membranous forms.

It seems, however, impossible to maintain that the two forms are specifically different and also JUNGERSEN (1917) regarded them as synonymous.

Distribution: The species is found on the European coast as far north as Lofoten and as far south as the Bay of Biscay. It is further found at the Faroes and off South Iceland and probably also on the American coast off New England and Nova Scotia.

Bathymetrical distribution: 1–789 m, generally, however, at depths from 20–150 m.

Vide further JUNGERSEN 1917 and the author's paper in 1913.

Genus: **Anthomastus** Verrill 1878.

Diagnosis: Vide KÜKENTHAL 1906 *a*, p. 29.

Anthomastus grandiflorus Verrill 1878.

Anthomastus grandiflorus Jungersen, 1927, p. 5–11, textfigs. 1–4, pl. 1.

Remarks: The very large collection which the "Ingolf" Expedition secured on 13 different stations has previously been worked up by JUNGERSEN in "The Danish Ingolf Expedition", Vol. V, pt. 11.

Distribution: The species is found on the Norwegian coast from Bergen to Trondheim and in the southern part of Davis Strait. It is further found in the North Atlantic Ocean south of the Wyville Thomson Ridge s. lat., and in the eastern part of the Atlantic Ocean it is found as far south as the Canaries, in the western part as far south as the Caribbean Sea.

Bathymetrical distribution: About 140–2875 m.

Family: **Nephthyidae** Gray 1859.

Diagnosis: Vide KÜKENTHAL 1903 p. 4–5.

Remarks: The family Nephthyidae is very difficult to work up because so many genera and species have been established, most of which have proved not to hold true. In this family were thus described several genera from the northern seas with altogether more than half a hundred species, though probably all these species are merely synonyms of a few of one or two genera.

KÜKENTHAL (1906, 1907) was the first to reduce the great number of species, those recognized by him mostly belonging to the genus *Eunephthya* sensu Kükenthal, and some years later MOLANDER and JUNGERSEN, both in 1915, published the results of their studies on the group. Both the last mentioned authors agree with KÜKENTHAL that most of the previously described forms are invalid, both being of the opinion that still some of the species recognized by KÜKENTHAL are but synonyms of others. Otherwise, however, the two authors do not agree.

JUNGERSEN, after having examined more than a thousand specimens from the northern seas, arrived at the result that all the northern Nephthyidae belonged to only four species of one single genus (*Eunephthya* sensu Jungersen), in his papers (1915–1917) he published very extensive lists of synonyms to these [illegible] agreement with state- [illegible] based would be set [illegible] of the Ingolf Expedi- [illegible] introduction, JUNGERSEN [illegible] before he had time [illegible]

[illegible] publish the results of his studies [illegible] 1928 published a treatment of [illegible] and p. 1 in this paper BROCH [illegible] opportunity during several discourses [illegible] that our points of view completely [illegible] DEICHMANN 1936 recognizes among the northern N[illegible] the four species mentioned by JUNGERSEN, [illegible] be pointed out and discussed below, some [illegible] BROCH's and DEICHMANN's descriptions [illegible]

[illegible] this paper deeply regrets that JUNGERSEN, with [illegible] of the northern Nephthyidae, did not [illegible] extended report, as many points are still rather [illegible] JUNGERSEN's determinations of the specimens [illegible] of the Zoological Museum of Copenhagen need [illegible] than the material directly yields the examiner.

[illegible] modern students of the northern Nephthyidae all [illegible] the division of these corals into two main groups [illegible] their capability of retraction of the anthocodiae.

[illegible] first group, with entirely retractile anthocodiae, comprises according to JUNGERSEN, BROCH, and DEICHMANN the two [illegible] *E. rubiformis* (Ehrenberg) and *E. fruticosa* (M. Sars); according to MOLANDER the group comprises the genus *Gersemia* Marenzeller, in which he, however, recognizes several [illegible] MOLANDER 1915), and VERRILL (1922) agrees quite with MOLANDER's point of view.

[illegible] second group, with non-retractile anthocodiae, comprises according to JUNGERSEN, BROCH, and DEICHMANN, the two [illegible] Verrill and *E. florida* (Rathke); according to MOLANDER the group comprises the genus *Eunephthya* with [illegible] recognized, distributed over two groups, viz. [illegible] *glomeratae* and *E. umbellatae*. The first group corresponds to *E. glomerata* sensu Jungersen, the second group to [illegible] sensu Jungersen. VERRILL (1922) agrees practically with [illegible] of MOLANDER except that he retains the generic name [illegible] for some other species and for the first of MOLANDER's [illegible] generic name *Drifa* Danielssen 1887, for the [illegible] *Duva* Koren & Danielssen 1883.

[illegible] first group, with retractile anthocodiae, it [illegible] supposed that the three authors JUNGERSEN, [illegible] DEICHMANN were in accordance in their view on [illegible] they recognize in the group. This is, however, [illegible] the case. In a foot note by DEICHMANN (1936 [illegible] is to be found: "BROCH's figure 5, [illegible] wrongly labelled. Both the shape [illegible] indicate *E. rubiformis*, likewise [illegible] of them are deep red. I have never seen [illegible] of red spicules in *E. fruticosa*. [illegible] *rubiformis*, resemble much [illegible] DEICHMANN is, however, not right in [illegible] figures have been confused. The [illegible] BROCH's key of determination [illegible] and correspond also to the [illegible] paper (1912 *b*). BROCH (1935 p. 19) [illegible] whether the colour of the [illegible] or not, that "Durch- [illegible] *Eunephthya fruticosa* im [illegible] dunkler und starker zur [illegible]

[illegible] *E. rubiformis* does not [illegible] DEICHMANN's *E. fru-* [illegible] Likewise there is no absolute accordance between BROCH's and JUNGERSEN's conceptions of *E. rubiformis* and *E. fruticosa*. As appears from the above, red sclerites may possibly be found in BROCH's *E. fruticosa* whereas such do not occur in JUNGERSEN's *E. fruticosa*. JUNGERSEN (1916, p. 189) writes about *E. rubiformis* that "The colour in this species is due to red spicules" and he further states that all other arctic species of *Eunephthya* possess colourless sclerites. Nor are JUNGERSEN's and DEICHMANN's *E. rubiformis* quite identical as appears from JUNGERSEN's papers where, among the synonyms to *E. rubiformis*, is included *E. rubiformis* Broch (1912 *b*) which apparently according to DEICHMANN should be an *E. fruticosa*.

E. rubiformis sensu Deichmann comprises among other forms *E. rubiformis* sensu Molander to which also VERRILL's *E. rubiformis* corresponds. Also JUNGERSEN (1917) includes in his synonym list to *E. rubiformis*, *E. rubiformis* sensu Molander. BROCH (1928 p. 15) states however "JUNGERSEN (1916), probably by a slip of the pen, ranged MOLANDER's "*Eunephthya rubiformis*" among the synonyms of *Eunephthya rubiformis* (Ehrenberg). MOLANDER's figures and description, however, leave no doubt that these have been based upon typical specimens of *E. fruticosa* (M. Sars)." It is evident that MOLANDER's *E. rubiformis* belongs to BROCH's *E. fruticosa*; it is, however, not quite certain that JUNGERSEN referred MOLANDER's *E. rubiformis* among the synonyms to *E. rubiformis* in his sense owing to "a slip of the pen"; it may be due to a conception of *E. rubiformis* which does not quite correspond to BROCH's view on the same species.

The great confusion which exists as to the various students' conception of the northern Nephthyidae with retractile anthocodiae is only indicated in the above-mentioned. Below, under the discussion of the genus *Gersemia*, the author revert to the problem in more detail.

In the second group of northern Nephthyidae, those with non-retractile anthocodiae, there are better accordance between the modern students' conceptions of the species, though the two species, which JUNGERSEN, BROCH, and DEICHMANN recognize, according to MOLANDER (and VERRILL) each is a group of species.

During the preparation of this paper the author has had access only to the material in the collection of the Zoological Museum of Copenhagen. However, in the 25 years which have elapsed since JUNGERSEN's death, this material has grown to such an extent that it now comprises more than 1300 specimens from very widely spread localities in the North-Atlantic Ocean and adjacent seas. Thus the material in the museum of Copenhagen is now about one fourth larger than the whole material to which JUNGERSEN had access in the Scandinavian museums, and consequently allows a thorough examination of the northern Nephthyidae.

At first the author was convinced that JUNGERSEN had gone far too wide in his synonym lists and that a point of view, such as taken by MOLANDER, would be the most convenient. However, by repeated, careful studies of the great material at disposal the author arrived at the conclusion that in the group with retractile anthocodiae only one single species might be distinguished, that thus *E. rubiformis* and *E. fruticosa* are synonymous, and that in the other group, with non-retractile anthocodiae, it was possible to distinguish between the same two species as JUNGERSEN did. The one of these species, however, comprising three forms which possibly may be regarded as valid sub-species (one of the forms perhaps a valid species) and which correspond to MOLANDER's species in the group *Eunephthya divaricatae-glomeratae*. It is to be noted that the material of one of these forms, identical with MOLANDER's *E. groenlandica*, only recently has been included in the collections of the Zoological Museum of Copenhagen and, though JUNGERSEN knew the form from MOLANDER's paper, he had no personal knowledge of it at the time when he wrote his papers on the northern Octocorals.

The present author believes that it is correct to maintain a generic difference between the two main groups of northern Nephthyidae, as done by Molander (1915, 1918) and by Broch (1939), and this course, which also seems the most convenient, is consequently followed below. Which generic names, however, should be used for these groups may be discussed.

Jungersen ranged, as mentioned above, all the northern Nephthyidae into one single genus, viz. *Eunephthya*, a genus which was established by Verrill (1869 p. 284) and in which Verrill as type designated a previously described species, "*Nephthya thyrsoidea* Verrill 1865". Besides, Verrill in the genus described a new species, *Eunephthya glomerata*, the type specimen of which was from Greenland and sent to Verrill by Lütken under the MS. name *Alcyonium glomeratum*.

The original description of *E. glomeratum* is short but distinct and Verrill in 1922, more than fifty years later, redescribed the type specimen and gave several figures. The original description of *Nephthya thyrsoidea* is, on the contrary, very deficient, and Kükenthal (1907 p. 377) doubts whether that species actually belongs to the genus *Eunephthya* in his sense. Verrill (1922) shares this doubt, and redescribes on p. 29 *Eunephthya thyrsoidea* on a cotype, as the original specimen was destroyed by the great Chicago fire, and states that his species is identical with *Capnella rugosa* Kükenthal 1901. Verrill is of the opinion that Kükenthal has made a wrong use of the generic name *Capnella* (in his diagnosis of the new genus *Capnella* erected for *Alcyonium imbricatum* Quoy & Gaimard Gray (1869 p. 129) e. g. states "Polypes retractile"), and Verrill therefore retains the generic name *Eunephthya* for those species which Kükenthal ranges into the genus *Capnella*, and instead he uses for *Eunephthya glomerata* the generic name *Drifa*, the genus then having as type *Drifa hyalina* Danielssen 1887, a species which is identical with Verrill's original *E. glomerata*. In those forms which Verrill (1922) ranges in *Drifa glomerata* are, however, included both forms which belong to *E. glomerata* sensu Molander and such forms which belong to *E. flavescens* sensu Molander. *Drifa hyalina* belongs to the latter.

Broch in 1928 with a query places *Eunephthya thyrsoidea* Verrill 1922 among the synonyms of *E. glomerata*, and Deichmann (1936) does the same without a query. The present author can not agree with this; Verrill's description in 1922 distinctly shows that *E. thyrsoidea* is different from *E. glomerata* and, as Verrill states, most probably identical with *Capnella rugosa* Kükenthal. If this is correct the species should, however, still be named *Capnella rugosa* Kükenthal 1902, as not until Verrill's redescription in 1922 was an identification possible. It is in any case not correct when Verrill rejects the generic name *Capnella*. This name is prior to *Eunephthya* and that Gray describes the zooid in *C. imbricata* (Q. & G.) as retractile should, if not a misprint, probably only allude to the fact that the tentacles may be withdrawn and the body contracted; Quoy & Gaimard themselves (1833 p. 281) describe the zooids in *Alcyonium imbricatum* as "non retractilibus", and Kükenthal's descriptions (1903) of the species of *Capnella* leaves no doubt as to the generic accordance between *C. imbricata* and *C. rugosa*.

There exists, however, much accordance between *Eunephthya glomerata* and the genus *Capnella* and maybe it is impossible to maintain a generic difference between the species of Nephthyidae now reckoned to *Capnella* and the North-Atlantic Nephthyidae with non-retractile anthocodiae. Broch (1939 p. 14), in any case, arrives at the result that there is no generic difference between the two groups and that consequently *E. glomerata* and *E. florida* should be ranged into the genus *Capnella* whereas the generic name *Eunephthya* should be retained for the other northern Nephthyidae, i. e. those with retractile anthocodiae.

If actually *E. glomerata* Verrill belongs to the same genus as *Capnella imbricata* (Quoy & Gaimard), and much favours this supposition, then Broch is right that the generic name *Capnella* Gray 1869 should be used for the northern Nephthyidae with non-retractile anthocodiae, and also in the present paper that name is adopted for the group. It will, on the other hand, be evident from the above that the generic name *Eunephthya* should not be used for the northern Nephthyidae with retractile anthocodiae if this group is referred to a genus different from that into which *E. glomerata* is ranged, and that Broch (1939) made a lapse in doing so. The correct generic name for the group would have been *Gersemia* Marenzeller 1878 as used both by Molander (1915, 1918) and by Verrill (1922). The name *Gersemia* was by Marenzeller (1878 p. 375) first used for some specimens which he identified with Rathke's *Gorgonia florida*, a species belonging to the group with non-retractile anthocodiae. Marenzeller showed, however, in 1886 that the identification was not correct and renamed the specimens *Gersemia danielsseni*, and Kükenthal (1906) after a re-examination identified the specimens with his *E. fruticosa*. On account of this and of the fact that also the other species described by Marenzeller 1878 in the genus *Gersemia* (*G. loricata*) clearly belongs to the group with retractile anthocodiae it is thought that no objection can be made against the use of the generic name *Gersemia* for that group.

Genus: **Gersemia** Marenzeller 1878.

Remarks: In this group of northern Nephthyidae, easily recognized by their entirely retractile anthocodiae, a considerable number of species have, as mentioned above, previously been described. Some of the modern students of the group recognize, however, only two species, though, as shown above, without agreeing in their conception of these.

Broch (1928) uses as the principal distinguishing character the shape of the sclerites in the bark of the branch tips of the colony. In *E. rubiformis* sensu Broch these sclerites should be "broad, fusiform or rod-like ones, up to 0.35 mm in length and richly armed all over with irregularly arranged compound wharts" (Broch 1928 p. 9).

In *E. fruticosa* sensu Broch these sclerites should mainly be "double stars up to 0.2 mm in length and with transversally arranged compound wharts generally in whorls" (Broch 1928 p. 9).

Deichmann (1936) uses another character to distinguish the group into two species. *E. rubiformis* sensu Deichmann comprises those specimens which have "Zooids small, only few mm in length, and retractile into the common cushion of tissue which forms the end of the branches" (Deichmann 1936 p. 60).

E. fruticosa sensu Deichmann comprises those specimens which have "Zooids tall, up to 8 mm in length, and retractile singly into the tubes which form the ends of the branches" (Deichmann 1936 p. 60).

Explained in another way *E. rubiformis* sensu Deichmann has small anthocodiae set well apart on the branches, and thus when the anthocodiae are expanded there are distinct spaces of coenenchyma between them. In *E. fruticosa* sensu Deichmann, however, the larger anthocodiae are more closely set, and when expanded no distinct spaces of coenenchyma are left between them.

The collection in the Zoological Museum of Copenhagen includes nearly a thousand specimens which may be ranged in the genus *Gersemia*, many of them determinated by Jungersen. A study of the comparatively few specimens which Jungersen labelled *rubiformis* showed that all these specimens possessed anthocodiae set well apart and of a size less than about 5 mm, and thus these specimens also belong to *E. rubiformis* sensu Deichmann. Only some of them (colonies from the Kara Sea, Spitsbergen and East Greenland) had, however, in the branch tips, sclerites corresponding to Broch's diagnosis of *E. rubiformis*, whereas the other colonies from about the same localities possessed sclerites by which they could just as well or better have been referred to *E. fruticosa* Broch, and the same may be said about [illegible] A colony from off [illegible] Smithsonian Institution [illegible] (a name not included [illegible] an *E. fruticosa* sensu [illegible] determinated by DEICHMANN [illegible] from the U. S. Nat. Mus., [illegible] All these colonies were taken [illegible] possibly be of the same lot. The [illegible] from off Cape Cod agree also perfectly [illegible] description of *E. rubiformis*.

[illegible] from the above that *E. rubiformis* sensu [illegible] *E.* [illegible] sensu Deichmann was the same, this, [illegible] as shown by a study of the material by [illegible]. In fact more than half of the specimens [illegible] regarded as *E. fruticosa*, correspond with [illegible] sensu Deichmann, and both in the material of [illegible] *E.* [illegible] corresponding to *E. rubiformis* sensu [illegible] that corresponding to *E. fruticosa* sensu Deichmann [illegible] specimens are found with sclerites by which they [illegible] referred to *E. rubiformis* sensu Broch.

[illegible] West Greenland (Jakobshavn, Egedesminde) [illegible] corresponding to *E. fruticosa* sensu Deichmann, [illegible] from base to top of the colonies was quite [illegible] sclerites, [illegible] ones only occurring in the anthocodial [illegible] the zooid body.

Apart from the colour of sclerites it has been found quite [illegible] characters by which JUNGERSEN may have [illegible] *E. rubiformis* from his *E. fruticosa*. It seems as [illegible] has regarded specimens of *Gersemia* with more or [illegible] as *E. rubiformis*, and the few colonies, by JUNGERSEN [illegible] *E. rubiformis*, in which the sclerites now are [illegible] have probably lost their colour since the time when [illegible] determined the specimens. From his papers (1887 [illegible] also appears that *E. rubiformis* sensu Jungersen [illegible] sclerites, and in the paper (1916 p. 10) JUNGERSEN [illegible] identification of a specimen which is thought [illegible] *E. rubiformis* though it "does not possess the usual [illegible] only showing a faint pink colour."

[illegible] careful study of the large collection at disposal the author [illegible] the conclusion that whereas it perhaps might have [illegible] to separate a smaller collection of northern Nephthyidae with retractile anthocodiae into various "species" as [illegible] MOLANDER (1915, 1918 *a*) this becomes quite impossible [illegible] of the present large collection. In spite of many [illegible] author has been quite unable to find any distinguishing character of any value.

[illegible] the colour of the sclerites, as apparently used by [illegible] principal distinguishing character, is worth[illegible] which apart from the colour of sclerites [illegible] become distributed over two different [illegible]

[illegible] character used by BROCH (the shape of [illegible] is of equally small value. In a [illegible] perhaps be a clear difference, in a larger [illegible] possible intermediate stages are found [illegible] *fruticosa* sclerites sensu Broch and [illegible] sensu Broch.

[illegible] about the character used by DEICHMANN [illegible] anthocodiae in comparison with the coenenchyma [illegible] about the character used by BROCH, [illegible] character, but as all possible inter[illegible] here between colonies of typical [illegible] Deichmann and such of typical *E. fru*[illegible] of as little value as any of [illegible]

[illegible] Zoological Museum of Copenhagen [illegible] M. Sars, from Vadsø [illegible] the sense of DEICHMANN, after the sclerites it may also come nearest to *E. fruticosa* sensu Broch.

It has thus been quite impossible to find any character or combination of characters which might be used to separate the northern Nephthyidae with retractile anthocodiae (= *Gersemia*) into more species or well-defined groups, as all the various forms in which *Gersemia* has been found pass by every structural degree insensibly into each other, consequently the author has regarded them all as belonging to one species which should be named *Gersemia rubiformis* (Ehrenberg 1834). And by this, maybe somewhat drastic, but the author thinks absolutely justifiable course, all the various problems, all the confusion which exists in connection with the synonymies of the northern Nephthyidae with retractile anthocodiae has been done away with.

It may be noted that also BROCH in 1935 doubts whether it is in reality possible to distinguish clearly between *E. rubiformis* and *E. fruticosa*. BROCH writes on p. 19 about some specimens referred to *E. fruticosa* that: "man kann bei solchen Exemplaren auch gelegentlich in Zweifel geraten, ob eine scharfe Grenze gegenüber der vorhergehenden Art (*E. rubiformis*) vorhanden sei."

In a form such as *Gersemia rubiformis* (Ehrenberg) s. l. it is evident that the conception of species is more comprehensive than e. g. the conception of the species in the family Chrysogorgiidae, where only little variation is allowed or found in the various forms. *Gersemia rubiformis* may perhaps be regarded either as a group of very closely related races which have about the same geographical distribution and quite freely hybridize, or as a species which in nature mutates backwards and forwards just as *Drosophila* in the laboratory.

The author thinks that the best of the proposed characters for distinguishing between two groups of the forms of *Gersemia fruticosa* is that proposed by DEICHMANN, though it may be regarded as of no specific value. In the enumeration below of the material collected by the "Ingolf" and other material kept in the Zoological Museum of Copenhagen it is therefore noted whether the specimens in question had small anthocodiae set well apart on the branch tips (*E. rubiformis* sensu Deichmann) or somewhat larger anthocodiae set more closely and thus when expanded without distinct spaces of coenenchyma between them (*E. fruticosa* sensu Deichmann). For part of the material it has, however, been impossible to state to which group the specimens in question should be reckoned.

It may be repeated that the rather few specimens with red sclerites (i. e. *E. rubiformis* sensu Jungersen) all belong to *E. rubiformis* sensu Deichmann. It may further be noted that no colony with red sclerites has been found with a distinct stem below the cluster of branches and that the largest colony with red sclerites measures only about 6 cm in height in contracted state. The reason why these specimens, representing *E. rubiformis* sensu Jungersen, in some way makes up a group of their own is without doubt that the presence of red sclerites is a rather rare phenomenon.

Gersemia rubiformis (Ehrenberg 1834).

Lobularia rubiformis Ehrenberg, 1834, p. 58–59.

Eunephthya fruticosa + E. rubiformis Jungersen, 1915, p. 1171–1181.

Gersemia rubiformis + G. uvaeformis + G. clavata + G. fruticosa + G. mirabilis Molander, 1915, p. 18–70, fig. 12, pl. 1, figs. 1–13.

Eunephthya rubiformis + E. fruticosa Jungersen, 1916, p. 187–193.

Jungersen 1917 p. 9–11.

Gersemia rubiformis + G. uvaeformis + G. clavata + G. fruticosa + G. mirabilis Molander, 1918 *a*, p. 1–11.

Gersemia rubiformis + G. canadensis + G. carnea + G. fruticosa + G. mirabilis + G. clavata + G. studeri + ? G. longiflora Verrill, 1922, p. 1–8, 20–28, 48–49, textfig. 4, 13, pl. 1, pl. 2, pl. 3, figs. 5–8, pl. 4, figs. 1–3, 8, pl. 5, figs. 3–5, pl. 11, pl. 14, figs. 3–3 a, pl. 17 a, fig. 1.

Gersemia rubiformis + G. uvaeformis + G. clavata + G. fruticosa Rylow, 1926 *a*, p. 65–70, figs. 3–10.
Gersemia rubiformis + G. clavata + G. fruticosa Rylow, 1926 *b*, p. 239–241.
Gersemia danielsseni + Eunephthya fruticosa J. A. Thomson, 1927, p. 44, 45–46, pl. 4 fig. 9.
Eunephthya rubiformis + E. fruticosa Broch, 1928, p. 3–10, 14–19, figs. 4, 5, 8, 9.
fruticosa + E. rubiformis Kramp, 1932, p. 10, figs. 3, 4.
rubiformis + E. fruticosa Broch, 1935, p. 17–19.
rubiformis + E. fruticosa Deichmann, 1936, p. 63–66, pl. 1, fig. 6, pl. 4, figs. 14–25.
Eunephthya fruticosa Pax, 1936, p. 227.
fruticosa + E. rubiformis Kramp, 1939, p. 3–4.
fruticosa Carlgren, MS.

For further references vide JUNGERSEN's papers and the list of synonyms at the end of this paper.

Description. References may be made to the papers by BROCH and MOLANDER, and to DANIELSSEN (1887). It should only be remembered that the differences which these authors use to separate species or even genera of the northern Nepthyidae are altogether useless, as the various forms pass insensibly into each other.

Material:

	Anthocodiae larger, more closely set and when expanded without distinct spaces of coenenchyma between them	Anthocodiae fairly small and set well apart on the branches
63°35′ N. 10°24′ W. 512 m, 0°5 C. "Ingolf" St. 3		
64°07′ N. 11°12′ W. 446 m, 2°5 C. - 4		
63°06′ N. 56°00′ W. 2258 m, 2°4 C. - 24		
63°30′ N. 54°25′ W. 1096 m, 3°3 C. - 25		
65°14′ N. 55°42′ W. 791 m, 3°5 C. - 28		
65°34′ N. 54°31′ W. 128 m, 0°2 C. - 29		
66°35′ N. 55°54′ W. 166 m, 1°6 C. - 31		
65°17′ N. 54°47′ W. 104 m. - 34		
61°50′ N. 56°21′ W. 2702 m, 1°5 C. - 36		
65°00′ N. 11°16′ W. 581 m, ÷0°1 C. - 59		
65°38′ N. 26°27′ W. 260 m, 5°9 C. - 98		
66°23′ N. 7°25′ W. 1802 m, ÷1°1 C. - 101		
65°34′ N. 7°31′ W. 1435 m, ÷0°6 C. - 105		
67°14′ N. 8°48′ W. 1619 m, ÷0°9 C. - 111		
67°57′ N. 6°44′ W. 2386 m, ÷1°1 C. - 112		
69°31′ N. 7°06′ W. 2465 m, ÷1°0 C. - 113		
69°13′ N. 8°23′ W. 1889 m, ÷1°0 C. - 117		
67°29′ N. 11°32′ W. 1666 m, ÷1°0 C. - 120		
67°40′ N. 15°40′ W. 932 m, ÷0°8 C. - 124		
67°19′ N. 15°52′ W. 552 m, ÷0°5 C. - 126		
63°26′ N. 7°56′ W. 887 m, ÷0°6 C. - 138		
63°29′ N. 6°57′ W. 1169 m, ÷0°9 C. - 140		
62°58′ N. 7°09′ W. 731 m, ÷0°1 C. - 143		
62°53′ N. 4°14′ E. 850 m, "Michael Sars"		
62°58′ N. 1°56′ E. 1120 m, St. 35		
62°35′ N. 1°04′ W. 650 m, ÷0°09 C. "Michael Sars" St. 67		
64°58′ N. 11°12′ W. 565 m, ÷0°38 C. - 96		
66°02′ N. 11°05′ W. 1010–900 m, "Thor" St. 51 (03)		
66°20′ N. 12°10′ W. 690 m, "Thor" St. 80 (08)		
Godthaabsfjord, "Tjalfe" St. 52		
66°14′ N. 56°08′ W. 325 m, "Tjalfe" St. 100		
68°20′ N. 54°03′ W. 400–500 m, - 107		
69°17′ N. 52°14′ W. 430 m, - 123		
69°16′ N. 51°35′ W. 146		
69°16′ N. 51°22′ W. 155		
66°22′ N. 57°16′ W. 686 m, 366		
65°09′ N. 53°33′ W. 55 m, 419		
65°06′ N. 54°19′ W. 83 m, - 422		
55°00′ N. 56°34′ W. 314 m, 2°8 C. "Godthaab" St. 14		
69°11′.4 N. 57°22′ W. 215 m, 1°20 C. (200 m) "Godthaab" St. 50		
69°50′ N. 61°36′ W. 1880 m, ÷0°42 C. (1860 m) 54		
71°52′.5 N. 62°12′ W. 450 m, 0°72 C. (430 m) 73		
75°26′ N. 62°26′ W. 820 m, 0°69 C. (790 m) 77		
76°36′ N. 68°54′ W. 480–80 m, ÷1°3 C. 86		
76°25′ N. 69°38′ W. 165 m, ÷1°49 C. (145 m) 107		

	Anthocodiae larger, more closely set and when expanded without distinct spaces of coenenchyma between them	Anthocodiae fairly small and set well apart on the branches
[illegible] W [illegible] 70 m (Godthaab St. 111		
[illegible] W [illegible] 70 m [illegible] 116	. .	. .
N [illegible] W [illegible] 1180 m [illegible] 135	. .	. .
N [illegible] W [illegible] 670 m [illegible] 113	. .	. .
N [illegible] W [illegible] 700 m [illegible] 141	. .	. .
[illegible] N [illegible] 48 W [illegible] 1750 m [illegible] 162	. .	. .
N [illegible] 18 W [illegible] 1490 m [illegible] 166	. .	. .
N 17 27 W [illegible] 140 m [illegible] 188	. .	. .
N [illegible] 24 W [illegible] 70 m [illegible] Dana St. 2333	. .	. .
N [illegible] 62 W 202 [illegible] 190 m) 2363	. .	. .
[illegible] W [illegible]	. .	. .
N [illegible] 21 W [illegible] Wandel	. .	. .
N 4 02 W 125 [illegible]	. .	. .
N 26 08 W 620 [illegible]	. .	. .
M [illegible] 165 [illegible]	. .	. .
[illegible]	. .	. .
N [illegible] type of *Eunephthya fruticosum* M. Sars 1860].	. .	. .
F [illegible] Norway	. .	. .
[illegible] 1500 [illegible]	. .	. .
[illegible] 1100 [illegible]	. .	. .
M [illegible] 65 95 [illegible]	. .	. .
[illegible]	. .	. .
[illegible] M [illegible] N [illegible] 2600 m (Albatross St. 2563	. .	. .
[illegible] 47 [illegible] Speedwell[illegible]	. .	. .
N [illegible] F [illegible]	. .	. .
[illegible] localities both at West and East Greenland[1]).	. .	

[illegible] has a very wide distribution [illegible] waters, in the North Pacific so far [illegible] the North Atlantic in the eastern [illegible] Storfjord, in the western part so far [illegible] Also the bathymetrical distribution is extre[illegible] found at depths from only 6 m to [illegible] about 500 m, however, only met with [illegible]

[illegible] 1915, 1916, 1917, Molander 1915, [illegible] 1929, 1935 Charts of distribution Broch 1928, [illegible] 29[illegible]

Genus Capnella Gray 1869.

[illegible] Molander (1915) and Broch [illegible] the northern Nephthyidae [illegible] two different groups by the [illegible] anthocodiae. [illegible] the species *Capnella florida* [illegible] warts, often [illegible] 21 *b*). Club-shaped [illegible] never exceeds that [illegible] always different [illegible] of northern *Capnella*, [illegible] distinctly [illegible] are figured in [illegible] in *C. florida*

[illegible] to Kramp [illegible] be set

In the other group which represents the species or group of species, *Capnella glomerata* (Verrill), the club-shaped sclerites have a unilaterally developed head and usually a distinct shaft (fig. 22).

Some specimens of *Capnella* taken in 61°23' N, 5°01' W, 180 m, by Wandel, and by Jungersen labelled *Eunephthya glomerata*, have fairly large anthocodial sclerites, either spindle- or club-shaped and measuring up to about 0.15 mm (fig. 21 *g*, *h*). As, however, the clubs are not quite as common in the anthocodiae as the spindles, and as the warts on the clubs are equally developed all over the whole sclerite, these specimens, in spite of some resemblance in their anthocodial sclerites with typical *C. glomerata* specimens, may be regarded as a form of *C. florida* (Rathke) though somewhat diverging. These specimens were of a purple colour when alive.

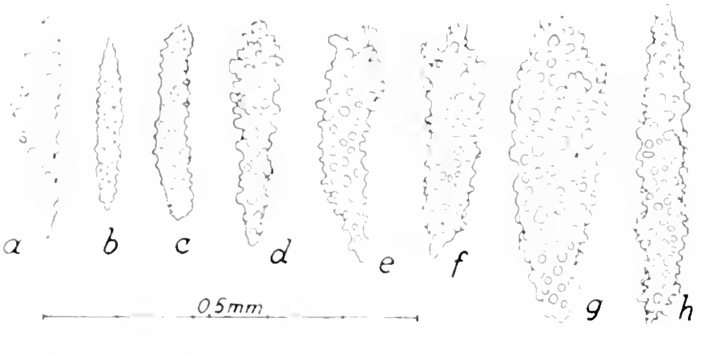


Fig. 21. *Capnella florida* (Rathke). Anthocodial sclerites, *a–f*, of the usual maximum size, *g*, *h*, of a specimen taken by Wandel in 61°23' N, 5°01' W. *d–g*, club-shaped sclerites, *b*, *h*, spindles, *a*, *c*, flattened rods.

Capnella glomerata (Verrill 1869) sensu Jungersen.

Eunephthya glomerata Jungersen, 1915, p. 1164 1169.
– Jungersen, 1916, p. 193 195.
– Jungersen, 1917, p. 11 16.
– Molander, 1918 *a*, p. 11 12.
Drifa glomerata + D. racemosa Verrill, 1922, p. 31 34, pl. 5 fig. 2 pl. 11 figs. 2, 4, pl. 15 figs. 4 5, pl. 17 a figs. 2 3 textfig. 5.
Eunephthya glomerata Rylow, 1926 *a*.
– Broch, 1928, p. 3 10, 10-12, figs. 1, 2, 6.
– Kramp, 1932, p. 5, fig. 4.
– Deichmann, 1936, p. 61 62.
– Pax, 1936, p. 227, fig. 153, 154.
– Kramp, 1939, p. 2, 3.
Capnella glomerata Broch, 1939, p. 14.
– Carlgren, MS.

For further references vide JUNGERSEN's papers.

Remarks: As mentioned above JUNGERSEN's and BROCH's *Eunephthya glomerata* corresponds to MOLANDER's group *E. divaricatae-glomeratae*, in which group MOLANDER (1915) recognizes three main species viz. *E. glomerata* Verrill sensu Molander, *E. flavescens* (Dan.) sensu Molander, and *E. groenlandica* Molander.

The collection of the Zoological Museum of Copenhagen includes about 200 specimens of *Capnella* referable to *C. glomerata* sensu late and in this material all the forms recognized by MOLANDER are represented. A study of the material gave the result that the form, by MOLANDER named *Eunephthya groenlandica*, apparently is so well distinguished from the other forms of *C. glomerata* that it possibly should be regarded as a valid species. However, the great variation known in the northern Nephthyidae and the fact that in the material the form is only represented from two localities, are in favour of at present regarding *C. groenlandica* (Molander) as but a distinct form of the species *C. glomerata* (Verrill) s. l. The two other forms recognized by MOLANDER are generally also fairly well distinguished in the material; there are, however, some few colonies which occupy an intermediate position and thus can not with certainty be referred to any of MOLANDER's forms.

Capnella glomerata (Verrill) f. **lütkeni** (Marenzeller).

The form named in this way corresponds to MOLANDER's *E. glomerata*. It has the following synonyms.

Ammothea arctica Lutken, 1875, p. 186 (nomen nudum).
– Luetkeni Marenzeller, 1877, p. 372 374, pl. 3 fig. 1.
Drifa islandica + Nephthya polaris Danielssen, 1887, p. 65 68, 92-98, pl. 6 figs. 30 71, pl. 13 figs. 2 15.
Eunephthya glomerata Broch, 1912 *b*, p. 12 14, figs. 11 13.
– Molander, 1915, p. 72 74, fig. 13 a, pl. 2 fig. 19.
Molander, 1918 *a*, p. 11 12.

Description: Vide MOLANDER 1915.

Material:

(Specimens which are not well distinguished from *C. glomerata* f. *flavescens* are marked with a query.)

63 35′ N. 10 24′ W. 512 m, 0 5 C. "Ingolf" St. 3.
(?)63 13′ N. 11 34′ W. 170 m, 7 C. – 6.
63 13′ N. 15 41′ W. 1130 m, 4 5 C. 7.
61 54′ N. 55 10′ W. 710 m, 3 8 C. 27.
65 34′ N. 51 31′ W. 128 m, 0 2 C. – 29
65 17′ N. 54 17′ W. 101 m, – 34
63 15′ N. 15 07′ W. 1197 m, 3 08 C. 53.
65 00′ N. 11 16′ W. 581 m, ÷ 0 1 C. 59.
64 56′ N. 36 19′ W. 381 m, 4 4 C. – 91.
62 35′ N. 4 01′ W. 542 m, ÷ 0 09 C. "Michael Sars" St. 67.
65 12′ N. 13 57′ W. 113 m. "Thor" St. 189 (03).
66 44′ N. 56 08′ W. 330 m. "Tjalfe" St. 400.
69 08′ N. 53 12′ W. 261 m. – 113 a.
69 16′ N. 54 35′ W. St. 116.
65 09′ N. 53 33′ W. 55 m. 119.
65 06′ N. 51 19′ W. 83 m. – 122.
74 52′.5 N. 62 42′ W. 450 m. 0 72 C. (130 m) "Godthaab" St. 73.
(?)77 05′.5 N. 71 13′ W. 790 m. ÷ 0 12 C. (725 m) "Godthaab" St. 87.
76 25′ N. 69 38′ W. 165 m, ÷ 1 19 C. (145 m) "Godth." St. 107.
76 10′ N. 76 20′ W. 85 m, ÷ 1 12 C. (75 m) "Godthaab" St. 111.
76 08′ N. 80 53′ W. 80 m, ÷ 1 05 C. (70 m) "Godthaab" St. 116.
Exeter Sound, Baffin Land 100 m, "Godthaab" St. 166 c.
63 06′ N. 40 40′ W. 437 m, 3 03 C. (430 m) "Dana" St. 6001.
Iceland (Bakkefjord, Midfjord).
Greenland[1]), numerous localities both off West and East Greenland; off East Greenland found so far north as Danmarks-Havn.

Remarks: The anthocodiae of this form have in contracted state generally a length of from 2 to 3 mm. The upper part (head) of the anthocodia is strongly spiculated on the abaxial side of the contracted zooid, whereas the adaxial side and the lower part (shaft) of the anthocodia are more poorly spiculated and sometimes quite devoid of sclerites. The sclerites of the abaxial side of the anthocodia are fairly clumsy clubs (fig. 22 *e g*) generally of a length of about 0.22 mm and with a maximum size of about 0.35 · 0.15 mm. They are arranged in a single layer with their heads pointing upwards and outwards and give the anthocodiae of this form of *E. glomeratum* a very characteristic appearance which has been very well figured by BROCH (1912 *b*). The figure has also been reproduced by PAX 1936, fig. 153.

Distribution: See under the following form.

Capnella glomerata (Verrill) f. **flavescens** (Danielssen).

To this form the following synonyms belong.

Eunephthya glomerata Verrill, 1869, p. 284.
Gersemia candida Koren & Danielssen, 1883, p. 9 10, pl. 5 figs. 1 15.
Drifa hyalina + Nephthya flavescens + N. rosea Danielssen, 1887, p. 59 64, 81 91, pl. 7 figs. 1 41, pl. 11, pl. 12, pl. 13 fig. 1.
Eunephthya racemosa Studer, 1901, p. 33 34, pl. 4 figs. 1 2.
– flavescens Molander, 1915, p. 74 78, fig. 13 b, pl. 2 figs. 15, 16.

Description: Vide MOLANDER 1915.

Material.

(Specimens which are not well distinguished from *C. glomerata* f. *lütkeni* are marked with a query).

63 13′ N. 15 41′ W. 1130 m, 4 5 C. "Ingolf" St. 7.
64 21′ N. 28 50′ W. 1484 m, 3 5 C. 10.
(?)66 18′ N. 25 59′ W. 621 m, ÷ 0 75 C. 15.
(?)65 13′ N. 26 58′ W. 474 m, 6 1 C. 16.
64 51′ N. 55 10′ W. 740 m, 3 8 C. 27.
(?)61 12′ N. 9 36′ W. 1026 m, 4 8 C. 44.
63 08′ N. 15 40′ W. 1301 m, 3 9 C. 54.
63 37′ N. 13 02′ W. 659 m, 3 4 C. 57.
62 58′ N. 7 09′ W. 731 m, 0 4 C. 143.
(?)65 27′ N. 51 45′ W. 126 m, Wandel.
(?)66 49′ N. 56 28′ W. 142 m,
(?)63 15′ N. 9 35′ W. 540 m,
5 sml. E. of Seidisfjord (Iceland), Wandel.
69 46′ N. 51 22′ W. 471 m, "Tjalfe" St. 155.

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[1]) Further particulars on the Greenlandic finds of Octocorals will be set forth in "The Zoology of East Greenland".

[illegible] St. [illegible]
[illegible] Godth[illegible] St. 87.
[illegible] 750 m. Dana St. 2341.
[illegible] W., [illegible] Dana St. 2361.
[illegible] W. [illegible] St. [illegible]
[illegible] W. [illegible]
[illegible] W. [illegible] "Dana" St. 6001.
[illegible] 500 m).

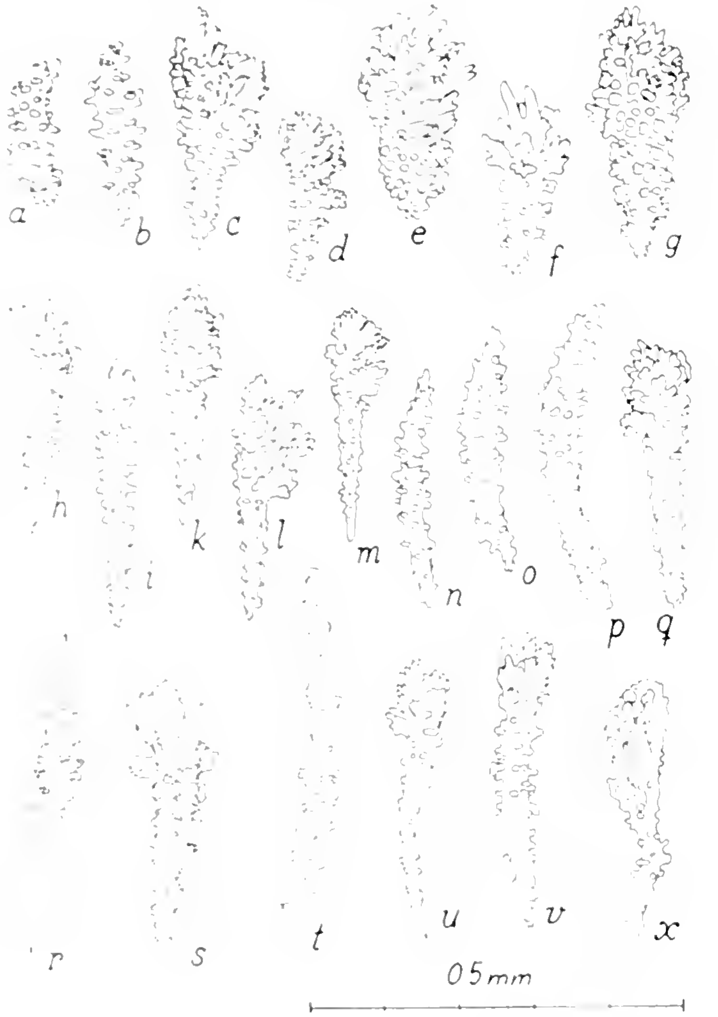


Fig. 22. Anthocodial sclerites. [illegible] of C. gl[illegible] [illegible] of C. [illegible] flavescens (Danielssen) [illegible] Molander; r, s, of the specimen [illegible] of the specimens taken by the [illegible] are drawn more or less in side view [illegible] from behind.

[illegible] anthocodia in this form is some[illegible] also the anthocodial head [illegible] provided with eight distinct, [illegible] more dense than in the [illegible] the shaft of the anthocodia [illegible] head i. e. at the mesen[illegible] 22 a, b) which may attain a [illegible] generally measure less [illegible] the sclerites are mainly [illegible] shaft and attain [illegible]

[illegible] and C. glomerata [illegible] specimens [illegible] occur and the occur[illegible] maintain that the [illegible] both the type specimen of *Eunephthya glomerata* Verrill (cf. Verrill 1922) and of *Nephthya flavescens* Danielssen are forms of f. *flavescens* which show likeness to specimens of f. *lütkeni*.

Distribution. According to Molander's statements (Molander 1915, 1918 *a*) and the material kept in the Zoological Museum of Copenhagen the two forms have an almost identical distribution comprising the Barents Sea, the Norwegian Sea, the Baffin Bay, the Davis Strait, the North Atlantic Ocean just south of the Wyville Thomson Ridge, and the West Atlantic Ocean off New Foundland and Nova Scotia.

Also the bathymetrical distribution is identical for the two forms. *C. glomerata* f. *lütkeni* has been met with in depths from 14–1497 m, and *C. glomerata* f. *flavescens* has been found in depths from about 60–1484 m. (According to Verrill *C. glomerata* in N. America is found at about 2700 m).

Though the distributions of these two forms of *C. glomerata* comprise the same areas, it seems that in the Norwegian Sea *C. glomerata* f. *flavescens* is by far the most common in the eastern part, off the coast of Norway, whereas in the western part, off the coast of East Greenland, *C. glomerata* f. *lütkeni* is the more common.

Capnella glomerata (Verrill) f. groenlandica (Molander).

Eunephthya groenlandica Molander, 1915, p. 78–79, fig. 13 c, pl. 2 fig. 18.

Description: Vide Molander 1915.

Material.
North of northern Iceland.
62 19' N., 8 51' W., 504 m, 1.21 C. (190 m). "Dana" St. 6005.

Remarks. The colonies are low, less than 6 cm in height, and of a beautiful light-red colour (in alcohol). The anthocodiae are very large, in contracted state measuring up to 8 mm in length by 3.5 mm in width, and distinctly ridged and very powerfully armed with densely crowded sclerites. That which most clearly distinguishes this form from *C. glomerata* f. *flavescens* is, besides the somewhat larger and somewhat differently shaped clubs of the anthocodial head (fig. 22 s, u–x), the occurrence of numerous very long and slender spindles in the anthocodia (fig. 22 r, t). These spindles measure up to 0.6 mm or more i. e. nearly twice the length of the longest spindles in f. *flavescens*.

E. glomerata f. *groenlandica* is at present well distinguished from the other northern forms of *E. glomerata* and it might perhaps be regarded as a valid species.

Verrill (1922 p. 34) supposed that *Eunephthya racemosa* Studer might be identical with *E. groenlandica* Molander. However, judging from the description and the measurements of sclerites given by Studer (1901), this may not be the case. *E. racemosa* belongs undoubtedly to *C. glomerata* f. *flavescens*.

Distribution. Besides in the above-mentioned localities, north of Iceland and a little west of the Faroes, the species is only known from an undefined locality off East Greenland.

Capnella florida (Rathke 1806).

Gorgonia florida Rathke, 1806, vol. 4, p. 20–21, pl. 137.
Eunephthya florida Broch, 1912 c, p. 39–43, figs. 30, 31.
Jungersen, 1915, p. 1169–1171.
rosea + E. florida + E. spitzbergensis Molander, 1915, p. 79–84, fig. 13 d, e, pl. 2 figs. 14, 16, 20, 21, 23.
Eunephthya florida Jungersen, 1916, p. 495–497.
Jungersen, 1917, p. 16–18.
Duva multiflora Verrill, 1922, p. 35–36, pl. 4 fig. 7, pl. 15 figs. 6, 7, textfig. 6, 7.

Eunephthya rosea J. A. Thomson, 1927, p. 15.
florida Broch, 1928, p. 3–10, 12–14, figs. 3, 7.
Kramp, 1930, p. 1–5.
Kramp, 1932, p. 6, fig. 7.
Kramp, 1933, p. 17.
Deichmann, 1936, p. 62–63.
Pax, 1936, p. 227, fig. 155.
Kramp, 1939, p. 3.
Capnella florida Broch, 1939, p. 14.
For further references vide JUNGERSEN 1917.

Description: Vide BROCH 1912e.

Material:
62°30′ N. 8°21′ W. 249 m, 7°2 C. "Ingolf" St. 1.
63°01′ N. 9°22′ W. 493 m, 5°3 C. - 2.
63°35′ N. 10°24′ W. 512 m, 0°5 C. - 3.
63°13′ N. 15°11′ W. 1130 m, 1°5 C. 7.
66°18′ N. 25°59′ W. 621 m, ÷0°75 C. 15.
63°30′ N. 54°25′ W. 1096 m, 3°3 C. 25.
66°35′ N. 55°54′ W. 166 m, 1°6 C. 31.
63°33′ N. 15°02′ W. 595 m, 5°9 C. 55.
63°37′ N. 13°02′ W. 659 m, 3°1 C. - 57.
60°37′ N. 27°52′ W. 1505 m, 4°5 C. 78.
64°45′ N. 27°20′ W. 584 m, 8°1 C. 89.
65°38′ N. 26°27′ W. 260 m, 5°9 C. - 98.
66°33′ N. 20°05′ W. 83 m, 5°6 C. 127.
62°58′ N. 7°09′ W. 731 m, ÷0°1 C. 143.
67°03′ N. 27°08′ W. 375 m, WANDEL.
61°42′ N. 27°13′ W.
65°30′ N. 55°26′ W. 525 m,
65°22′ N. 54°02′ W.
61°23′ N. 5°01′ W. 180 m.
66°20′ N. 25°12′ W. 180 m.
5 sml. E. of Seidisfjord (Iceland). WANDEL.
64°16′ N. 11°15′ W.
61°40′ N. 7°10′ W. "Diana".
66°40′ N. 11°05′ W. 900–1040 m, "Thor" St. 51 (03).
63°15′ N. 22°23′ W. 216–326 m, - 171 (03).
65°50′ N. 26°51′ W. 392 m, 5°83 C. - 150 (04).
60°19′ N. 2°50′ W. 525 m, "Michael Sars" St. 9.
E. of the Faroes, 365–410 m, "Michael Sars" St. 9.
62°35′ N. 1°01′ W. 620–640 m, ÷0°09 C. "Michael Sars" St. 67.
62°53′ N. 9°06′ W. 160 m, 3°86 C. "Michael Sars" St. 85.
70°12′ N. 51°28′ W. 478 m "Tjalfe" St. 177
68°28′ N. 51°17′ W. 317–461 m, 199.
66°22′ N. 57°16′ W. 686 m, 366.
63°57′ N. 53°18′ W. 680 m, 4°35 C. (500 m) "Godthaab" St. 32.
68°31′ N. 53°57′ W. 520 m, 1°79 C. (500 m) 158.
60°22′ N. 17°27′ W. 120 m, 5°76 C. (110 m) 188.
64°25′ N. 23°05′ W. 121 m, 7°46 C. (118 m). "Dana" St. 3200.
62°27′ N. 1°51′ W. 150 m, 4°66 C. (125 m). 5866.
61°30′ N. 8°52′ W. 515 m, 8°13 C. (500 m) 5950.
Trondheim Fjord.
East Greenland (Turner Sound, Cape Tobin, Miki's Fjord), 6–130 m.
West Greenland (Bredefjord).

Remarks: The material consists of about 150 specimens and comprises both colonies with anthocodiae almost devoid of sclerites, colonies with strongly spiculated anthocodiae, and all possible transitional forms. The material confirms thus BROCH's and JUNGERSEN's view when they united into one all the species described under the generic name *Duva* by KOREN & DANIELSSEN (1883) and DANIELSSEN (1887). Attention may also be called to the somewhat diverging form described above p. 28, which has unusually large anthocodial sclerites (fig. 21 *g*, *h*).

Distribution: In the Norwegian Sea the species has been found along the Scandinavian coast from the latitude of Bergen as far as Kola Fjord, at Spitzbergen, and in East Greenland as far north as Scoresby-Sound. It is very common on the Wyville Thomson Ridge s. l. and is also known from several localities in Baffin Bay and Davis Strait. In the eastern part of the North-Atlantic Ocean the species has been found as far south as off the Irish coast, in the western part as far south as about 41° N.

The bathymetrical distribution of the species ranges from 6 m (at East Greenland) to 1505 m, southwest of Iceland; it is, however, mainly found at depths greater than about 200 m.

Vide further JUNGERSEN (1915, 1916, 1917) and BROCH (1928), chart of distribution by BROCH (1928 p. 13, fig. 7).

Ordo: Gorgonacea Verrill 1865.

Subordo SCLERAXONIA Studer 1887

Diagnosis: Vide Kükenthal 1924, p. 8.

Family Paragorgiidae Aurivillius 1931

Diagnosis: Vide Aurivillius 1931, p. 10.

Genus Paragorgia Milne Edwards 1857.

Paragorgia arborea (Linné 1758).

[illegible] Linné 1758, p. 803.
[illegible], Broch 1912 c, p. 10–19, figs. 4–10.
Jungersen 1917, p. 19–22.
Kükenthal 1919, p. 77–80, fig. 31.
Verrill 1922, p. 17–18, textfig. 1, pl. 13,
[illegible] 14 [illegible] 1.
Kükenthal 1924, p. 28–29.
Nordgaard 1930, p. 1–2, fig. 1.
Broch 1935, p. 20.
Deichmann 1936, p. 81–82.
Pax 1936, p. 254–256, figs. 177, 178.
Stiasny 1937, p. 71–78, textfig. Z, pl. 4
[illegible] 31–33.
Verseveldt 1940, p. 20–32, figs. 5–10.
Carlgren, MS.

[illegible] references vide Broch (1912 c), Jungersen [illegible] 1924.

[illegible] Vide Broch 1912 c.

Material:
The Norwegian coast (Finmarken, Lofoten, Trondheim Fjord) 90–200 m. Several colonies.
60°51' N, 4°02' E, 125 m, 5 I C, "Michael Sars" St. 16, 3 colonies.
61°29' N, 6°22' W, 282 m, "Dana" St. 5702, 1 colony.

Remarks: This species was not taken by the "Ingolf" Expedition, and in the eastern part of the North-Atlantic Ocean and adjacent seas it has not previously been recorded far away from the Norwegian coast. The above-mentioned find made by the "Dana" in 1938 at a locality in the Faroe Sea somewhat east of Suderö represents in this area the hitherto westernmost find of *Paragorgia arborea* and adds the species to the fauna of the Faroes.

Distribution: The species is at present known to occur along the Scandinavian coast from Hardangerfjord to Finmarken and as far west as the Faroes, off the Portuguese coast (one locality), in the Barents Sea, off the American North-Atlantic coast on the banks of New Foundland and Nova Scotia, and further in the North Pacific.

Vide further Jungersen 1917 and Broch 1935 (chart of distribution, Broch 1935 p. 10–11).

Bathymetrical distribution: About 75–800 m.

Family Semperinidae Aurivillius 1931.

Diagnosis: Vide Aurivillius 1931 p. 10.

Genus Anthothela Verrill 1879.

[illegible] Kükenthal 1924, p. 14.

Anthothela grandiflora (M. Sars 1856).

[illegible] M. Sars 1856, [illegible] 63–75, pl. 10 figs. 10–12.
[illegible] 1912 c, [illegible] 5–9, figs. 1–3.
J[illegible] 1918, [illegible] 6–8, fig. 1.
[illegible] 1919, [illegible] 13–14, fig. 17.
[illegible] 22, [illegible] 18–19, textfig. 4, pl. 6
[illegible]
[illegible] 1924, [illegible] 15–16, figs. 13–14.
[illegible] 1927, [illegible] 16–18, pl. 1 fig. 20.
[illegible] 16, [illegible] 5 fig. 28.
Anthothela grandiflora Pax, 1936, p. 254, figs. 175–176.
Deichmann, 1936, p. 78–79.
Stiasny, 1937, p. 20–23, textfigs. F^1, F^2, pl. 1 figs. 6, 7.
Jägerskiöld, 1939, p. 21.
Verseveldt, 1940, p. 37–47, figs. 13–15.
Carlgren, MS.

For further references vide Broch 1912 c.

Description: Vide Broch 1912 c, Verseveldt 1940.

Material:
Finmarken (northern Norway), (Cotype ?) Fragment.
Trondheim Fjord (Roberg, Skarnsund, Brettingnaes), 150–300 m, several colonies.

63°15′ N. 15°07′ W. 1197 m, 3.08° C. "Ingolf" St. 53. 1(2) colonies.
64°44′ N. 27°00′ W. 913 m, 6.4° C. - - 81. Fragments.
63°12′ N. 20°06′ W. 510 m, "Thor" St. 168 (03). 1 fragment.

Remarks: The material consists of upright branched colonies, of which one from the Trondheim Fjord measures 22 cm, and of some membranous specimens from the same locality.

The material from the "Ingolf" St. 81 differs somewhat from the usual type. It consists of four tiny fragments measuring from about 1–2 cm. The fragments are slightly branched and have a diameter of about 0.75–1 mm. The colony to which they have belonged may have had a much slender habitus than the usual colonies of *Anthothela grandiflora*, even more slender than in Sars' original specimens from Finmarken. The verrucae measure about 1–2 mm in height. The anthocodial part of the zooid body in the largest expanded zooids measures about 5 mm. The sclerites of the specimen are of the same type as in those from the Trondheim fjord (vide Broch 1912 c) only they are not so crowded in the coenenchyma.

Distribution: The species is known from the Scandinavian coast from Finmarken in the north to the Skagerrak in the south, where it has been recorded by Jägerskiöld (1939) from 58°31′ N. 10°05′ E. 510 m. Also Möbius (1873 p. 119) mentions *Bracteum grandiflorum* from the Skagerrak (off Arendal 75 m), but this record is somewhat doubtful as the *B. grandiflorum*, which Möbius (1874 p. 260) records from East Greenland, by a reexamination by Jungersen (1915 p. 1156, 1916 p. 195) was recognized as a specimen of *Eunephthya (Capnella) glomerata*. Jungersen, however, did not make any reference to *E. glomerata* from the Skagerrak, and it therefore is possible that Möbius' *B. grandiflorum* from the Skagerrak actually was correctly identified. In Scandinavian waters *Anthothela grandiflora* is found at depths from about (75)150–600 m. It has further been found in the waters south and southwest of Iceland in depths from about 500–1500 m, and along the American coast from off Marthas Vineyard in the south to off Nova Scotia in the north, and J. A. Thomson in 1927 records the species from off Madeira, the Azores and the Cape Verde in depths from about 1100–1700 m. Chart of distribution, fig. 32.

Bathymetrical distribution. About (75)150–1700 m.

Subordo: HOLAXONIA Studer 1887

Diagnosis: Vide Kükenthal 1924, p. 237.

Family: Acanthogorgiidae Kükenthal & Gorzawsky 1908.

Diagnosis: Vide Aurivillius 1931, p. 38–39.

Genus: Acanthogorgia Gray 1857.

Diagnosis: Vide Kükenthal 1929, p. 239.

Acanthogorgia armata Verrill 1878.

Acanthogorgia armata Verrill, 1878, p. 376.
Verrill, 1882, p. 361.
Verrill, 1883, p. 31–33, pl. 3 figs. 1, 1 a, 1 b, 2, 2 a, 2 b.
Verrill, 1884, p. 220.
verrilli Studer, 1901, p. 14–15, pl. 7 figs. 1–6.
? armata Hickson, 1905, p. 225.
nec Nutting, 1910, p. 13–14, pl. 19 fig. 1.
? J. St. Thomson, 1911, p. 880.
Kükenthal, 1924, p. 249–250.
J. A. Thomson, 1927, p. 37–38, pl. 1 fig. 12.
Deichmann, 1936, p. 149–150, pl. 16 figs. 1–4.
Stiasny, 1939, p. 137–138, pl. 4 fig. 7, pl. 5 fig. 10.
? 1940, p. 21–22.
? 1942, p. 37–38.
1913, p. 129.

Material:

Off Georges Bank or a neighbouring locality, in great depth. 1 colony. (This specimen was given to the Zoological Museum of Copenhagen 1880 by the Danish Lieutenant Commander C. F. Wandel who during the summer took part in the cruises of the "Blake", in charge of A. Agassiz.)
61°44′ N. 30°29′ W. 2137 m, 3.0° C. "Ingolf" St. 18. 3 fragments of axis.
62°58′ N. 23°28′ W. 915 m, 5.5° C. "Ingolf" St. 73. Axis fragment.
64°44′ N. 27°00′ W. 913 m, 6.4° C. "Ingolf" St. 81. 3 colonies.
62°57′ N. 18°58′ W. 957 m, "Thor" St. 166 (03). 6 colonies.
63°05′ N. 20°07′ W. 557 m, - - 167 (03). 3 colonies.

Diagnosis: Colony richly branched, shrub-like or bush-like, often in one plane, with brown, horny basal disk and axis. Zooids cylindrical, slightly widened at the corona, size of verrucae generally 6–7 × 1–1.2 mm, placed at right angles and distributed on all sides all over the colony, usually fairly closely set and much crowded at the branch tips. In zooid body eight interseptal, double rows of crossing, peculiarly bent, spinous spindles, arranged en chevron, average length 0.7–0.8 mm, maximum length about 1.5 mm. Neck region of zooid not very distinct. Coronal sclerites arranged en chevron, slender, angularly bent, with a short, much warty ray and a long, projecting, smooth spine, average size about 1.6 mm, maximum size about 2.4 mm. In the lower part of tentacle curved spindles arranged en chevron, in the upper part small, flattened rods, transversally arranged. Sclerites of coenenchyma much varying, mostly bi- or quadriradiate, decreasing in size from the smaller branches towards the base where small, lumpy sclerites may be the most common.

Description: The specimens vary in height from 6 to 17 cm and are often somewhat broader than high. They are mostly richly branched, several of them in only one plane, but most of them more irregular. Often there is no distinct main stem, and from the base more stems may rise. The branching is nearly right angled, the branches, however, soon curving and becoming parallel to the stem or branch from which they issue.

The colonies have been attached to solid objects. The diameter of the stem at the base is in a 8 cm high colony about 1.2 mm, in a 15 cm high colony 3 mm, and in the largest specimen, a 17 cm high one, about 4 mm.

The bare axis fragments from the "Ingolf" St. 18 and St. 73 may have been of colonies about 10 cm high.

[illegible] in alcohol, [illegible] are a bright [illegible] [illegible] sides of the stems and [illegible] branches much crowded, [illegible] between them. In a single

Fig. 23. [illegible] armata Verrill. [illegible] coronal sclerites, [illegible] of about [illegible] sclerites of zooid body in natural position. [illegible] indicates the attachment of the mesenteries.

[illegible] zooids are likewise crowded from the base to the [illegible] colony.

[illegible] are cylindrical, slightly widened at the corona, and [illegible] contracted tentacles generally 6–7 mm in length [illegible] width, their appearance then as shown in VER[illegible] 1883 pl. 3 figs. 1, 1 a). They may measure up to [illegible] one colony all the zooids are somewhat shorter [illegible] about 3.4 × 1.5 mm, and in appearance [illegible] to the zooids figured by VERRILL in pl. 3

[illegible] the sclerites are long, slender, spinous, [illegible] which typically are placed crosswise [illegible] straight part is placed in a longi[illegible] pointing towards the apex of the zooid, [illegible] and ends in the nearest [illegible] (fig. 23 h). The sclerites in the [illegible] much closer and more trans[illegible] one. The differing forms of [illegible] different degrees of contraction. [illegible] average 0.7–0.8 mm in [illegible] at the middle, and cor[illegible] VERRILL (1883 p. 33). The [illegible] measured about 1.5 mm. [illegible] indistinct neck region, [illegible] the corona may be some[illegible] transversally arranged

The corona is formed by some long, projecting coronal sclerites in each interseptal row below the tentacles, arranged en chevron as those of the main zooid body and generally bent in a similar manner with the one ray strongly warty and the other, much longer and projecting one, the socalled spine, generally smooth in its whole length (fig. 23 c–g). The lower half or more of the spine of some of the coronal sclerites may be granulated (fig. 23 d), but is never coarsely warty as the short basal ray. The largest measured coronal sclerites had a length of about 2.1 mm, the maximum length is, however, seldom more than about 1.9 mm, and in most zooids the largest coronal sclerites are about 1.6 mm which corresponds to the largest size stated by VERRILL (1883 p. 32). In DEICHMANN's statement (1936 p. 150) that "The marginal spicules may be as much as 1.1 mm in length" 1.1 mm is probably a misprint for 2.1 mm. The long coronal sclerites generally number four to six in each interseptal row and generally a few much shorter and often straight ones may be found besides (fig. 23 a–c), and similar ones occur also at the base of the tentacles.

The tentacles are rather short with only half a dozen pairs of pinnulae and by contraction bent down over the peristome. Their dorsum is strongly armed, in the lower part with curved, spinous spindles (fig. 24 a, b) arranged en chevron, maximum size about 0.4 mm, and in the upper part with numerous, mostly transversally placed, flattened rods (fig. 24 g–i) measuring from 0,1 × 0,02 to 0,3 × 0,05 mm.

Sclerites were noticed neither in the pinnulae nor in the peristome or stomodaeum.

The sclerites of the coenenchyma are of several types and vary much both in the different parts of the colony and also in the different specimens. The largest sclerites are found in the smallest branches and in the branch tips and, generally speaking, the sclerites gradually decrease in size towards the base where the smallest sclerites of the colony are to be found.

In the smaller branches the sclerites are more or less bent spindles resembling those of the zooid body and of the same maximum length, but often of a somewhat larger average size (about 1 mm) (fig. 25 a). Besides, in some colonies as e. g. that from off Georges Bank, triradiate sclerites of nearly corresponding size are just as common (fig. 25 b). In the same colony, which is about 9 cm high and 12 cm broad, the most common sclerites in the main branches are tri- or quadriradiate, measuring up to 0,4 mm in diameter (fig. 25 c, d). Straight or curved spindles are, however, also fairly numerous, and these may measure up to 0,8 × 0,05 mm and are either scarcely warty in their whole length or have a strongly warty, and a smooth part, and thus much resemble the coronal sclerites though being of a considerably smaller size and also having the warty ray much more pointed (fig. 25 f, g). Besides the said sclerites also some coarse and blunt rods of fairly large size (0,8 × 0,14 mm) may occur (fig. 25 e). In the coenenchyma of the base of this specimen tri- and quadriradiate sclerites are likewise the most common, measuring about 0.25 mm in diameter, but here also small lumpy sclerites are found in large number.

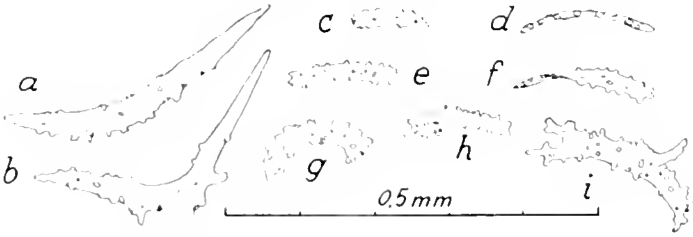


Fig. 24. *Acanthogorgia armata* Verrill. *a*, *b*, sclerites of tentacle base. *c–i*, sclerites of outer part of tentacle. *d*, shown from the side.

The sclerites of the coenenchyma from corresponding parts of the other specimens seem, generally speaking, to be somewhat smaller than in the above-mentioned colony, and are in some specimens more variable.

The sclerites of the branches in a colony from the "Thor" St. 167, 13 cm high, are mostly slender tri- or quadriradiate ones (fig. 26 *a*, *b*), but besides several larger and more coarsely built ones (fig. 26 *c*) occur. In the same specimen the sclerites of the base are mostly some lumpy ones (fig. 26 *m*–*q*) less than 0.2 mm in size, whereas only rather few and small tri- and quadriradiate sclerites are found, some of which, however, are almost six-radiate due to strongly projecting processes, which are nearly equal the rays in length (fig. 26 *l*). Also spindles of about 0.3 mm in length occur, but they are only few.

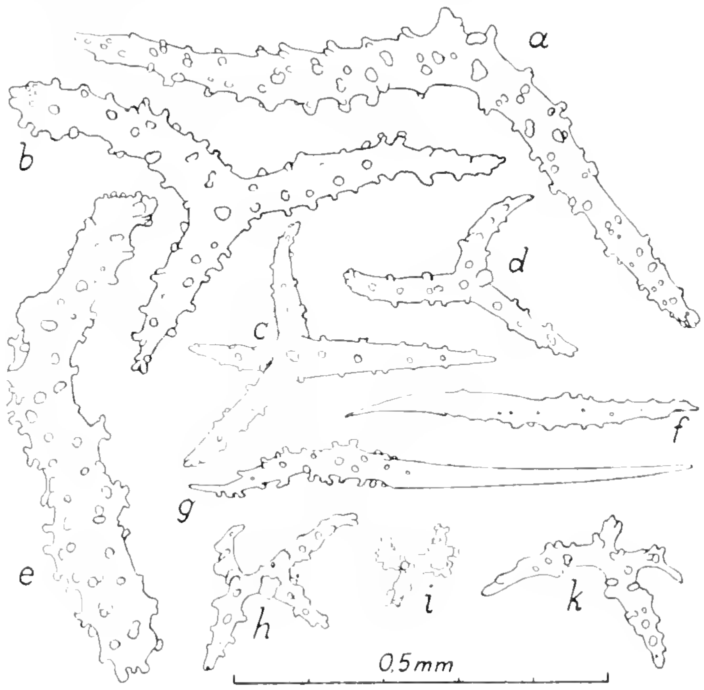


Fig. 25. *Acanthogorgia armata* Verrill. Specimen taken by the "Blake" Expedition off Georges Bank or a neighbouring locality. *a*, *b*, di- and tri-radiate sclerites from one of the smaller branches, both types about equally common. *c*–*g*, sclerites from one of the main branches (stems) in the colony. *c*, *d*, tri- and tetra-radiate sclerites which are the most common. *e*, coarse spindle, a rather rare form. *f*, *g*, spindles occurring in fairly large number. *h*–*k*, sclerites from the base.

Spindles occur everywhere in the coenenchyma, though in a very varying number. They are e. g. fairly common in the stem of a 6 cm high colony from the "Ingolf" St. 81 and here they are either long, very slender ones (fig. 26 *d*) measuring up to 1.2 × 0.05 mm, and often being angularly bent, or smaller crescent-shaped ones (fig. 26 *h*, *k*) measuring up to 0.1 × 0.06 mm. In the same stem the triradiate sclerites were only small ones, less than 0.2 mm in diameter and often irregularly shaped (fig. 26 *e*–*g*), and some very coarsely built, not branched sclerites of varying shape were also found rather common (fig. 26 *i*).

Discussion: There can be no doubt that the above-described specimens, in spite of some variation in the sclerites of the coenenchyma, belong to one species, viz. *Acanthogorgia armata* Verrill, to which species, as shown by DEICHMANN in 1936, STUDER's *Acanthogorgia verrilli* is also referable.

Under the name *A. armata* some specimens have also been recorded from the Cape of Good Hope by HICKSON (1905) and from the coast of Sumatra by NUTTING (1910) respectively, the identities of which, however, are doubted by KÜKENTHAL (1924). Specimens of the first form (South Africa, 300–575 m) have been examined by STIASNY, who (1940), with a query, records them as *A. armata*. STIASNY has further (1942), likewise with a query, recorded *A. armata* from the Mediterranean, the bay of Capri and (1939 *b*), without a query, from the coast of Morocco, 20–160 m. Unfortunately, however, the author has had access neither to the paper by HICKSON nor to those by STIASNY (1939 *b*, 1940) and thus is not able to discuss the statements made in these papers.

As regards NUTTING's specimen it is difficult from the description to ascertain whether he has dealt with a previously known species or a new one. The present author found it possible that NUTTING's material would prove to belong to *A. dofleini* Kükenthal & Gorzawsky 1908. STIASNY, however, announces in his paper of 1943 that in his revision of the Acanthogorgiidae of the Siboga-Expedition he will describe the specimen as a new species under the name *Acanthogorgia pararmata*, and in the same paper STIASNY designates *A. dofleini* as an uncertain species.

Distribution: *Acanthogorgia armata* is known from American waters from off New Foundland in the north to off Martha's Vineyard in the south, in depths from 275 to 1267 m. The species is also by J. A. THOMSON (1927) recorded from off the Azores and from the Portuguese coast (off Cape Mondega) in depths from 550 to 1250 m, and by STIASNY (1939 *b*) from off the Moroccan coast in depths from 20 to 160 m. The finds made by the "Ingolf" and the "Thor" were made south and south-west of Iceland in depths from 557 to 957 (2137) m. The latter depth parenthetically since here only a dead colony was secured. Chart of distribution, fig. 20.

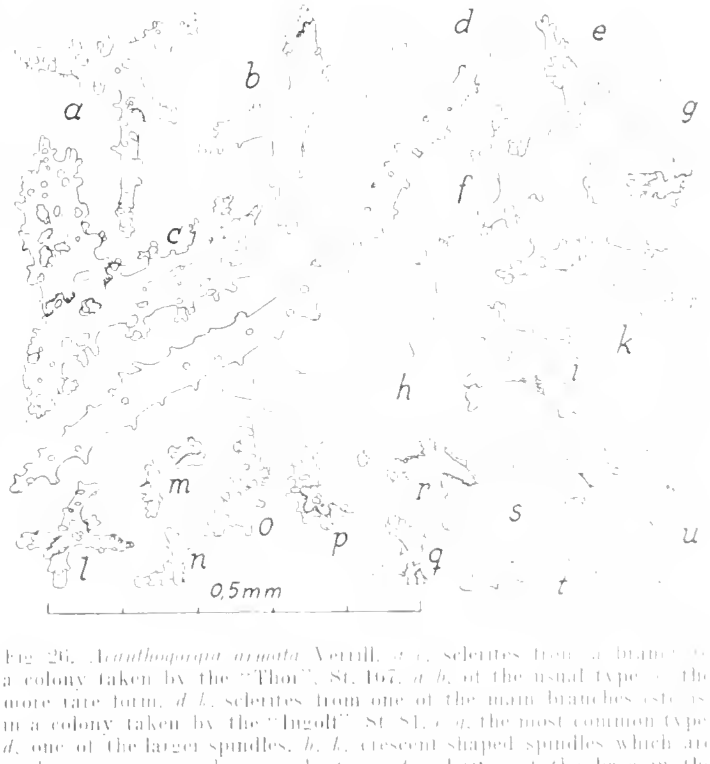


Fig. 26. *Acanthogorgia armata* Verrill. *a*–*c*, sclerites from a branch of a colony taken by the "Thor", St. 167, *a*, *b*, of the usual type, *c*, the more rare form. *d*–*l*, sclerites from one of the main branches (stems) in a colony taken by the "Ingolf" St. 81, *e*–*g*, the most common type, *d*, one of the larger spindles, *h*, *k*, crescent shaped spindles which are fairly common, *i*, a lumpy sclerite. *m*–*t*, sclerites of the base in the same colony, *m*–*p*, representing the most common type, *t*, one of the rather rare spindles.

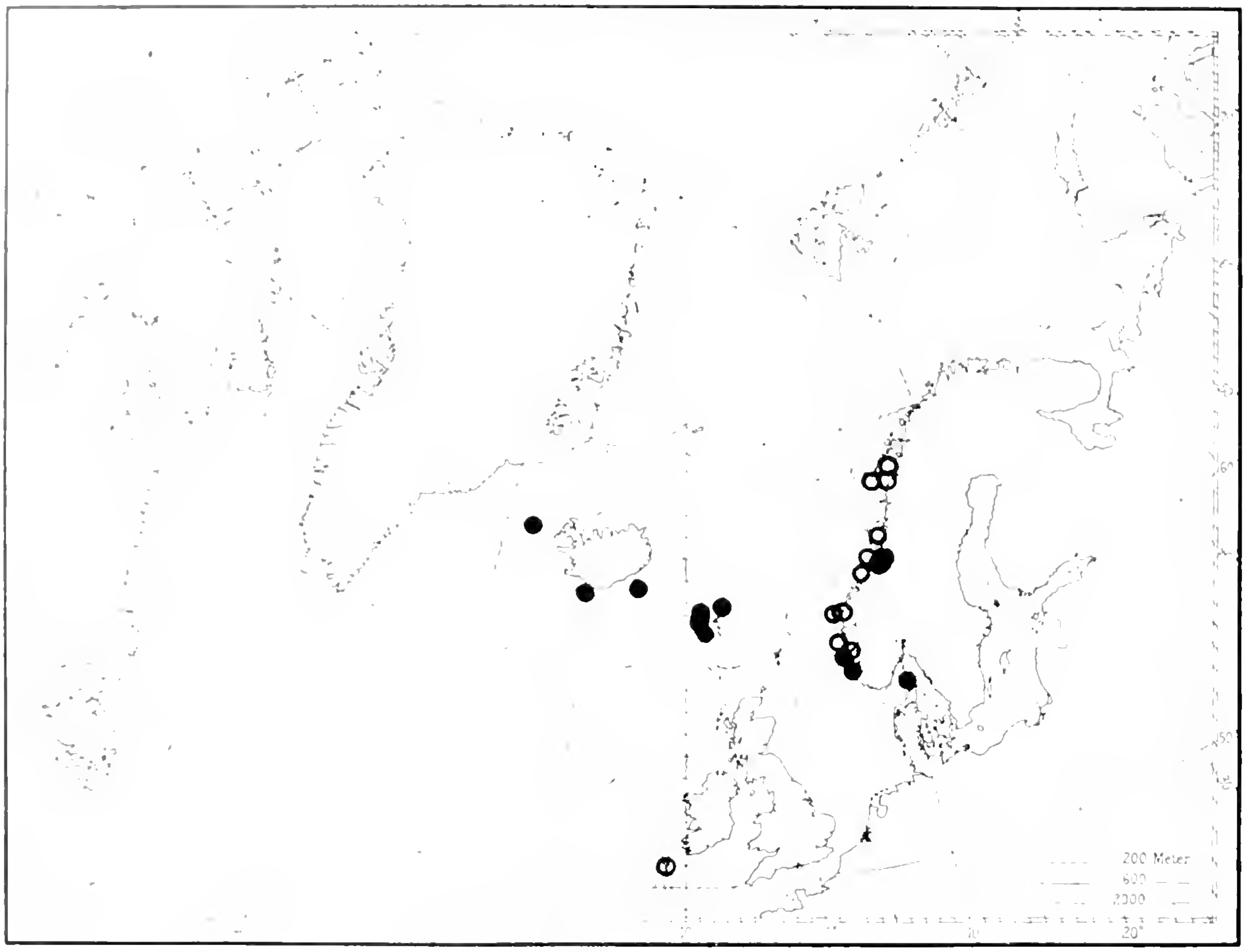


Fig. 2[illegible]. *Paramuricea placomus* (L.).

Family **Muriceidae** Gray 1859 emended

Diagnosis: Vide Aurivillius 1931, p. 94.

Genus **Paramuricea** Kölliker 1865.

Diagnosis: Vide Aurivillius, 1931, p. 156.

Paramuricea placomus (Linné 1758).

[illegible] Linné 1758, p. 802.
Koren & Danielssen 1883, p. 13, pl. 6.
Broch 1912 a, p. 17–20, figs. 9–10.
[illegible] Broch 1912 a, p. 21–26, figs. 11–14.
[illegible] 1917, p. 27–31.
[illegible] 1927, p. 39, pl. 1, fig. 2.
[illegible] 1930, p. 2.
Aurivillius 1931, p. 166–170, fig. 32.
[illegible] 1936, p. 135–136, pl. 11, figs. [illegible]
[illegible] 1936, p. 257, fig. 180.
[illegible] 1939, p. 15.
[illegible] MS.
[illegible] 1931.
[illegible] 1912 [illegible] Aurivillius 1931.

[illegible] St. [illegible] 1 fragmentary

65°43' N. 26°58' W. 471 m, 6.1°C. "Ingolf" St. 46. 1 fragmentary colony.
63°33' N. 15°02' W. 595 m, 5.9°C. "Ingolf" St. 55. 10 colonies.
63°12.5' N. 20°06' W. 540 m, "Thor" St. 168 (03). 1 colony.
Skagerrak (29 miles N. $\frac{5}{8}$ W. of the Skagen light-ship) 317 m, "Thor" St. 297 (01). 1 colony.
62°44' N. 6°06' W. 330 m, "Dana" St. 5840. 1 fragmentary colony.
62°07' N. 8°35' W. 375 m, 6.58°C. (325 m) "Dana" St. 6007. 2 fragmentary colonies.
61°39' N. 7°55' W. 352 m, "Dana St. 6008. 1 fragmentary colony.

Besides, the collection of the Zoological Museum of Copenhagen includes numerous colonies from Norway (Hvidingsø, Bergen, several localities in the Trondheim Fjord and many without exact locality).

Remarks. The specimens of *P. placomus* kept in the Zoological Museum of Copenhagen are generally branched mainly in one plane, but there are some which are one-sided bush-like branched. Anastomoses between the branches are rather frequent, especially in the large colonies.

The specimens taken in the North Atlantic are only small, several of the specimens from the Norwegian coast, however, measure 50 cm or more in height, and one specimen, from very old time kept in the zoological collections of Copenhagen, measures about 90 cm in height and about 110 cm in width.

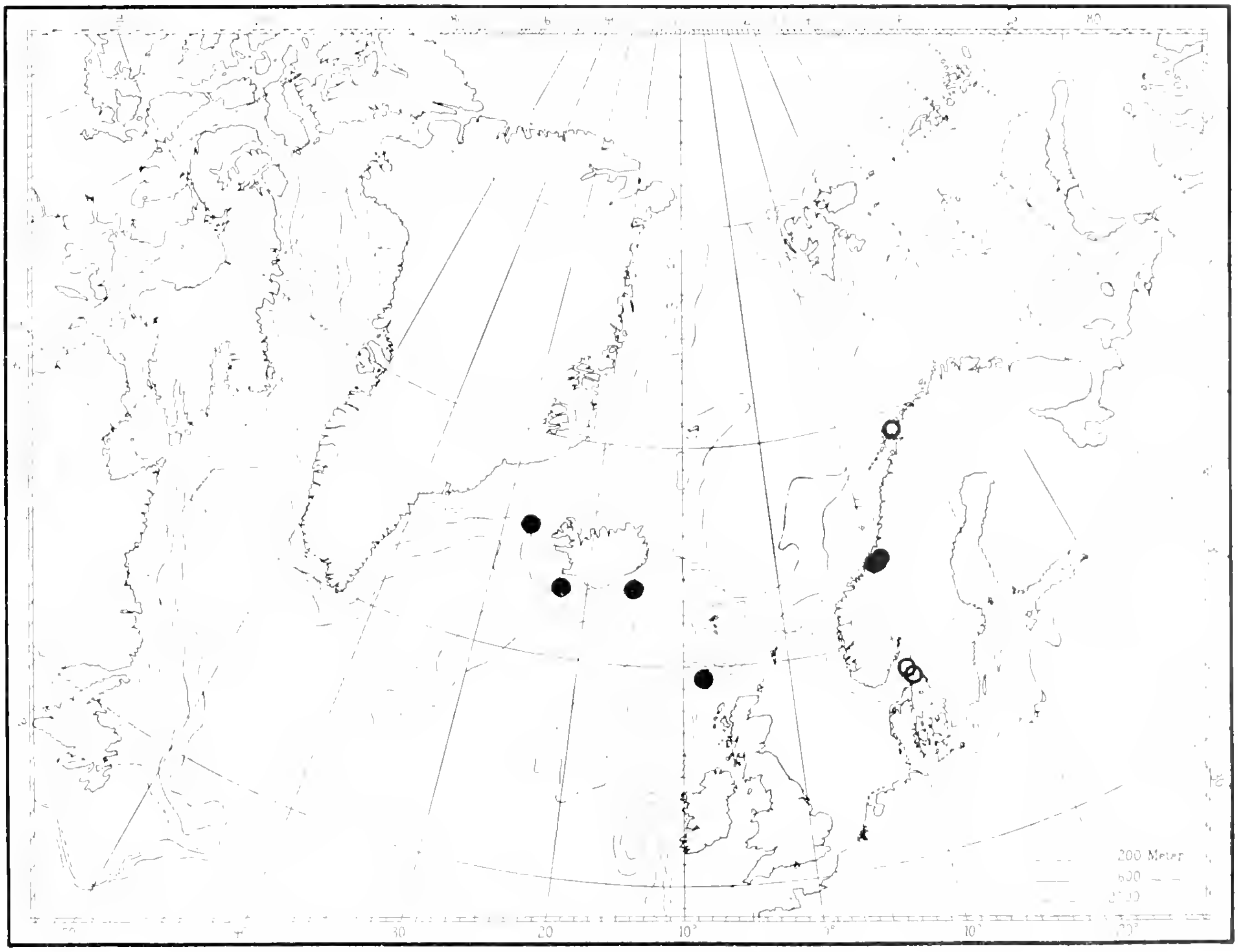


Fig. 28. *Trachymuricea kükenthali* (Broch).

On the authority of BROCH (1935 p. 11, footnote), *Cl. stormi* Koren & Danielssen is included among the synonyms of *P. placomus*, and it appears from the original description and BROCH's redescription of this form that BROCH's point of view in 1935 without doubt is correct. A quite analogous membranous form of *Trachymuricea kükenthali* will be described below.

JUNGERSEN (1917 p. 29) records *P. placomus* from the "Michael Sars" St. 76 a, b, c and St. 85. However, three of the specimens from the "Michael Sars" St. 76 kept in the Zoological Museum of Copenhagen have proved to belong to *Trachymuricea kükenthali* (Broch) and were also by JUNGERSEN labelled as *P. placomus* f. *kükenthali*. On the other hand, the specimen which JUNGERSEN mentions from the Skagerrak ("Thor" St. 297) is a distinct *P. placomus*.

Distribution: The species is with certainty known to occur along the Scandinavian coast from Lofoten in the north (Bodo) to the Skagerrak in the south. It occurs further in the North-Atlantic Ocean on the Wyville Thomson ridge from the Faroes, south of Iceland to Danmark Strait and on the eastern coast of North America (off New England). The species is also recorded from south of Ireland, the west coast of France, the Cape Verde, and the Mediterranean. It seems, however, to be open to doubt whether the last-mentioned specimens actually belong to the North-Atlantic *P. placomus* (cf. AURIVILLIUS 1931 p. 170, and STIASNY 1912 p. 26–27). In the northern part of the Atlantic Ocean and along the Norwegian coast *P. placomus*, however, is a common species. Chart of distribution, fig. 27.

Vide further JUNGERSEN 1917.

Bathymetrical distribution: From about 150 m (75 m) to about 1600 m.

Genus: **Trachymuricea** Deichmann 1936.

Diagnosis. Vide DEICHMANN 1936, p. 132.

Trachymuricea kükenthali (Broch 1912)

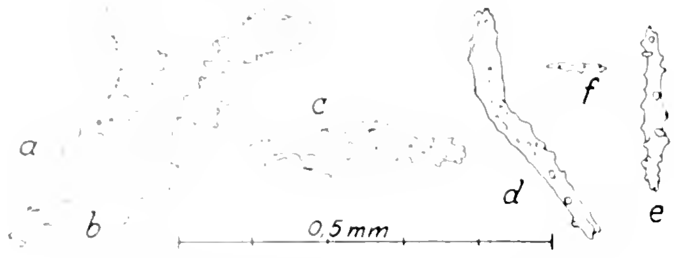
Paramuricea kükenthali Broch, 1912 *c*, p. 26–31, figs. 15–20.
Arndt, 1912, p. 125.
Broch, 1913 *a*, p. 181.
placomus (pars) Jungersen, 1917, p. 27–31.
Muriceides kükenthali Aurivillius, 1931, p. 175–180, fig. 34
Paramuricea kükenthali Dons, 1932, p. 11.
Jägerskiöld, 1935, p. 15.
1936, p. 18
Trachymuricea Deichmann, 1936, p. 131.
Muriceides Pax, 1936, p. 257
Paramuricea Jägerskiöld, 1937, p. 21
placomus (pars) Kramp, 1939, p. 1–5.
Muriceides kükenthali Carlgren, MS.

Description: Vide BROCH 1912 *c* and AURIVILLIUS 1931

Material.
65°43' N., 26°58' W., 174 m, 6.1° C., "Ingolf" St. 16, 1 fragment.
63°33' N., 15°02' W., 595 m, 5.9° C., — 55, 1 fragment.

[illegible] M[illegible] S[illegible] St. 76: 3 colo- [illegible] 47 [illegible] 29 [illegible] *P. placomus*, [illegible] I[illegible] St. 171 (0650) 2 colonies, [illegible] S[illegible] Bøttingnaes 150–300 m.

[illegible] by Broch (1912 c) on [illegible] F[illegible] but were by Jungersen [illegible] with *Paramuricea placomus* (L.). [illegible] specified. Aurivillius (1931) [illegible] likewise on specimens from the Trond- [illegible] to the genus *Muriceides* Wright & [illegible] Deichmann in 1936 established a new genus [illegible] among others *T. kükenthali* (Broch).



[illegible] *kükenthali* (Broch). *a*, *b*, sclerites from antho- [illegible] lower part of anthodia (neck of zooid); *d*, sclerite [illegible] sclerite from outer part of tentacle; *f*, pinnula sclerite.

[illegible] the authors' studies on the several specimens in [illegible] Zoological Museum of Copenhagen which may be referred to [illegible] agrees in all essentials with Aurivillius' exhaustive [illegible] of the species (Aurivillius 1931), and a closer [illegible] of the material has therefore not been found worth [illegible]

[illegible] in his paper (1917), without any explanation, [illegible] among the synonyms to *P. placomus*; on the [illegible] of the specimens he had, however, noted *P. pla-* [illegible] That Jungersen united the two species [illegible] apparently he did not intend entirely to sup- [illegible] *kükenthali*, was no doubt on account of the sur- [illegible] in appearance and spiculation which is met [illegible] and another fact which also may account [illegible] on the species is that the two forms in [illegible] found together; thus both species are common [illegible] of *T. kükenthali*, and of the three stations [illegible] occurred *P. placomus* two also gave *T. kü-* [illegible]

[illegible] by the "Ingolf" and "Thor" are small [illegible] the former only fragments. The material [illegible] M[illegible] S[illegible] on the other hand, consists of three [illegible] colonies, measuring from about [illegible]

[illegible] from the type locality (the Trondheim [illegible] branched and not always distinctly in one plane, those taken by the "Michael Sars" are only very sparsely branched, consisting of an upright stem (up to 4 mm in diameter) with a very few (e. g. four) side-branches distinctly arranged in one plane and likewise only slightly or not at all branched. Anastomoses were found in one colony. The specimens thus differ somewhat in their main habitus from the typical; it may also be noted that their coenenchyma is fairly thick and that the verrucae are only very slightly protruding.

Molander (1929 p. 3) supposes that *Trachythela rudis* Verrill 1922 is a *Paramuricea*, probably synonymous with *P. kükenthali*, but an identity with the latter species is, in spite of some similarities, not present (see further the discussion on *Clavularia griegi* n. sp.).

The Zoological Museum of Copenhagen has, however, a small, quite membranous colony from the Trondheim Fjord which without doubt is a young specimen of *T. kükenthali*.

The colony in question consists of a membranous stolon expanded on a fragment of *Lophelia* and measures about 15 × 6 mm. From the base about 18 closely placed zooids arise.

The spiculation of the specimen agrees with that of typical upright and branched specimens. The sclerites of the anthostele (verrucae in Aurivillius) are mainly longitudinally arranged, warty spindles, most of them provided with a distinctly outturned upper end (fig. 29 *a*, *b*) and on average measuring about 0.4 mm.

In the lower part of the anthocodia (polypal neck in Aurivillius) the sclerites are scattered, transversally arranged, warty spindles with blunt ends, measuring about 0.35 mm (fig. 29 *c*). In the upper part of the anthocodia the sclerites are arranged en chevron in eight rows which continue uninterruptedly in the rows of sclerites in the tentacle dorsa.

The sclerites in the anthocodial crown and in the lower part of the tentacles are bent, somewhat club-shaped spindles (fig. 29 *d*) with the upper and shorter ray generally provided with ridges. The largest of these sclerites measure about 0.5 mm, and the average size is about 0.35 mm. The upper ray of these sclerites are longitudinally arranged in the tentacles along the middle of the dorsum as distinct from the arrangement of the sclerites in the tentacles of the very similar form described in this paper as *Clavularia griegi* n. sp.

The outer part of the tentacles are provided with a broad row of longitudinally arranged, warty rods about 0.2 mm in length (fig. 29 *e*). In each pinnula there are a few small sclerites (fig. 29 *f*).

Distribution: Besides from the type locality, the Trondheim Fjord, the species is recorded from a locality just north of Lofoten (Broch 1913) and from some places in the Skagerrak at about 200 m depth (Jägerskiöld 1935, 1936, 1937). The localities of the specimens kept in the Zoological Museum of Copenhagen are all just south of the Wyville Thomson Ridge, from the Faroes to Danmark Strait, and probably the species may prove to be common in the whole North-Atlantic Ocean. Chart of distribution, fig. 28.

Bathymetrical distribution: From about 150 m in the Trondheim Fjord to about 1300 m south of the Faroe Bank.

Family **Primnoidae** Verrill 1866, emended 1883

[illegible] 1919 p. 309.

[illegible] by Studer in 1887 [illegible] 1889 in the Challenger Report, [illegible] followed by Kükenthal [illegible] Versluys (1906), who [illegible] Studer's classification, on p. 156–158 however proposed a new subfamily classification, which with the modifications given by Aurivillius (1931 p. 238) seems to give the best picture of the relationship of the different genera, and which accordingly is followed below.

Only two of the five subfamilies are represented in the North-Atlantic Ocean, each with one genus and one species.

Subfamily: **Primnoinae** Versluys 1906, emended.

Diagnosis: Zooids with operculum. Opercular scales overlapping each other in adaxiad direction. Adaxial side of zooids devoid of body scales or only with reduced ones. In the abaxial longitudinal rows 2-7 body scales. Zooid body scales having their outside plentifully set with small and pointed warts, which, however, do not form actual ridges.

Genus: **Primnoa** Lamouroux 1812.

Diagnosis: Vide Kükenthal 1919, p. 358.

Primnoae resedaeformis (Gunnerus 1763).

Gorgonia resedaeformis Gunnerus, 1763, p. 321-329, pl. 9.
Primnoa resedaeformis Broch, 1912 *e*, p. 32-37, figs. 21-25.
Jungersen, 1917, p. 25-27.
— Kukenthal, 1919, p. 360-362.
— Nordgaard, 1930, p. 2.
Aurivillius, 1931, p. 293-296, fig. 58.
— — Broch, 1935, p. 29-33, figs. 17-18.
Deichmann, 1936, p. 157.
— Pax, 1936, p. 257, figs. 181, 182.
— Kramp, 1939, p. 4.
— Stiasny, 1939 *a*, p. 35.
— — Carlgren, MS.

For further references vide Jungersen 1917, Kükenthal 1919 and Deichmann 1936.

Description: Vide Broch 1912 *e* and Aurivillius 1931.

Material:
Off the Scandinavian coast in several localities from the Skagerrak in the south to Bodö in the north. 150-470 m. Many colonies.
S. W. Greenland (Grædefjord, Frederikshaab, Bredefjord, Julianehaab, Ilua). 225-540 m. Some colonies.
S. E. Iceland. 225 m. 1 colony.
42°06′ N. 63°15′ W. 1 colony.
62°01′ N. 1°00′ E. 373 m. "Michael Sars" St. 53. 1 colony.
62°19′ N. 8°51′ W. 501 m, 1.21° C. (490 m). "Dana" St. 6005. 1 colony.
62°07′ N. 8°35′ W. 375 m, 6.58° C. (325 m). "Dana" St. 6007. 1 colony.
Pacific coast of Alaska. 1 colony.

Remarks: The author did not succeed in finding any characters in the Pacific specimen of *P. resedaeformis* (without the broken-off base 65 cm in height) which could distinguish this specimen from an Atlantic one; this also corresponds with the view of Aurivillius (1931) and Broch (1935) that the Pacific specimens of *P. resedaeformis* only on geographical reasons can be separated from the Atlantic as a distinct variety.

Distribution: In the North-Atlantic Ocean the species occurs along the Scandinavian coast from the Skagerrak to Finmarken (according to Brattström also found in the Varangerfjord, Carlgren MS.), along the coast of North America from George's Bank to Fundy Bay, in the southern part of Davis Strait, and further it has been found in the Barents Sea. In all these localities it has only been taken at moderate depths (95-565 m). In the eastern part of the Atlantic Ocean it has, however, also been recorded from off the Portuguese coast and here at fairly great depths, about 1000 m.

In the northern Pacific Ocean the species is known from several localities both along the American and the Asiatic coast, and is here mainly found at somewhat greater depth than in the Atlantic (335-832 m).

Vide further Jungersen (1917) and Broch (1935) with chart of distribution p. 40-41.

Subfamily: **Primnoellinae** Versluys 1906, emended

Diagnosis: Zooids with operculum, opercular scales overlapping each other in adaxiad direction. Body scales of adaxial side of zooid sometimes wanting. Generally more than 7 (and not less than 4) zooid body scales in the abaxial longitudinal rows. Outside of body scales either smooth or provided with ridge formations.

According to Versluys the subfamily comprised only the genus *Primnoella*. With the above-mentioned diagnosis the subfamily, however, also includes the genus *Caligorgia* Gray, which was referred to it by Aurivillius in 1931 on account of the close relationship which seems to exist between that genus and *Primnoella*. It may thus be difficult in some cases to ascertain to which genus some of the species should be referred (cf. Kükenthal 1919 p. 483).

Genus: **Primnoella** Gray 1857.

Diagnosis: Colonies generally unbranched or in some species scarcely branched. The zooids, which usually are placed in whorls, are more or less bilateral-symmetrical and are, besides the operculum, provided with a circum-operculum. Zooid body scales fairly smooth on the outside, warty on the inside. In the stem a layer of scale-like sclerites under which an inner layer of lumpy ones may be found.

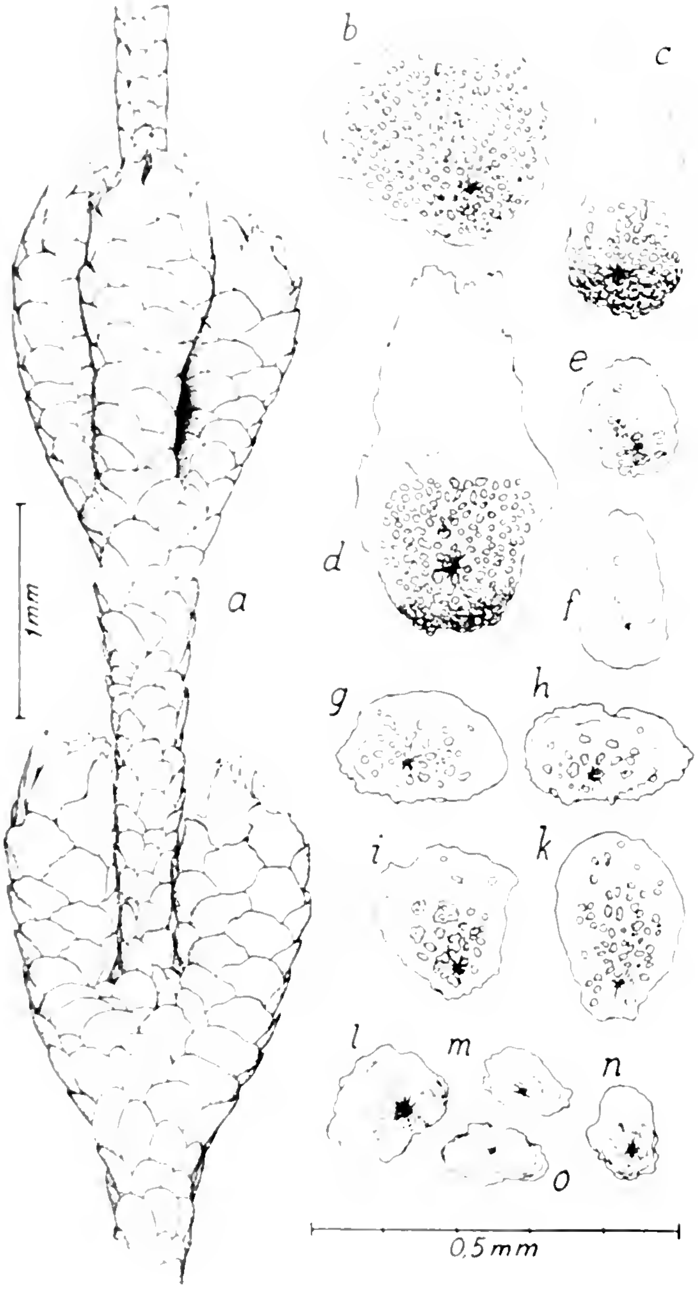
Primnoella jungerseni n. sp.

Material:
61°34′ N. 31°12′ W. 2148 m, 1.6° C. "Ingolf" St. 11. 8 colonies.
61°44′ N. 30°29′ W. 2137 m, 3.0° C. 18. 2 colonies.

Diagnosis: Colony unbranched, flexible, flaccid, with disk-like attachment. Zooids bilateral-symmetrical, ascending and placed in whorls, two or three zooids in each whorl. The intervals between the whorls measuring about 2.5 mm. Size of verrucae generally 1.6-1.8 mm. Opercular sclerites and circum-opercular sclerites of about the same type, the former being somewhat smaller than the latter which measure about 0.5 mm. Zooid body scales placed in eight longitudinal rows with about 6-7 scales in the abaxial rows and about 4 scales in the adaxial rows. From the abaxial side of zooids, besides the two abaxial, also the two abaxial-lateral rows of sclerites visible. In the stem a single layer of scales (no inner layer of differently formed sclerites).

Type. In the Zoological Museum of Copenhagen.

Description. The largest of the colonies was collected at the "Ingolf" St. 18 and has been selected as the type. It is an entirely intact specimen which measures 94 mm in height and is attached to a small stone by a basal disk of about 1-1.2 mm in diameter. The stem which is very flaccid and highly flexible is in the lower part of the colony about 0.4 (-0.5) mm in diameter and is only slightly more slender towards its end, being about [illegible] whorl. The axis [illegible] 0.18–0.2 mm in [illegible] about 9 mm [illegible] regular intervals, the [illegible] of the intervals is about [illegible] those between the



[illegible] from two different [illegible] uppermost lateral sclerites, [illegible] scale of medium [illegible] scales. *l–o*, scales [illegible] inside in [illegible]

[illegible] the base, are about [illegible] uppermost and the next [illegible]. The whorls are usually [illegible] each other, only the [illegible] consists of three zooids. [illegible] against the stem, [illegible] closed over their mouth. The verrucae measure about 1.6–1.8 (2) mm in length by 0.4–0.5 mm in diameter. In the uppermost whorl of zooids the verrucae measure, however, only 1.1 mm in length. The number of zooid body scales in the abaxial rows is usually 6–7, rarely 8.

The other colony from the "Ingolf" St. 18 consists of two fragments which are supposed to be of one set, viz. a 7 mm large, bare axis attached to a stone by a basal disk, 0.8 mm in diameter, and a 40 mm large, fragmentary colony without base. All the 13 remaining whorls of zooids consist of but two zooids. The intervals between the whorls vary between 1.8–3 mm and the size of the verrucae vary between 1.5–1.9 mm. The zooid body scales number 6–7 per abaxial row.

Most of the colonies from the "Ingolf" St. 11 are more or less damaged. The largest specimen is 53 mm in height; its zooids number two or three per whorl, and their verrucae measure about 1.5–1.65 mm. In a section of 28 mm there are 11 whorls, the largest interval between two whorls being 1.5 mm.

One of the other colonies is 49 mm high and has 13 whorls of zooids, the lowermost whorl being placed 8 mm above the base and the intervals between the rest varying from 5–2.2 mm. The number of zooids in the four lowest whorls is 2, in the fifth 3, in the sixth 2 and in the rest of the whorls 3 zooids. The upper zooid whorl is somewhat damaged, the point of axis being bare. The zooid body scales number 6–7–8 and exceptionally 9 per abaxial row.

Two colonies have been attached on a small stone. Of the one only the basal disk is left, of the other 28 mm of the stem with 5 whorls of zooids is left, the lowermost whorl being placed 5.5 mm above the base and the intervals between the others being 5.4, 3.1, 5 and 3.6 mm respectively. The number of zooids is two in the two lowest whorls, three in the rest. The size of the verrucae varies between 1.8–2 mm in height.

A fragmentary colony (38 mm high without base and lower stem) is, besides the type specimen, the only one in which the tip of the colony is intact. The specimen has 13 whorls of zooids left, one of which (the sixth from the top) consists of three zooids whereas in all the other whorls there are but two zooids. The intervals between the whorls vary from 2–2.7 mm; the interval between the uppermost of the whorls but two and the uppermost but one being, however, 1.7 mm and the interval between this whorl and the uppermost being only 1.4 mm. The size of the verrucae varies between 1.55 and 1.9 mm, in the zooids of the uppermost whorl it is, however, only 1.5 mm and in the zooids of the uppermost whorl but one the verrucae measure 1.3 and 0.8 mm respectively.

Of the rest of the colonies from the "Ingolf" St. 11 two measure 44 and 45 mm respectively, whereas the others consist of smaller fragments.

All the colonies are pure white (in alcohol), the colour being due to the sclerites.

The colour of the axis, which in some colonies is laid bare in large sections, is, in the lower part, slightly yellow brown, towards the upper part of the colony it becomes lighter and is here light blue green iridescent. The terete and very flexible axis has in the lower part a width of about 0.12–0.2 mm and tapers gradually towards the tip of the colony. Where in the basal disk it is extended to form the attachment of the colony, it is in one colony pure white, i.e. strongly calcified, whereas in other colonies no such strong calcification has taken place. The width of the stem varies from about 0.5 to 0.25 mm in diameter, and the basal disk which is always roundish, measures from 0.6–1.2 mm in diameter.

At the "Ingolf" St. 18, however, a fairly lobated basal disk, which measures about 4 mm in diameter and about 1 mm in height and which may possibly have belonged to an older colony of *P. jungerseni*, was found attached to a stone.

The coenenchyma of the stem and basal disk is fairly thin. The basal disk is covered with a close layer of scale-like and overlapping sclerites, oval or more rounded in shape (fig. 30 *l–o*). These scales are usually small, about 0.1–0.15 mm in diameter, the largest having a diameter of about 0.2 mm. They are not warty, but have on their outside more or less marked, concentric ridges which are the impressions of the overlapping scales. Both these and all the other sclerites of the colony are delicately striped from the sclerite-centre ("nucleus") outwards towards the edges.

In the coenenchyma of the stem, one layer of scale-like sclerites is found imbricately covering each other from the bottom upwards. These scales (fig. 30 *e–k*) are thin, with a smooth outside and an inside which is more or less warty, especially in the basal portion, with sometimes fairly large, rugged warts (fig. 30 *i*). The sclerites are usually oval in the longitudinal direction of the stem and with an eccentric placed sclerite-centre (fig. 30 *i, k*). They may, however, also be oval in a direction across of the stem (fig. 30 *g, h*) and have then a more centrally placed sclerite-centre. Their outlines are usually fairly regular; only in their basal part, where they are attached into the coenenchyma, they may be somewhat irregular. Their size usually varies by about 0.2 mm (0.12–0.35 mm).

The zooid whorls consist in some of the colonies of but two ascending zooids placed opposite, usually, however, there are in the colony both whorls with two and three zooids (cf. the above-stated descriptions of the habitus of some of the colonies). The intervals between the whorls (the "internodes") vary somewhat, but are always a little longer than the length of the verrucae (= the contracted zooid). All the zooids are contracted and closely pressed against the stem (fig. 30 *a*). They (the verrucae) measure in length about 1.5–2 mm, usually 1.6–1.8 mm, by 0.4–0.5 mm in width.

The zooids are imbricately covered with eight rows of scales, which are placed with the sclerite-centre off the mesenteries of the zooid. The uppermost, the opercular sclerites, which may be laid down so as to cover the mouth of the zooid, are of a rectangular or pointed triangular shape (fig. 30 *c*, fig. 31 *3*). Their basal part with the sclerite-centre is closely warty on the inside and the basalmost margin is somewhat thicker than the rest of the sclerite; the upper and larger part of the sclerite is smooth also on the inside. The opercular sclerites measure about 0.3–0.45 mm in length, those of the adaxial side of the zooid being the smallest.

The operculum is covered by the eight large marginal sclerites which form a distinctly circum-operculum. The circum-opercular sclerites (fig. 30 *d*, fig. 31 *2, 4, 8*) are of about the same type as the opercular sclerites. Their size varies from about 0.5–0.6 (0.65) mm, those of the adaxial rows usually being the smallest, in any case the most narrow, whereas those from the lateral and abaxial side of the zooid may be fairly broad and with a much more irregular outline (fig. 30 *a*).

When the operculum and circum-operculum are closed above the mouth of the zooid, a pointed cone in which the adaxial sclerites are covered by the abaxial is formed.

The zooid body scales (fig. 30 *b*, fig. 31 *1, 4*) are of a rather uniform appearence, they are roundish with a smooth outside and have nearly their whole inside covered with small warts, only a narrow border along the upper part of the scale being smooth. They measure up to about 0.4 mm, the uppermost scales of the lateral rows usually being the larger. Those of the abaxial rows decrease only little in size from the top of the zooid towards the base, whereas those of the adaxial and adaxial-lateral rows decrease considerably in size; the basalmost scales measuring only about 0.1–0.13 mm.

The zooid body scales usually number 6–7 in the abaxial rows, sometimes, however, there may be 8, and in one zooid 9 scales were counted in the abaxial rows. From the abaxial to the adaxial side of the zooid the number of scales in the longitudinal rows gradually decreases so that in the adaxial rows there are usually about 4 zooid body scales.

The strongly contracted zooids are usually somewhat concave on their adaxial side. In some zooids so concave that a distinct deep furrow is formed in which the zooid body scales of the two adaxial rows are placed with their outside against each other. The zooid which is figured in fig. 31 is one of the least contracted and is only slightly concave on its adaxial side, nor are the circum-operculum and operculum here fully closed above the mouth of the zooid.

There are no deposits in the tentacles. In some of the whorls one of the zooids is considerably smaller (i. e. younger) than the others, measuring but 0.8–1.3 mm in contracted state. In these young zooids the zooid body scales in the abaxial rows number 6–7; and from the full-grown zooids the young ones in habitus differ mainly by their less developed circum-opercular sclerites.

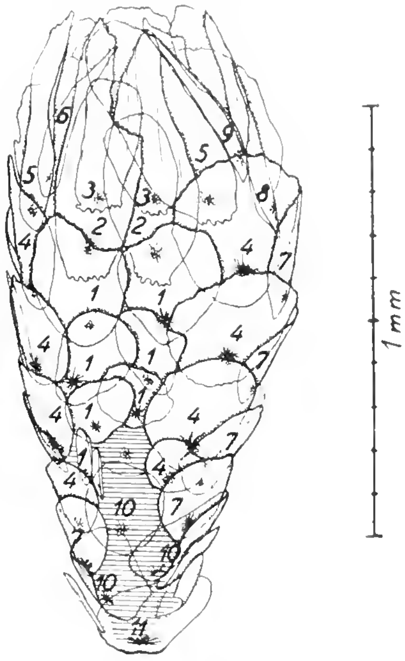


Fig. 31. *Primnoella jungerseni* n. sp.

A zooid made transparent and shown from the adaxial side. The nuclei of the sclerites, but not the warts on the inside, are indicated. The zooid is cut from the stem, by which operation some of the stem scales at the base of the zooid are cut through and the basalmost pair of adaxial scales removed somewhat from their natural position. The hatched area is the place where the cut has been performed.

1. zooid body scales of the adaxial rows.
2. circum-opercular - -
3. opercular - -
4. zooid body - - adaxial-lateral rows.
5. circum-opercular - -
6. opercular - -
7. zooid body - - - abaxial-lateral -
8. circum-opercular - -
9. opercular - -
10. zooid body scales of the abaxial rows.
11. the large stem scale direct below the basalmost pair of abaxial body scales.

In the two colonies where the tip of the colony is intact the stem is flattened between the uppermost pair of zooids (the uppermost whorls in these colonies consisting of only two zooids placed opposite each other). The stem ends somewhat below the top of the verrucae, and the point of the axis ends a little further below, at about the base of the adaxial side of the zooids. In both these colonies the uppermost zooids are somewhat smaller than the other zooids (cf. the above stated description). Thus a tip growth is indicated besides the intercalar growth.

Discussion: The species is referred to the genus *Primnoella* on account of the shape of its scale like sclerites, its unbranched colony and its whorls of zooids. There are, however, some differ-

[illegible] species of *Primnoella* [illegible] sclerites is missing, the [illegible] (Wright & Studer 1889, Versluys [illegible] generic character, [illegible] that all the previously [illegible] have an inner layer of differ- [illegible] absence of such a statement [illegible] to an actual absence of that [illegible] in description. Within the rela- [illegible] species with and species without an [illegible] the stem are also known.

[illegible] from most other *Primnoella* species [illegible] in the whorls. No other *Primnoella* [illegible] in which the most common number [illegible] two and the largest number [illegible]

[illegible] number of zooids in the whorls, the comparatively [illegible] abaxial zooid body scales, and the absence of [illegible] lumpy sclerites in the stem are all characters [illegible] relationship between *P. jungerseni* and some of [illegible] described species of *Caligorgia*.

[illegible] of the other species of *Primnoella* may perhaps be [illegible] *P. jungerseni*, viz. *P. distans* Studer 1878 and *P. polita* Deichmann 1936 (= *P. distans* Wright & Studer 1889). [illegible] these species was described on a specimen, 23 cm high [illegible] collected in the South Pacific (22°21' S. 151°7.7' E.) [illegible] of about 1000 m (550 Faden), and Wright & Studer (1889) [illegible] to have recaptured some specimens of this species [illegible] West Atlantic Ocean (off Pernambuco, Brazil, 220–730 m, [illegible] West Indies, about 825 m). Kükenthal (1919 [illegible] however, whether this is true, and Deichmann (1936) [illegible] a new species, *P. polita*, which is identical with *P. distans* Wright & Studer 1889, on colonies from off Frederiksted, West Indies, [illegible] depth of about 920 m.

[illegible] two species (*P. distans* Studer 1878 p. 644 pl. 1 fig. 9, *P. polita* Deichmann 1936 p. 162–163 pl. 26 fig. 12 (= *P. distans* Wright & Studer 1889 p. 85–86 pl. 17 fig. 1) have the low [illegible] of zooids in the whorls in common. Studer states for *P. distans* that the lowermost whorl has two zooids and that [illegible] number of zooids per whorl soon increases to four. Wright & Studer state for their material (i.e. the species *P. polita*) a [illegible] which in the lowermost whorl is two, in the [illegible] then four, but in some whorls five. Deichmann [illegible] number of zooids in the whorls as usually three, rarely [illegible] species have thus a somewhat higher number [illegible] whorl than *P. jungerseni*.

D[illegible] not pointed out any differences between *P. polita* and *P. distans*. Kükenthal, however, who as mentioned [illegible] Studer's specimen from 1878 and Wright & Studer's [illegible] from 1889 are identical, gives as basis [illegible] the different appearance of the figured [illegible] difficult to explain, that the intervals [illegible] *P. distans* are larger than those in Wright [illegible] the statements in the texts are, however, [illegible] the intervals as 3–4 mm, [illegible] of the intervals between the whorls [illegible] species as e.g. in *P. jungerseni*, [illegible] value. Thus in one specimen [illegible] measures 2.7 mm, whereas [illegible] interval measures 5.4 mm and [illegible] whereas the intervals [illegible] *P. jungerseni* are measured from the [illegible] whorl to the attachment of the [illegible] figures) that both [illegible] the intervals [illegible] to the base of the zooids.

Studer states for the verrucae (Zellen) of *P. distans* a size of 2 mm, and Wright & Studer state for the verrucae (calyces) in their material of *P. polita* a size of 1.5–2 mm. Deichmann gives 1.5–1.75 mm. Thus the size of the verrucae in the three species discussed here is nearly equal and then cannot yield any distinguishing character. Such may, however, be found in their shape and scale covering. The verrucae of *P. distans* are, as pointed out by Kükenthal in 1919, curved adaxially towards the stem, whereas the verrucae in Wright & Studer's specimens issue from the stem at an acute angle and are straight, as is also the case in Deichmann's specimen. Studer's figures show further (if they are correct) that the verrucae of *P. distans* are more slender than those of *P. polita* and *P. jungerseni* and that in the abaxial rows of zooid body scales the number of scales is considerably higher (about 10–15). It also appears from the figures that in the zooids of *P. distans* just as in *P. polita* there are only two abaxial rows of scales visible from the abaxial side of the zooid.

Studer's *P. distans* is somewhat larger than both *P. polita* and *P. jungerseni* as it measures 23 cm without the lacking basal part, whereas the largest *P. polita* (that figured by Wright & Studer 1889 pl. 17) including the base of the colony measures about 22 cm and the largest *P. jungerseni* only measures 9.4 cm. *P. distans* differs from the two other species in having a very considerable part of the stem without zooid whorls; Studer states 11 cm between the scar of the broken off base and the lowermost whorl.

P. distans may in the slender verrucae with more than 10 zooid body scales in the abaxial rows be sufficiently distinguished from the two other species of *Primnoella* with a low number of zooids in the whorls: i. e. *P. jungerseni* and *P. polita*; and these may easily be distinguished from each other, since in the verrucae of *P. jungerseni* four rows of scales are visible from the abaxial side, whereas in *P. polita* only two rows are visible, as so nicely shown in Wright & Studer's figures.

In *P. jungerseni* the verrucae are also chubbier. The base consists in *P. jungerseni* of an only small basal disk, whereas in *P. polita* it consists of a lobed or root-like portion which may be of a rather large extent. Nor for *P. polita* is described an inner layer of lumpy spicules in the stem, and such a layer may probably be missing.

P. jungerseni belongs to the group Convexae Wright & Studer 1889 (Diagnosis: Vide Kükenthal 1919 p. 385). To this group also *P. distans* and *P. polita* have been reckoned though with the same right they might have been referred to the other group, Carinatae Wright & Studer 1889 (= Compressae Kükenthal 1919). The shape of their zooids is as described for the Convexae, but the number of scale rows visible from the abaxial side of their verrucae is only two as in the Carinatae.

Distribution. *Primnoella jungerseni* is known from two localities, viz. in the Danmark Strait (south of the Wyville Thomson Ridge) and in the North-Atlantic Ocean somewhat south of the first locality. Chart of distribution, fig. 32, the depths being 2448 m and 2137 m respectively. It is to be noted that this species is the first *Primnoella* which has been found in the North-Atlantic Ocean, whereas hitherto all the about 20 species described of this genus have been found in the southern hemisphere and only one of them, the above-mentioned *P. polita*, also has been taken north of the equator, at the West Indies.

Besides in the geographical distribution *P. jungerseni* also differs somewhat from the other species of *Primnoella* in the bathymetrical distribution as hitherto no other *Primnoella* has been found in depths greater than about 1100 m.

Primnoella jungerseni may be expected to have a very wide distribution as it is a deep-sea species of a genus which otherwise is nearly exclusively restricted to the southern hemisphere.

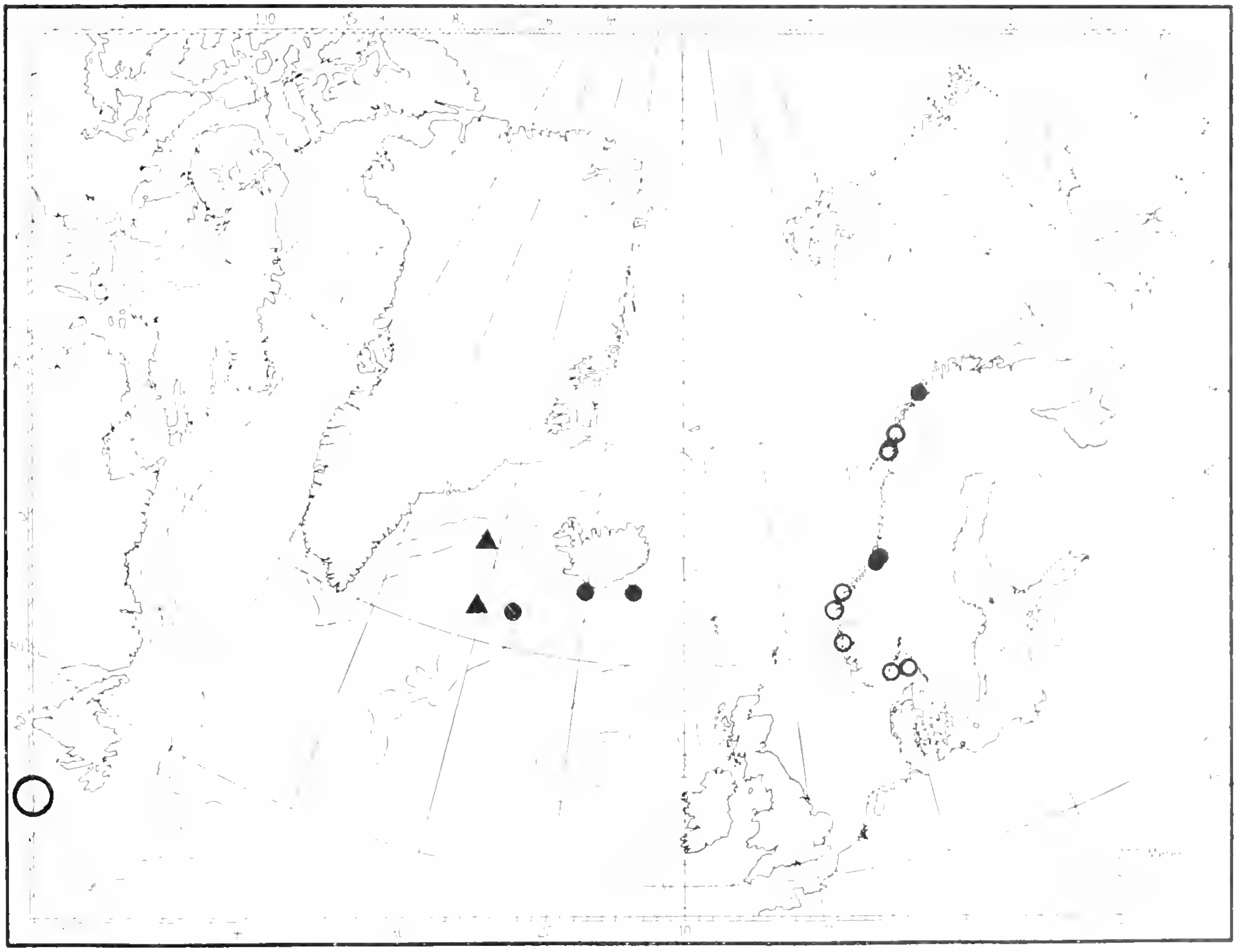


Fig. 32. ● *Anthothela grandiflora* (M. Sars). ▲ *Primnoella pinguescens* n. sp.
The large open figure indicates that the species is recorded from the area, though without exact locality.

Family: Gorgonidae Dana 1846 emended.

Diagnosis: Vide Kükenthal 1921, p. 321.

Genus: Stenogorgia Verrill 1883.

Diagnosis: Kükenthal 1921, p. 347.

Stenogorgia borealis (Jungersen) Kramp 1930.

Stenogorgia borealis Jungersen, 1915, p. 1186, nomen nudum.
Kramp, 1930, p. 6–11, figs. 2–5.

Description: Vide Kramp 1930.

Material:
65 13′ N. 26 58′ W. 171 m, 6 1 C. "Ingolf" St. 16.
62 00′ N. 22 38′ W. 1630 m, 2 9 C. - 39.
61 11′ N. 27 00′ W. 913 m, 6 1 C. - 81.
65 38′ N. 26 27′ W. 260 m, 5 9 C. 98.
66 33′ N. 20 05′ W. 83 m, 5 6 C. 127
The Faroes.
S. W. Greenland, Kvanefjord. 565 m. "Tjalfe".
S. W. Greenland, Bredefjord. 700 m. "Rink" St. 125.
S. E. Greenland, Lindenowfjord. 300 m.
63 50′ N. 10 55′ W. 330 m, "Dana" St. 6000.
63 33′ N. 11 25′ W. 317 m, 1 31 C. (315 m). "Dana St. 6001

Remarks. The colony from the "Ingolf" St. 98 was when alive stated to be grey with a pale blue touch.

Distribution. The species is found in several localities on the Wyville Thomson Ridge from the Faroes to Greenland, it is further found in two localities somewhat south west of Iceland and in some of the southernmost fjords of Greenland both on the east and west coast. The list above includes all the previously known localities which apart from the three last mentioned all are marked on a chart in Kramp's paper (1930 p. 10).

Stenogorgia rosea Grieg 1887

Stenogorgia rosea Grieg, 1887, p. 6–8, pl. 1, figs. 1–11, pl. 2 figs. 1–9.
Bielschowsky, 1929, p. 189–190, fig. 31.
Kükenthal, 1921, p. 349.
Pax, 1936, p. 258.
Carlgren, MS.
For further references vide Kükenthal 1921.

Description. Vide Grieg 1887 and Bielschowsky 1929.

[illegible] 1903, Scandinavian [illegible] Kattegat [illegible] the south [illegible] BIRSCHOWSKY (1929 [illegible] 1945, p. 123) to be a mistake for [illegible] was not dealt with in the author's paper "The Danish Octocorals from the Waters inside Skagen". Professor CARLGREN states, however, in his manuscript on the Danish Anthozoa ("Koraldyr. Danmarks Fauna") that the species actually is taken in the northern Kattegat, at Tistlarna, by JÄGERSKIÖLD, the locality being situated somewhat south-west of Göteborg.

Bathymetrical distribution: About 20–400 m.

Family Chrysogorgiidae Verrill 1883.

Diagnosis: Vide KÜKENTHAL 1919, p. 489–490.

Subfamily Lepidogorgiinae Versluys 1902.

Genus Radicipes Stearns 1883.

Diagnosis: Vide KÜKENTHAL 1919, p. 541.

[illegible] of the species of this genus are described [illegible] North Atlantic Ocean, and of these species two were recaptured [illegible] Ingolf Expedition. JUNGERSEN (1915), it is true, referred [illegible] of the "Ingolf" to only one species, viz. [illegible] Wright & Studer; but this was, as will be evident [illegible] appears below, a lapse, as, in reality, only one of [illegible] is referable to that species, whereas the other un[illegible] to another species, viz. *R. gracilis* (Verrill), [illegible] JUNGERSEN with a query was made a synonym [illegible] KÜKENTHAL (1919) thought doubtful, [illegible] VERRILL's description, though on some [illegible] gives the main characteristic features [illegible] comparison with the other species known in

Radicipes challengeri Wright & Studer 1889.

[illegible] Wright 1885, p. 691.
Wright & Studer, 1889, p. 3–4, pl. 1 figs. 1, 1a; pl. 5a, fig. 2.
[illegible] Versluys 1902, p. 14–15, figs. 18–19.
[illegible] gracilis (partim) Jungersen, 1915, [illegible]
[illegible] Kükenthal 1919, p. 543–544.
1924, p. 441–442.
[illegible] J. A. Thomson 1927, p. 20, pl. 4, fig. 17.
[illegible] Kramp, 1932, p. 10.

[illegible] "Ingolf" St. 83. 1 colony.

[illegible] an open spiral. Stem slender. [illegible] attached to the stem in [illegible] from the tentacles having [illegible] reaching a length of about [illegible] Intervals between [illegible] successive tentacle [illegible] number. In stem [illegible] size about [illegible] 0.15 – 0.05 mm). [illegible] shaped [illegible] 0.17 – 0.05 mm) or [illegible] constricted middle [illegible] 0.25 – 0.03 mm). In the [illegible] 0.25 – 0.02 mm. [illegible] about 0.12 – 0.03 [illegible]

Description: The material consists of a single colony which is broken into several fragments and lacks the basal part. The colony is unbranched, highly flexible and somewhat elastic and may, when alive, have measured about 70 cm or more in length. It has been coiled into an open spiral with several windings and has had the zooids placed on the inner side of these.

The colour of the specimen (in alcohol) is white.

The round axis is white, slightly light-blue irridescent, measuring in the lower part of the colony about 0.5 mm in diameter. The diameter of the stem is about 0.75 mm.

The zooids are placed obliquely on the stem in such a manner that a rather long part of the zooid body is parallel to the axis (fig. 33). They are arranged in a unilateral row, usually quite close to each other, but the successive intervals may also be up to 4 mm. The intervals seem, however, larger on account of the long part of the zooid body which lays parallel to the axis. The intervals between the tentacle crowns vary from 2 to 12 mm. Occasionally the zooids may be placed so close together that a part of one zooid overlaps a part of another; in one place in the colony four zooids (tentacle crowns) are thus crowded on only 6 mm.

The zooid body reaches a length of generally 7–8 mm, measured parallel to the axis, and has, perpendicularly on the axis, a height which reaches about 2 mm, being generally 1.2–1.3 mm, and to this come the tentacles which may have a length of about 4 mm.

The heights of the zooid bodies are thus somewhat greater in this specimen than in the type specimen examined by VERSLUYS, who in 1902 (p. 15) for the corresponding measure states "hochstens 1 mm, meist 0.9 oder 0.8 mm und weniger." VERSLUYS' statement that the intervals between the zooids usually are 4–5 mm and in the upper part of the colony about 7 mm, refers probably to the intervals between the tentacle crowns.

The zooids, seen from above, may reach a width of about 1.75 mm and are thus somewhat protruding from the stem. Below the tentacles they have a diameter of about 1.5 mm. Several of the zooids are filled with and expanded by ripe or nearly ripe eggs, and only in these the lower part of the zooid body is easily distinguishable from the stem (compare fig. 33).

The tentacles are of unequal size. The adaxial one is always small, often quite rudimentary, usually of a size of about 1 mm or less. The other tentacles usually measure up to about 4 mm. Some (two or three) of the abaxial are, however, often distinctly smaller than the other. The tentacles are not retractile, but by contraction curved in over the peristome. The pinnulae may number up to about 20–25 pairs.

Among the full-grown zooids a less developed one may occasionally be found.

The tip of the colony which has been broken off is regenerating, and the stem measures here, below the scar, about 1.3 mm in diameter, but above the scar, in the regenerating part, it measures only about 0.4 mm in diameter. The old axis is not continuing into the regenerating tip, but several millimetres below the scar a new axis is developed lying parallel to and very close up to the old axis and continuing into the new tip of the colony. This tip bears two zooids which have not yet developed an oral opening or tentacles but nevertheless contain large eggs.

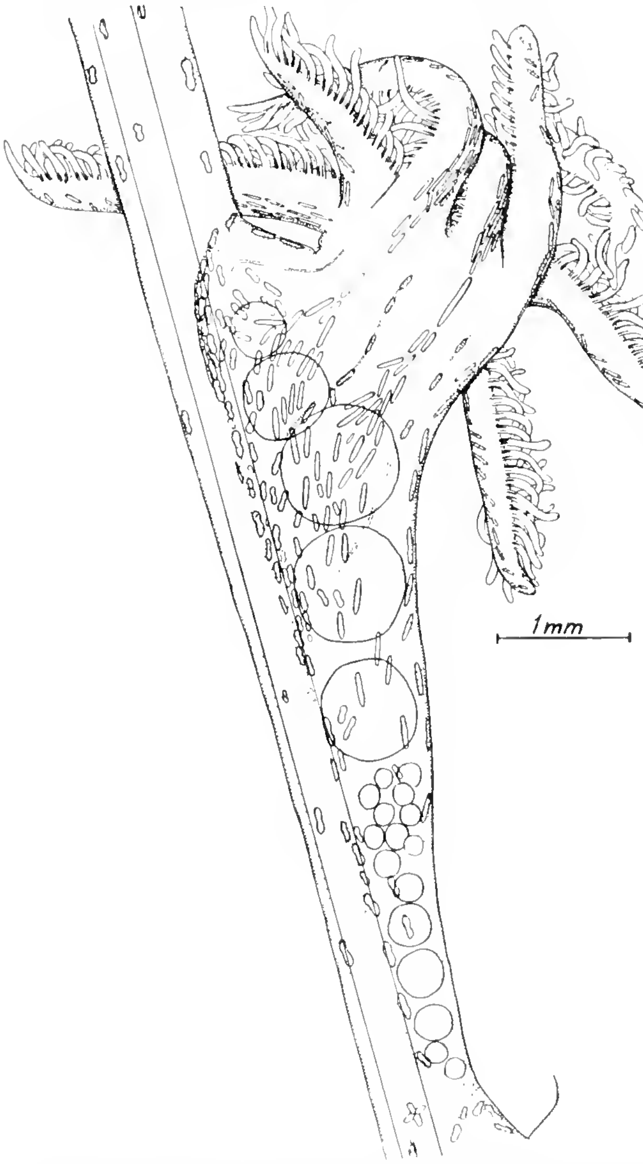


Fig. 33. *Radicipes challengeri* (Wright & Studer). The zooid has been made transparent and the axis and the eggs are indicated. It may be noted that both somewhat more and somewhat less spiculated zooids are found.

The coenenchyma of the stem is thin and provided with extremely few sclerites, which are placed so scattered that there may often be about 2 mm between them; a few sclerites may, however, sometimes be found rather close to each other (fig. 34 *k*). The stem sclerites are scale-like and placed in the longitudinal direction of the stem. The most common type is the oblong form with rounded ends and narrowed middle (i. e. nearly 8-shaped) which is figured fig. 34 *a*, *b*; the largest of this type measures about 0.25 × 0.07 mm, but besides these some somewhat smaller sclerites with a less smooth surface (fig. 34 *c*–*g*) or a more irregular outline (fig. 34 *h*, *i*) may be found. The latter form, the largest of which measures about 0.15 × 0.05 mm, is by Versluys (1902 p. 11) considered the most common form in the specimen examined by him.

In the zooids the sclerites are likewise only few in number. In the basal part of the zooid body they are for the most part transversally placed, in the middle and upper part of the zooid body they are, however, longitudinally arranged and principally restricted to eight intermesenterial rows (fig. 33). These rows of sclerites continue sometimes without interruption into the rows of sclerites in the tentacle dorsa, often, however, the sclerites are quite absent in the upper part of the zooid body. Besides the intermesenterial rows of sclerites a few sclerites may be found along the attachments of the mesenteries.

The sclerites of the zooid body are scale-like and rather smooth, yet with some very small teeth at the ends. The transversally placed ones at the base of the zooids are mainly of the same type as the most common in the stem. The largest of these 8-shaped sclerites are about 0.25 mm in length, but generally they are less than 0.2 mm (fig. 35 *d*, *e*, *o*). The longitudinally placed sclerites in the main zooid body are generally of a somewhat longer and narrower type without constricted middle (fig. 35 *i*–*c*). They usually measure about 0.25 × 0.03 mm and not more than 0.3 mm in length. Only the single sclerite, which in the upper part of the zooid body often fills out the space between the rows of sclerites in the zooid body and the tentacle dorsum, may be somewhat longer and is often somewhat narrower (e. g. 0.4 × 0.02 mm). Twins, quadruplets (fig. 35 *g*, *h*) and some small differently shaped sclerites (fig. 35 *f*) may be found between the other sclerites, and 8-shaped sclerites may be found in the longitudinal rows of sclerites, as also in the basal part of the zooid body some of the other type occur.

The sclerites of the tentacles are in the tentacle dorsum rather long, narrow scales or flattened spindles (fig. 35 *p*–*s*) the largest of which generally measure about 0.25 × 0.02 mm. In the lower part of the tentacle they are placed longitudinally in a row which may be four (sometimes six) sclerites broad, in the middle and upper part of the tentacles they decrease in size and are more scattered and usually more transversally placed (in the fully outstretched tentacles they become probably all longitudinally arranged).

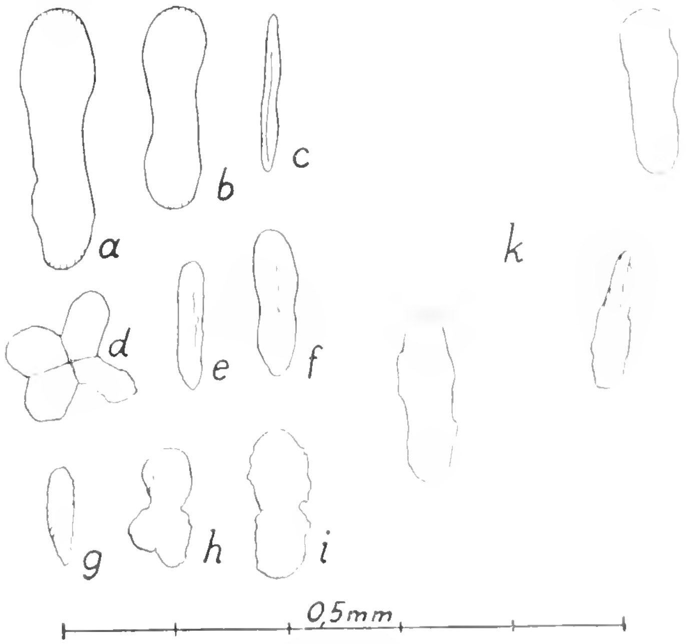
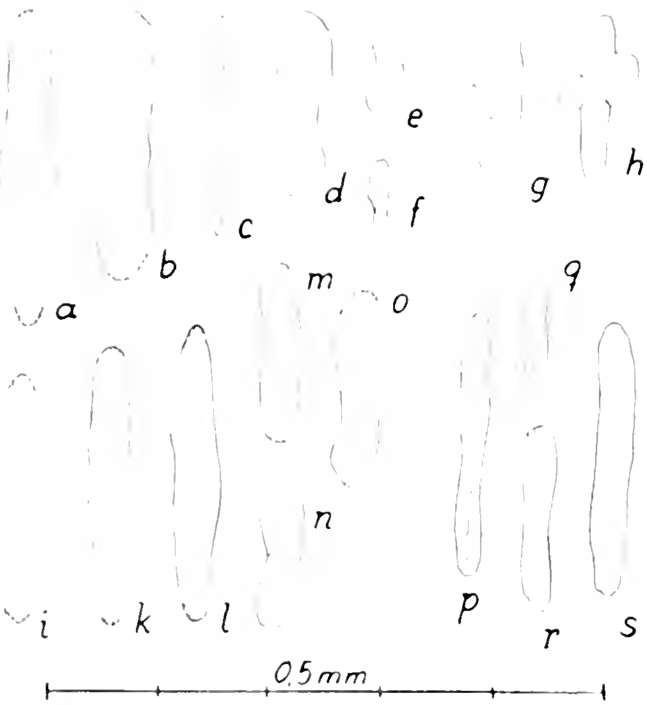


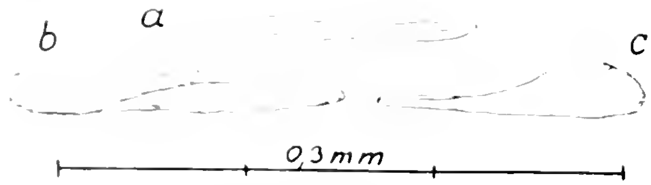
Fig. 34. *Radicipes challengeri* (Wright & Studer). *a*–*i*, sclerites from the stem. *a*, *b*, of the most common type. *c*, shown from the side. *k*, a group of three sclerites from the stem in natural position.

In each pinnula there are two sclerites, one on each side. They are scale like and measure generally 0.12 (–0.2) × 0.05 mm [illegible] length. They are, however, [illegible] in such a manner that one [illegible] at the base of the pinnula, [illegible] of the pinnula with its [illegible] part. Thus that picture is seen [illegible] VERSLUYS (1902, p. 15) describ[illegible] [illegible] Ende [illegible] scelerites.



[illegible] (Wright & Studer). a–h, sclerites from [illegible] body; d of the most common type, e, shown from [illegible] sclerites from upper part of zooid [illegible] type; p–s, sclerites from tentacle dorsum.

D[illegible] The description above differs on several points [illegible] WRIGHT & STUDER's original description of [illegible] VERSLUYS (1902) gave, however, after [illegible] one of the type specimens, a redescription of [illegible] correction of WRIGHT & STUDER's errors, and [illegible] by the "Ingolf" agrees in all essentials with [illegible] which only in some few points was not quite [illegible]



[illegible] (Wright & Studer). Sclerite from pin[illegible] shown from the side.

[illegible] are surely only known from [illegible] off Gibraltar, 1080 m, and a [illegible] N. [illegible] W. (750 m) (recorded by [illegible] locality is situated some [illegible] probably the species may be [illegible] the deeper parts of [illegible] fig. 37 [illegible]

Radicipes gracilis (Verrill 1884).

Lepidogorgia gracilis Verrill, 1884, p. 220.
1885, p. 512, pl. 2, figs. 10, 10 a.
Versluys, 1902, p. 16.
Radicipes challengeri + ? gracilis (partim) Jungersen, 1915, p. 1183–1184.
gracilis Kukenthal, 1919, p. 518.
Verrill, 1922, p. 12, figs. 10, 10 a.
Lepidogorgia verrilli J. A. Thomson, 1927, p. 20–21, pl. 3, fig. 18, pl. 5, fig. 20.
Radicipes gracilis Kukenthal, 1924, p. 412.
challengeri Kramp, 1932, p. 10.
gracilis Deichmann, 1936, p. 227.

Material:
61°50' N., 56°21' W., 2702 m, 1.5 C. "Ingolf" St. 36. 13 juvenile colonies + some fragments.
62°00' N., 21°36' W., 1591 m, 3.3 C. "Ingolf" St. 10. 11 colonies.
62°06' N., 22°30' W., 1587 m, 3.1 C. [illegible] 68. 1 colony.
62°57' N., 19°58' W., 957 m, "Thor" St. 166 (03). 1 juvenile colony.
62°19' N., 56°00' W., 2550 m, 1.91 C. (2525 m). "Godthaab" St. 21. 2 colonies.

Diagnosis: Colony erect, slightly spirally twisted. Stem slender, rigid, only towards the tip flexible and elastic. Calcareous base root-like, much branched. Zooids fairly cylindrical and obliquely seated at intervals of generally 5–10 mm. Zooid body when fully grown measuring nearly 2 mm in length by about 1 mm in diameter. Tentacles of about equal size; when contracted about 3 mm in length. Size of verrucae usually 3 × 1 mm. Sclerites of coenenchyma scale-like, oblong with rounded ends and constricted middle, longitudinally arranged in a generally fairly close layer, average size about 0.13 × 0.035 mm, maximum size about 0.3 × 0.05 mm. Zooids strongly armed, the interseptal sclerites somewhat obliquely placed and of the same type as the stem sclerites, the septal ones, and those of the lower half of the tentacle dorsum, longitudinally placed larger scales usually without constricted middle, average size 0.3 × 0.05 mm, maximum size about 0.5 × 0.06 mm. In some zooids, usually in the tentacle bases, also some few more or less flattened spindles measuring up to 0.7 × 0.05 mm. Sclerites of outer half of tentacle dorsum obliquely placed scales 0.1 × 0.02 mm–0.2 × 0.03 mm. Sclerites of pinnulae slender, scale-like, somewhat twisted, measuring up to 2 mm in length; often a few in each pinnula.

Description. The material includes colonies of a much varying age.

The smallest specimen is the juvenile one from the "Thor" St. 166 which only measures about 1.4 cm in height and has not yet developed more than the primary zooid, nor has the specimen developed a calcareous base, but the tiny stem, which measures only 0.1–0.2 mm in diameter, passes below over in a small bag formed extension into which also the axis of the specimen extends. The single zooid measures, with incurved tentacles, scarcely 2 mm in length, having a width of scarcely 1 mm.

Also the collection from the "Ingolf" St. 36 consists of juvenile specimens which, however, all have developed the characteristic features of the species. They vary in height from about 2.5 cm to 4.5 cm and bear three to four zooids placed unilaterally. The root-like calcareous bases, which anchored the specimens into the mud, are richly branched and in comparison with the stems fairly large. None of the bases bear now more than one stem, but from some of the bases it seems that more stems have risen when the specimens were alive. The diameter of the stem is scarcely 0.2 mm. The interval between the base and the lowermost zooid varies from 15–25 mm and the intervals between the zooids may vary from about 4 to about 5 mm. The largest zooids measure, with the tentacles slightly incurved, about 5 mm in

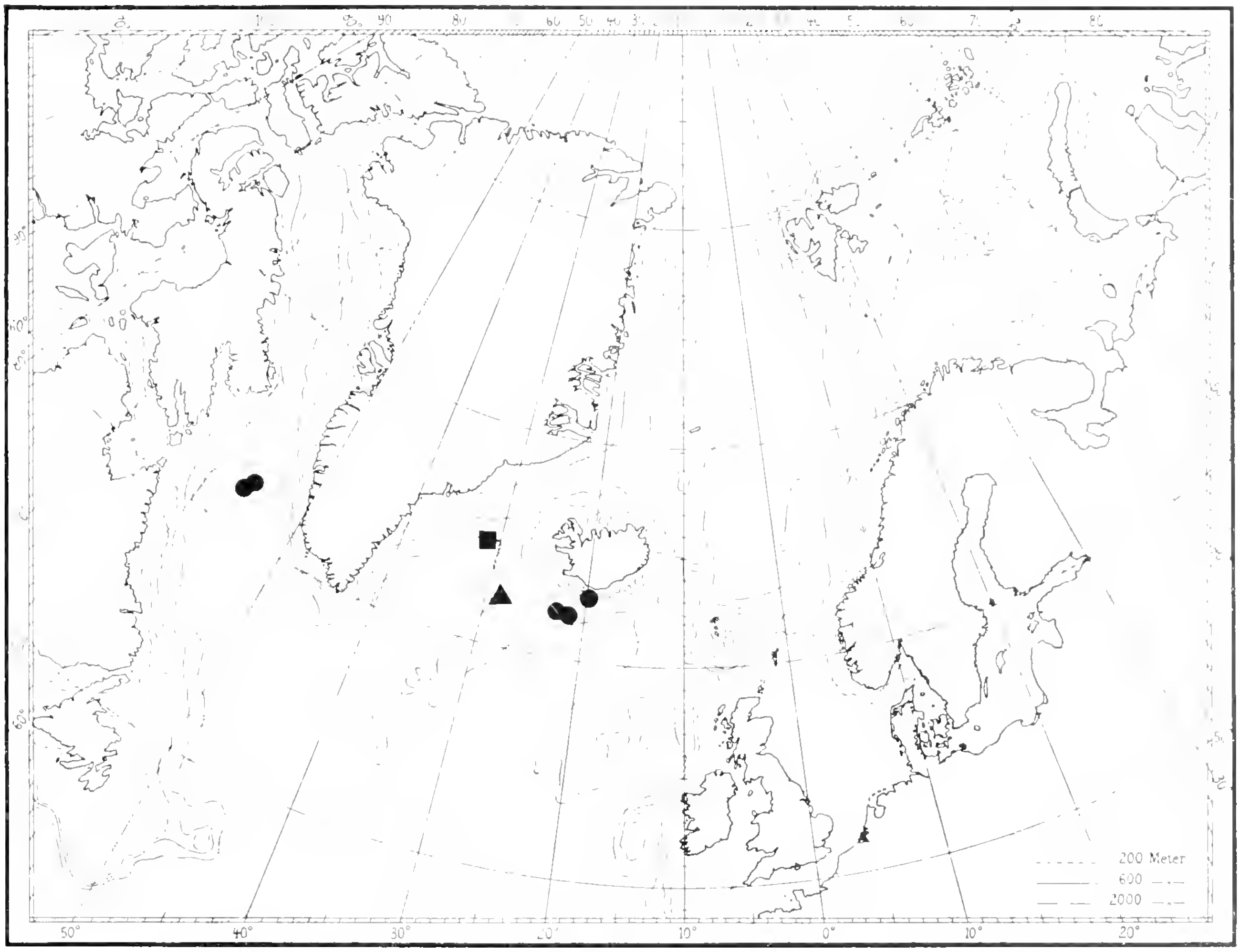


Fig. 37. ▲ *Radicipes challengeri* (Wright & Studer). ● *Radicipes gracilis* (Verrill). ■ *Chrysogorgia campanula* n. sp.

length by about 1 mm in width. The uppermost zooid is always full-grown, but else in the colonies every second of the zooids is generally a young one.

The material from the "Godthaab" St. 21 consists of a single calcareous base from which, however, two stems arise. One of these is 7.2 cm in length and has five zooids, the interval between the base and the lowermost zooid being 32 mm, and the intervals between the zooids varying from 7–10 mm. The other stem measures about 8.5 cm in length and bears full-grown zooids. The interval between the base and the lowermost full-grown zooid is 30 mm, and the intervals between the zooids vary from about 5 to 9 mm. The stem has in the lower part a diameter of about 0.75 mm, having about 25 mm above the base two small zooid-buds, less than 0.5 mm high, placed 2 mm apart. The verrucae measure about 3–4 mm.

The colonies from the "Ingolf" St. 40 are of much varying size, the smallest measures about 7.5 cm and the largest may, when alive, have measured more than 50 cm in length. The interval between the base and the lowermost zooid is about 60 mm in a 15 cm high colony, in a 39 cm high colony about 80 mm, in a 25 cm high colony about 75 mm, and in a 40 cm high colony about 45 mm. The largest interval between the base and the lowermost zooid is found in the colony 34 cm high, from "Ingolf" St. 68, and measures about 95 mm. The intervals between the zooids are generally 5–8 mm, but may vary from 4 to 11 mm. The zooids seem to vary somewhat in size. In some of the larger colonies the largest verrucae are scarcely 3 mm in height. In other colonies the verrucae are 4.5 mm high by 1.1–1.2 mm in width. In more of the colonies the zooids are distinctly of unequal age, every second being considerably smaller than the others.

The diameter of the stem is generally about 1 mm in the lower part of these colonies which are from 40 cm to 50 cm high, but in one colony, 15 cm high, the stem is considerably thicker, measuring below about 2 mm in diameter and in nearly its whole length being distinctly thicker than the zooids, which however are fairly small in this colony. In this specimen also the spiculation of the stem, as will be mentioned below, differs somewhat from the typical.

The colonies are erect, slightly spirally turned, and the larger specimens are rigid, only towards the tip somewhat flexible. The axis is roundish, having the surface provided with short longitudinal scratches. In the smaller colonies the colour of axis is whitish and light-blue irridescent, in the lower part of the medium sized colonies more yellow and in the larger colonies slightly light-brown.

The colour of the colonies is in alcohol white. The juvenile colonies from the "Ingolf" St. 36 were noted as colourless when alive and the large colony, 36 cm high, from the "Ingolf" St. 68 was noted to have the axis shining whitish through the coenenchyma and very pale pink zooids.

The zooids are fairly cylindrical in shape and placed somewhat obliquely upon the stem which is slightly swollen at the places where they are attached. The zooids are strongly spiculated and by contraction somewhat curved towards the stem. The tentacles are of about equal size and not retractile. The zooid [illegible] about 2 mm, whereas [illegible] in length. Typically [illegible] the stem, but in some [illegible] regularly placed and in [illegible] at the middle of the [illegible] opposite.

[illegible] of the stem are scale like, [illegible] middle. Their average [illegible] their maximum size about [illegible] arranged, generally in a [illegible]. In the lowest part of the stem [illegible] scattered, whereas they are [illegible] closer layer near the zooids (comp. fig. 38).

[illegible] Verrill). a, a zooid from one of the juvenile [illegible] St. 36; b, a zooid of the colony from the Godthaab St. 24.

[illegible] figures 39 a, b that the sclerites of the stem [illegible] colonies from the "Ingolf" St. 36 are somewhat [illegible] than those from the larger colonies, and, as [illegible], there is a corresponding difference in [illegible]. In the somewhat differing colony from St. [illegible] unusually thick stem the sclerites are [illegible] (comp. fig. 40), but also in this colony [illegible] at the places of the zooids. [illegible] from the "Thor" St. 166 sclerites [illegible] part of the stem and in the zooid. [illegible] base is often devoid of [illegible] occur and are then of the same [illegible] of them also longitudinally

[illegible] generally scale like scle- [illegible] are of the same type as the [illegible] generally parallel to [illegible] in the zooid body are placed [illegible] type as those from the [illegible] obliquely arranged in [illegible] (fig. 38 b, 41 b, [illegible] longitudinally arranged (fig. 38). The interseptal sclerites of the zooid body are generally of a slender scale like form with more or less rounded ends and usually without constricted middle. Their maximum size is about 0.5 × 0.06 mm, and generally they measure about 0.3 mm in length (fig. 41 a, b, m–q).

Fig. 39. *Radicipes gracilis* (Verrill). *a*, sclerites in natural position in the stem of a juvenile colony from the "Ingolf" St. 36, between the uppermost and nextuppermost zooid. *b*, a section of coenenchyma with the sclerites in natural position, from the middle part of stem in a colony 32 cm high from the "Ingolf" St. 40; the diameter of the stem in the lowest part of this colony scarcely 1 mm.

In the tentacle base and nearly the lower half of the tentacle dorsum similar sclerites are found arranged longitudinally in a row generally 5–8 sclerites broad. The sclerites decrease gradually in length from the tentacle base, where the largest sclerites of the zooid are usually found, until they become about 0.2 mm in length at the outer half of the tentacles. The sclerites in the outer half of the tentacle dorsum are typically obliquely placed in two rows, one on either side of the middle of the tentacle. Their

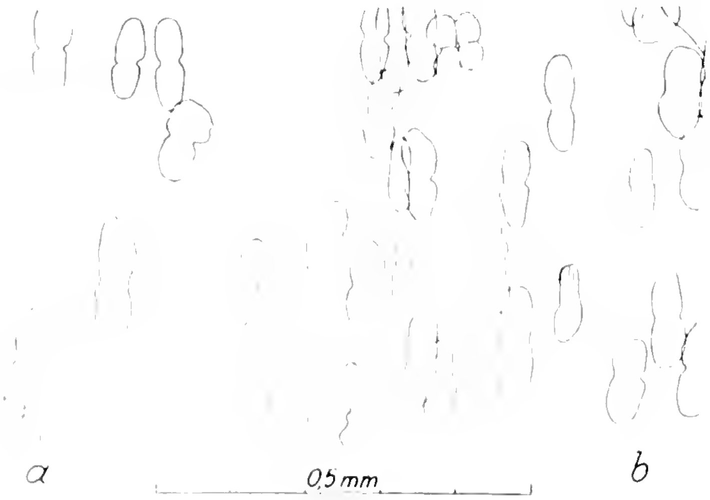


Fig. 40. *Radicipes gracilis* (Verrill). Sections of coenenchyma of stem in the colony, 45 cm high, from the "Ingolf" St. 40, which in the lower part has a diameter of about 2 mm. *a*, from the lowest part of the stem below the zooids. *b*, from the upper part of the stem between two zooids.

length varies from 0.2–0.1 mm and their width from 0.03–0.02 mm (fig. 41 *r–u*).

The pinnulae number from about 15 to 20 pairs. Especially the outermost ones may be devoid of sclerites, but else the pinnulae are generally provided with two or a few slender, scale-like, somewhat twisted sclerites (fig. 41 *v–æ*) the largest of which measure about 0.2 mm.

In some zooids, in the lower half of the tentacles or in the upper part of the zooid body, a few sclerites may be found which differ from the typical ones in being more slender and spindle-shaped, though usually more or less flattened (fig. 41 *f–h*). In the juvenile colonies, where, as already mentioned, the sclerites distinguish themselves by their comparatively long and slender form, also some few of the interseptal sclerites which extend into the tentacle base are exceptionally large and of a very slender, flattened spindle-shaped type measuring up to about 0.7 mm in length by about 0.05 mm in width (fig. 41 *i, k*).

All the sclerites are fairly smooth, with rather smooth edges, only the ends having a fine-toothed appearence.

No sclerites were noticed in the peristome.

Discussion: There may be no doubt that the specimens described here belong to VERRILL's species, *Lepidogorgia gracilis*. Though this species was somewhat insufficiently described, VERRILL's original description includes all its most conspicuous characters. Thus VERRILL (1884 p. 222) described the axis as "tall, slender, terete, tapering to a flexible tip" and just this axis, which in the larger colonies is rigid and only is flexible towards the tip, seems to be a characteristical feature in this species in comparison with the other species of *Radicipes*. Likewise VERRILL's description of the general appearance of the colony and his statement of the intervals, and the diameter of the zooids and stem corresponds well with the material of the "Ingolf" Expedition.

VERRILL states for the colonies a size of up to 90 cm and for the living colonies an orange or salmon colour.

From the descriptions above of *R. challengeri* and *R. gracilis* it will be evident that these two species are quite distinct, and that JUNGERSEN in 1915 made a lapse when he, though with a query, united them. By the closer examination of the specimens, which JUNGERSEN, if he had lived, would have had to make before he was able to publish the rest of his intended reports on the northern Octocorals, he himself would certainly have discovered and corrected the error.

R. gracilis is easily distinguished from all other, previously described, species of *Radicipes* especially by its rigid, erect stem, as the stem in all other species of *Radicipes* is coiled into a spiral and very flexible. That species, which most resembles *R. gracilis*, is *R. aureus* Kükenthal (1919 p. 544) from the Indian Ocean which likewise has fairly distinctly placed zooids with tentacles of about equal size. In this species the stem sclerites seem, however, typically to be without constricted middle, and the sclerites of the zooid body attain a considerably larger size, measuring up to 1.3 mm, and seem also, after KÜKENTHAL's figures, to be much more irregularly placed than in *R. gracilis*. The species has also, as distinct from *R. gracilis*, the usual spirally coiled stem.

It seems most probable that the *Lepidogorgia verrilli* which J. A. THOMSON in 1927 described from 42°40' N – 62°19'30" W, 1450 m, is actually a *R. gracilis*, both the locality and THOMSON's figures support this supposition. *R. verrilli* (Wright) is moreover a Pacific species.

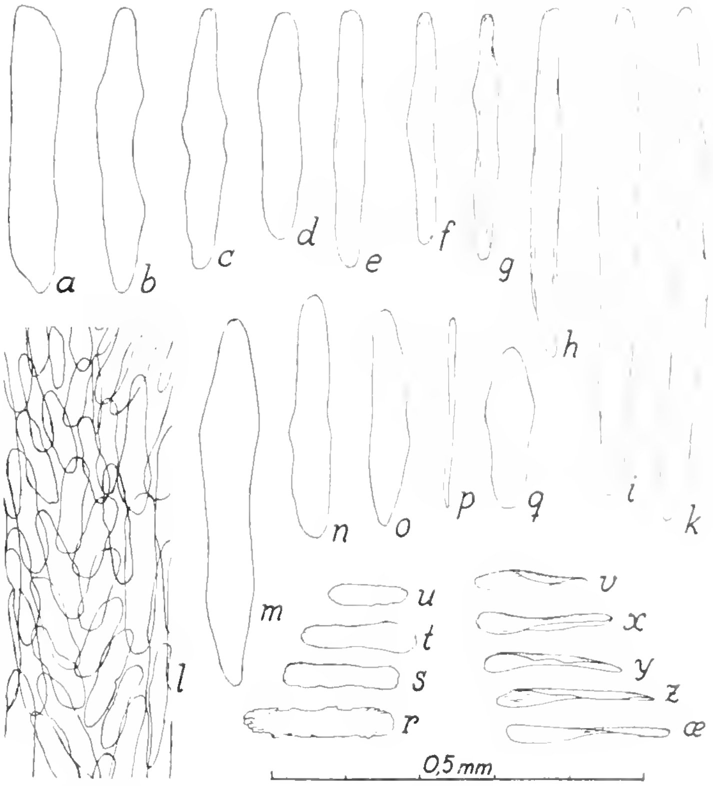


Fig. 41. *Radicipes gracilis* (Verrill). Sclerites of zooid. *a, b, m–q*, interseptal scale-like sclerites from zooid body, *p*, shown from the side. *h–k*, exceptional large and rather spindle-shaped sclerites from upper part of zooid body and tentacle base. *c–g*, sclerites from lower half of tentacle dorsum. *c, d*, scale-like, *e, f*, flattened spindle-like, *g*, spindle-shaped one about round in section. *l*, section of zooid body showing the septal sclerites in natural position. *r–u*, sclerites from outer half of tentacle dorsum. *v–æ*, sclerites from pinnulae.

Distribution: The species is found in the Davis Strait and south of Iceland and has further been recorded from the western part of the Atlantic ocean from off Georges Bank in the north to off Delaware Bay in the south. Chart of distribution, fig. 37.

Bathymetrical Distribution: about 957–3173 m.

Subfamily: **Chrysogorgiinae** Studer 1887, emended Versluys 1902

Genus: **Chrysogorgia** Duchassaing & Michelotti 1866.

Diagnosis: Vide KÜKENTHAL 1919, p. 506.

The genus comprises several species of which, however, only a few belong to the Atlantic fauna. Most of the species are found in the tropical parts of the oceans at moderate depths whereas the two North-Atlantic species are found at fairly great depths.

Chrysogorgia agassizii (Verrill 1883).

Dasygorgia agassizii Verrill, 1883, p. 22–23, pl. 2, figs. 4, 4a, 4b.
1884, p. 220.
1885, p. 511–512, pl. 9, fig. 199.
Roule, 1896, p. 304.
Chrysogorgia agassizii Versluys, 1902, p. 60.
nec. Nutting, 1912, p. 55.
Chrysogorgia agassizii Kükenthal 1919, p. 530, fig. 233.
1924, p. 403.
? pentasticha J. A. Thomson, 1927, p. 22.
agassizii Deichmann, 1936, p. 233–234, pl. 23, figs. 34–40, pl. 24, figs. 1–2.

Material.

64°34' N, 31°12' W, 2448 m, 1.6° C, "Ingolf" St. 11: 12 more or less fragmentary colonies, some axis fragments and 16 basal disks.

62°06' N, 19°00' W, 1960 m, 3.1° C, "Ingolf" St. 64: 9 more or less fragmentary colonies and some axis fragments.

62°58' N, 25°24' W, 1192 m, 4.8° C, "Ingolf" St. 81: 2 axis fragments.

[illegible] St. 41: 2 small fragments.

[illegible] dextrorse. Branches some[illegible] branched with generally [illegible] between successive branches 2–3.5 [illegible] generally 3–4 mm, of outermost [illegible] Zooids on the branches. One zooid [illegible] exception of the most distal ones [illegible] may be found. Zooids somewhat [illegible] contracted state measuring about 2.5 mm [illegible] 0.6–0.75 mm in diameter. Sclerites of [illegible] oblong, scale-like, about S-shaped, [illegible] close layer (maximum size in stem about 0.2 × [illegible] about 0.25 × 0.02 mm). Sclerites of zooid [illegible] arranged in a close layer. Two types of zooid [illegible] the most common being a slender, somewhat [illegible] tuberculated spindle usually with blunt ends and often [illegible] in the middle (maximum size about 0.4 × 0.07 [illegible]). Sclerites of the other, usually much less common type [illegible] fairly smooth, often S-shaped and of a size be[illegible] of the spindles and the scales of the coenenchyma. [illegible] of tentacles connected by a web, thus by contraction [illegible] forming a protecting tube round the outer pinnulae-[illegible]. Sclerites in dorsum of the lower part longitudinally [illegible] spindles slender and round spindles usually with pointed [illegible] size about 0.5 × 0.08 mm). Sclerites of upper, [illegible] broad, flat, somewhat curved and transversally arranged (maximum size about 0.3 × 0.07 mm). In pinnules [illegible] number of rugged, rod-like or flattened sclerites. [illegible] and sometimes also upper part of stomodaeum some [illegible] flattened sclerites (average size 0.15 × 0.02 mm). [illegible]

[illegible] The only fully intact specimen is a colony, [illegible] St. 41. The zigzag bent stem is dextrorsal [illegible] axis and gives rise to a branch at each bend. The [illegible] placed in a spiral turning towards the right [illegible]. Every sixth branch are placed in the same vertical [illegible] between them the spiral turns twice round the stem. The base of the specimen is a white, strongly calcified, some[illegible] irregular and lobated disk which measures about 10 × 5 mm. [illegible] at the base about 1.25 mm in diameter and [illegible] that in the tip of the colony it scarcely measures [illegible]. The coenenchyma on the basal disk and lowest stem is [illegible] higher up in the colony it is remarkably [illegible]. The [illegible] and smooth axis measures in the lower part [illegible] and is here of a bronze-like colour and [illegible]

[illegible] between the base and the lowermost branch is [illegible] the intervals between the successive branches [illegible]. The branches are slightly ascending, forming [illegible] 70° with the longitudinal axis of the colony, [illegible] branched as many as six times, [illegible] only two or three times. The [illegible] in a horizontal plane and the [illegible] between 50–70°. The length of the [illegible] 3–4 mm and measures generally [illegible] usually between 15 mm and [illegible] are about 35 mm. The [illegible]. In the lowermost branches the inner [illegible] in diameter, but the dia[illegible] second order is only 0.3–0.2 mm and [illegible]. Both the branches and the [illegible] and elastic. [illegible] branches, they are obliquely [illegible] towards the apex of the [illegible]. The inner internodes [illegible] be lacking on the internodes of second order and even on those of the third, fourth and fifth order. There are never more than one zooid on each internode except on the outermost where up to five zooids may be found. Usually the zooids are placed at fairly regular intervals of 4 to 5 mm, the intervals may, however, also be somewhat smaller or larger (3–7 mm). The zooids on the inner internodes are usually placed near or on the point of bifurcation. The full-grown zooids measure in contracted state about 2.5–3 mm in length having a diameter of scarcely 1 mm. Most of the zooids from the uppermost part of the colony, including those of the branch tips, are young ones, measuring 0.5–0.3 mm or less. In the rest of the colony young zooids are restricted to the outer internodes inside the full grown tip zooids.

The largest colony in the material is a specimen from St. 11 which, with the base broken off, measures 32 cm and probably has not been very much larger. The diameter of the axis in the lower part of this specimen is about 2 mm. Many axis fragments measuring about 3 mm in diameter are, however, found in the material, and thus, probably, fairly larger colonies of this species may be found. The smallest colony may, probably, when intact have been about 10 cm high.

The calcareous bases of all the colonies are disk-like. They are generally fairly regularly round or oval with the axis of the colony attached in their middle; they may, however, have a rather irregular outline and sometimes, though rarely, they are provided with very short stolon-like processes. These basal disks generally have been attached to stones or other hard substances, and in the present material several are found which have been attached to each other. There is, however, also present a basal disk which has not been attached to a solid subject, but is hollow conical, still enclosing the clod of clay by means of which the colony has been anchored into the mud. The basal disk in question measures at the oval somewhat lobated base of the cone 27 × 17 mm and has a height of about 11 mm. It is the largest calcareous base in the collection and the axis of the colony measures about 3 mm in diameter. The basal disks are else of a solid conical shape, they are generally rather low, but some few occur in which the height of the cone is nearly half the diameter. There is a strong distinction between the axis and the base, and many of the basal disks show in their middle the conical hole where the axis has been attached (fig. 12 c).

The colour of the axis of the stem is bronze-like or light-brown, golden irridescent and always darker in the lower part of the colony than in the upper part where it is light golden, as the entire axis in the younger specimens. The colour of the colonies (in alcohol) is else white.

The interval between the base and the lowest branch is 10–12 mm in the few cases where it has been possible to measure it.

The stem (axis) is in one colony 50 mm above the base divided into two parallel stems of equal size and in the intact colony branches have been found only on these. Surely, the main stem is slightly zigzag bent from about 15 mm above the base to the dividing into two, but no distinct scars after branches are found. It seems as if the colony once has been subject to a damage, which caused the loss of the branches and the whole upper part; after that the colony has developed two new stems from the scar of the broken-off stem, but has not developed new branches on the main stem. On this the scars after the broken-off branches have been less and less distinguishable as the colony has grown and have now quite disappeared.

Traces of regeneration are found also in other colonies. All the branches in one colony are of normal thickness near the stem, but about 4 mm from the stem they suddenly become hairfine. Probably the colony once lost all its branches and is now developing new ones from the scars of the original. In a few colonies there are two stems and in these cases it seems as if the original stem has been broken off and that the colony then, some centimetres below the scar, has developed a new stem issuing at about a right angle from the first stem, but soon bending and becoming parallel to this. It is noteworthy that the new stems are not developed at the issue of a branch, but outside the spiral of branch-building coenenchyma.

One of the larger colonies is bent at right angles on two places, 50 mm apart. The colony has apparently twice in its life been overturned and has reacted on the injuries by in the first case developing a new stem perpendicular to the old one and in the other case by bending the stem at a right angle.

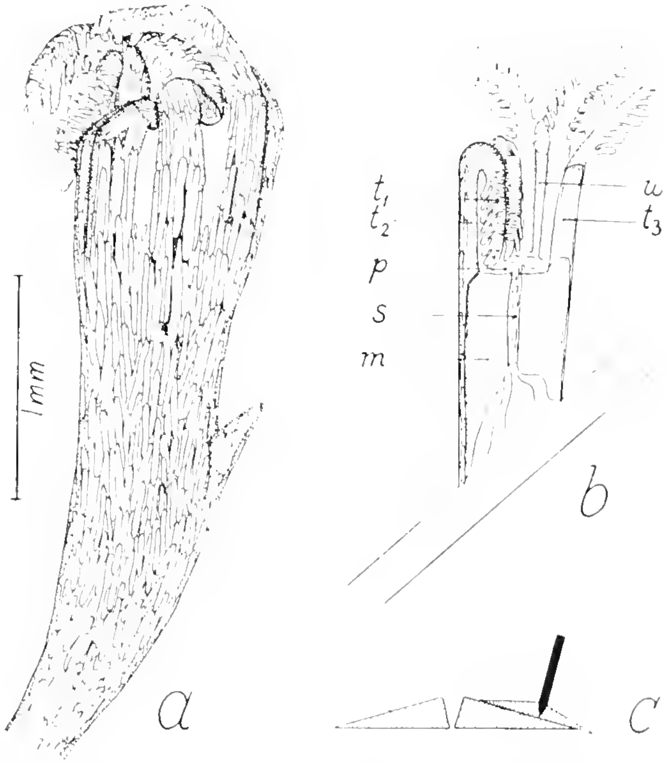


Fig. 42. *Chrysogorgia agassizii* (Verrill). *a*, a tip-zooid. *b*, scheme of zooid. t_1, outer free, pinnulae bearing part of tentacle. t_2, lower half of tentacle. *u*, the web which connects the lower halfs of tentacles. t_3, the hollow tentacle. *p*, the peristome. *s*, the stomodaeum. *m*, mesenteries. *c*, two basal disks in section, showing the conical attachments of the horny axis into the calcareous base.

In one colony an anastomosis was noticed between two different branches.

The intervals between successive stem-branches are generally about 2.5 mm, varying between 2 and 3.5 mm, yet in some colonies a few of the lowermost intervals may be considerably larger, up to 13 mm. The orthostiche intervals (intervals between successive branches of the same vertical plane) vary from 10 to 15 mm and are generally 11–12 mm.

The branching of stem is, as mentioned above, typically $^{2}/_{5}$ turn dextrorse. This regular mode of branching is, however, occasionally somewhat disturbed. The branches are e. g. in sections of a few of the colonies placed in such a manner that about every fourth or third stand in the same vertical plane whereas the branching otherwise is the usual $^{2}/_{5}$ turn dextrorse. In some colonies a few extra branches issue from outside the typical spiral of branch-building coenenchyma generally being much smaller and slender than the normally placed ones. And one colony is distinguished by having two series of branches: the normal ones placed in a spiral $^{2}/_{5}$ turn dextrorse and with orthostiche intervals of about 12 mm, and besides a series of smaller branches which are placed more scattered in an $^{1}/_{5}$ spiral turning towards the left and with ortostiche intervals of about 25 mm.

The branches bifurcate generally only once or twice, some are, however, bifurcating three times, and branches may be found where bifurcating has taken place up to six times. The internodes of first order measure generally 3–9 mm and the largest measure 16 mm. Zooids are found only exceptionally on these internodes, still there were in one case two zooids on the first internode, the one, however, placed at the bifurcation. The other internodes, apart from the outermost, have typically one zooid which, however, may be missing. If exceptionally there are two zooids, then the one is always placed at the point of bifurcation. The outermost internodes may reach a considerable size, the largest being about 75 mm, and are usually provided with several zooids. The largest number noticed was 19 zooids on a 73 mm long internode. The largest branches are about 80 mm and are found in colonies which probably may have measured 25–30 cm in height; often these branches bifurcate but once with the inner internode measuring about 5 mm and the outer about 75 mm. The angle of bifurcation is generally about 60–70° and may narrow down to about 50°.

The zooids measure in contracted state (verrucae) about 2.5 (2–3) mm in height having a width of 0.5–0.75 mm. Those of the uppermost part of the colonies are often all young ones but such are else only found on the outermost internodes inside the full-grown tip zooids.

It is noteworthy that the zooid in this species has about the lower, strongly spiculated half of its tentacles connected by a web, so that above the peristome a tube is formed which by contraction of the zooid protects the upper free pinnulae-bearing parts of the tentacles (fig. 42).

The species may probably live in dense growths on the sea bottom, and one of the colonies shows very distictly that it has been placed in the outer part of such a growth. The stem is bent, showing that the specimen during its growth has been pushed away by growing neighbour colonies, and the branches on that side of the specimen which has turned towards the growth are less than 30 mm in length and generally do not bifurcate, whereas those of the outer side of the colony measure up to 55 mm and bifurcate two or three times.

The sclerites in the coenenchyma of the base, stem and branches are thin and scale-like and of an oblong shape with rounded ends and usually a narrowed middle part. In the outer parts of the base they are placed fairly scattered (fig. 43), near the stem, however, in a rather close layer and here arranged with their longitudinal axis pointing towards the stem. The sclerites in stem and branches are longitudinally arranged in a rather close layer about one sclerite thick (fig. 44 *a*, *b*). The sclerite layer is, however, neither in stem nor in the branches continuous, but interrupted by scattered sclerite free spaces.

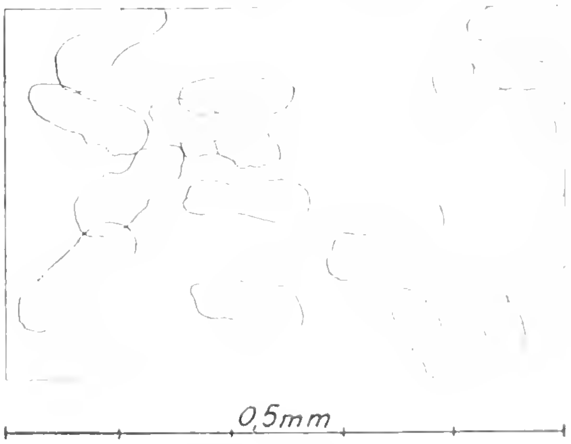
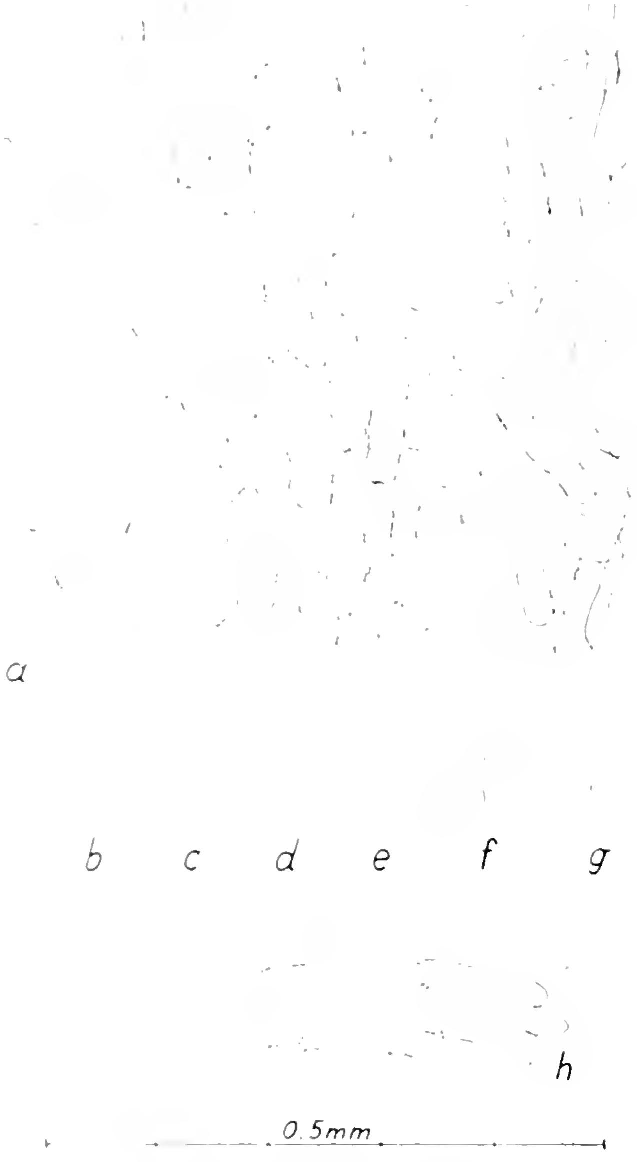


Fig. 43. *Chrysogorgia agassizii* (Verrill). Sclerites in natural position from outer part of basal disk.

The largest scales are found in the base and the lower part of the stem and measure about 0.2 mm in length by about 0.06 mm in width at the ends and 0.4–0.5 mm at the narrowed middle [illegible] length some- [illegible] rites of this [illegible] In the [illegible] the largest mea- [illegible] narrow, measuring



[illegible] section of coenenchyma of [illegible] colony about 16 cm high [illegible] colony about 35 cm high [illegible] natural position.

[illegible] are at the base more or [illegible] to the longitudinal axis of [illegible] The lower part of [illegible] very close layer. The [illegible] different type. The most [illegible] type is spinous, slender, [illegible] with rounded ends and [illegible] 15 [illegible] The maximum [illegible] type of sclerites from [illegible] form (fig. 15 *a, c*). [illegible] branches and stem [illegible] reaching the size of [illegible] seen in the lower [illegible] nearly up to [illegible] scale-like scle-rites occur in a very varying number and whereas in some zooid bodies about half the sclerites are of the scale-like type, this type seems in other zooids to be almost absent. Intermediate stages between the two types of zooid body sclerites may be found.

The lower parts of the tentacles, i. e. the parts connected with each others by a web, are strongly armed with a row, up to 6–8 sclerites broad, of spinous spindles, resembling those from the zooid body, but usually being round and having pointed ends. One of the typical form is figured in fig. 15 *c*, but some may be found which are thicker and of a more irregular shape and often with blunt ends. Their maximum size is about 0.5 × 0.08 mm. The sclerites decrease in size towards the free pinnulae-bearing part of the tentacle (about 0.2 mm), but are still round spindles (fig. 15 *f, g*). In the lowermost free part of the tentacle the sclerites are of about the same type (fig. 15 *h*) and also longitudinally directed, but else the tentacle dorsum is covered with a close layer of transversally arranged, flat and somewhat curved sclerites with a rugged surface (fig. 17 *e–g*) the largest measuring about 0.3 × 0.07 mm, but most being much smaller.

The pinnulae generally number 6–12 pairs. They may sometimes be devoid of sclerites but are generally provided with a bundle of a few sclerites which usually are less than 0.25 mm in length and of a very varying shape. They have a rugged surface and are sometimes nearly rod-like, sometimes with flattened, often extended ends, and sometimes flat, resembling those of the tentacle dorsum (fig. 17 *d–h*).

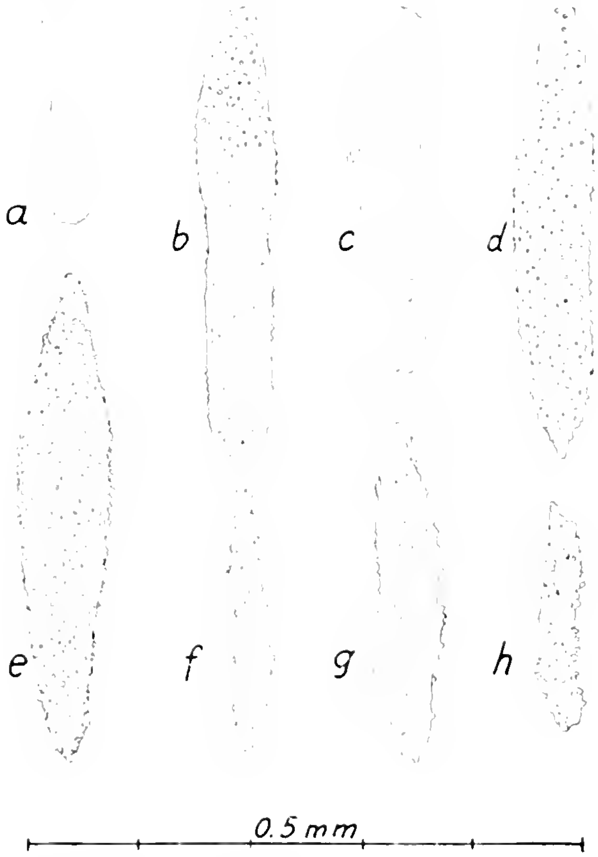


Fig. 17. [illegible] (Verrill). *a–d*, sclerites of zooid body. *e–g*, sclerites from tentacle dorsum of the lower half of tentacle. *h*, sclerite from the lower part of pinnulae-bearing part of tentacle.

The peristome is provided with small, somewhat flattened sclerites measuring about 0.15 × 0.02 mm (fig. 17 *a–h*). Generally there are only a few sclerites, placed very scattered, but sometimes a rather close layer of these sclerites may be found. In some zooids a few sclerites of the same type occur also in the upper part of the stomodaeum, mainly along the attachments of the mesenteries.

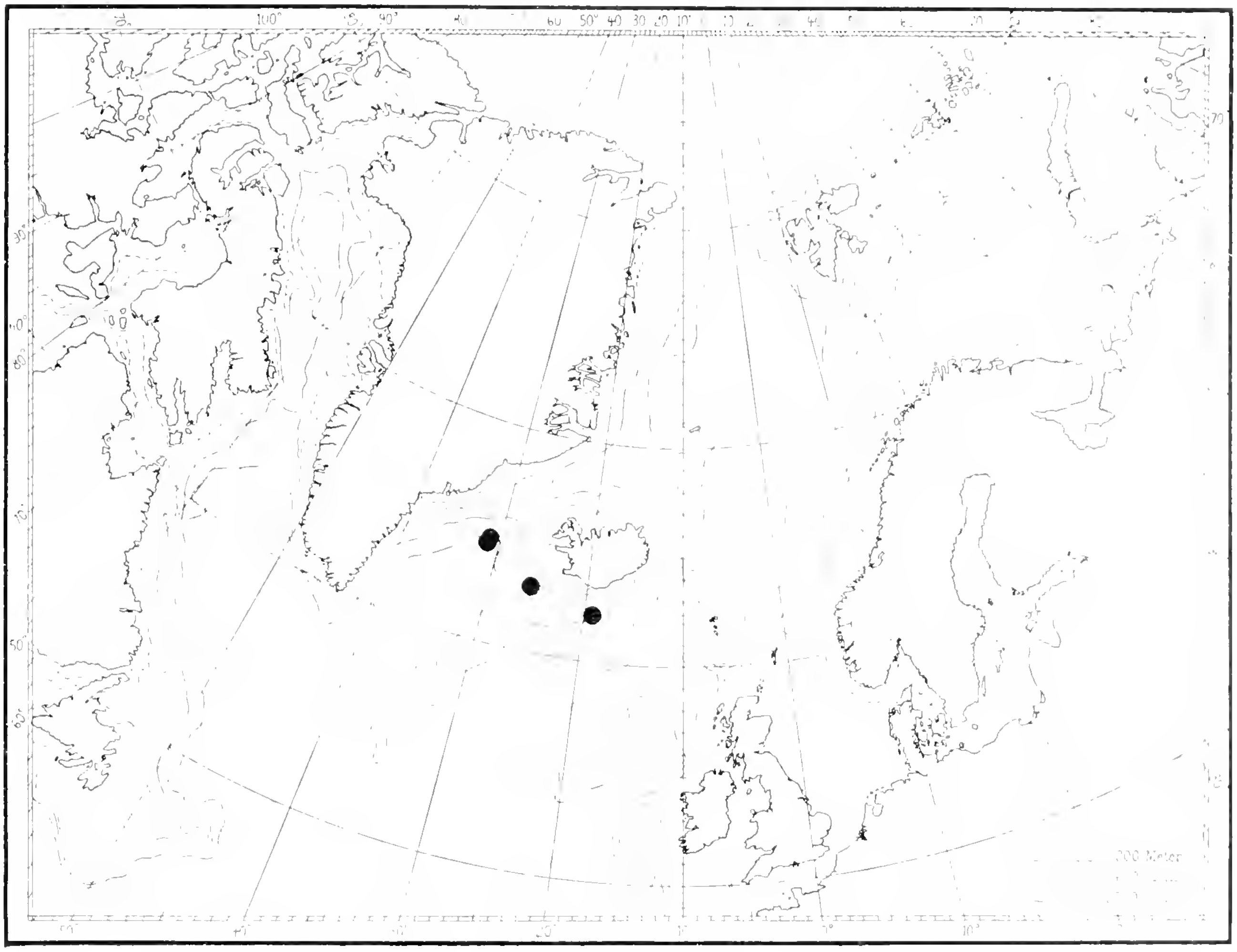


Fig. 46. *Chrysogorgia agassizii* (Verrill).

Discussion: The species, to which this collection of the "Ingolf" Expedition is referred, was described by Verrill in 1883 on two specimens from 41° 21′ 45″ N. 65° 35′ 30″ W. in 2171 m, and apart from one point the material of the "Ingolf" agrees well with Verrill's description and figures both of the general appearance of the colony and of the sclerites. Verrill thus mentions both the two types of sclerites from the zooid body. He states, however, that the scale-like type is the most common whereas the opposite proved to be the case in the "Ingolf" collection; but this is a point to which no importance may be attached as Deichmann in 1936 (p. 231) not at all mentions this scale-like type from the zooids though she re-examined Verrill's specimen. In the specimens taken by the "Ingolf" the scale-like sclerites also occurred in a very varying number. The measures, which Verrill states for the sclerites, agree also well with those of the "Ingolf" collection. It is true that the greatest length, which he mentions for the scale-like type from the zooid body, is only 0.18 mm; on pl. 2 fig. 1 *b, c* a sclerite is, however, figured which after the magnification scale may have been 0.3 mm in length.

When Verrill (p. 22) states "The tentacles are not entirely retractile" this may allude to the fact that their lower halves are coalesced.

Deichmann (p. 231) states that the zooids are "with few spicules", an information which does not agree with the conditions in the "Ingolf" specimens, and, also seems to be in contrast with Verrill's figure pl. 2 fig. 1 *a*.

The specimen, upon which Verrill's description was mainly based, lacks the base, but Verrill (1883 p. 22) describes the base in the other specimen from the same locality as divided "into several long, divergent, irregular, palmate, flattened processes" and he writes (1885 p. 511) about some other specimens from the same area in about 2162–2191 m, that "its root-like base is divided into short, flat, irregular branches." Also the two photos of *C. agassizii* reproduced by Deichmann (1936 pl. 31) show beautiful stoloniferous bases.

In regard to the shape of the bases there is thus a distinct difference between the specimens from off Georges Bank in the West Atlantic and those with basal disks from the North Atlantic south and west of Iceland. How much importance should be attached to this difference is, however, difficult to ascertain. In

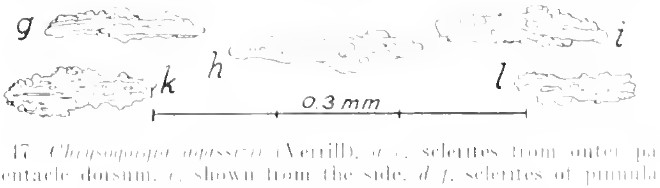


Fig. 17. *Chrysogorgia agassizii* (Verrill). *a–c*, sclerites from outer part of tentacle dorsum, *c*, shown from the side. *d–f*, sclerites of pinnulae. *g–l*, sclerites from peristome and stomodaeum.

[illegible] found with the base [illegible] been anchored into the [illegible] found with a tendency to [illegible] soft bottom the same colonies [illegible] stoloniferous base.

[illegible] however, that "The base is [illegible] connected by a horny joint [illegible] apparently originates from VER- [illegible] and if it proves to correspond [illegible] off Georges Bank, then the differences [illegible] the West Atlantic and those from the [illegible] greater than stated above and probably [illegible] specific distinction as in the latter speci- [illegible] the contrary, is sunk into the calcareous base. [illegible] (1919 p. 530) already doubted the identity of [illegible] the Pacific which NUTTING (1912 p. 55) refers [illegible] KÜKENTHAL points out that the coenenchyma in [illegible] is thick, with few sclerites, whereas in [illegible] thin and with numerous sclerites, and to this [illegible] added that NUTTING describes the sclerites as [illegible] whereas in the coenenchyma of *C. agassizii* [illegible] smooth, and that the spiculation of the tentacles [illegible] In NUTTING's specimen "Double rows of thin, [illegible] spicules extend along the basal parts of the dorsal [illegible] of the tentacles" whereas there are spinous spindles in [illegible] parts of the tentacles of *C. agassizii*.

[illegible] which J. A. THOMSON (1927 p. 22) reports [illegible] off the Azores in 1425–1968 m is, as DEICHMANN (1936 p. 222) supposes, most probably identical with *C. agassizii* [illegible] J. A. THOMSON's *C.* [illegible] from off Cape Verde in 1377 [illegible] Azores in 3018 m, and his *C. orientalis* from [illegible] Cape Verde in 1311 m may prove to belong to the same species.

[illegible] belongs to the group Spiculosae Wright & Studer and since it has both scales and spindles in the zooid [illegible] nearly related to the species of the *squarrosa*-group (cfr. KÜKENTHAL 1919 p. 510) from which it, however, [illegible] distinguished by its regular $^{2}/_{5}$ turn dextrorse branching of the stem and in generally having the branches [illegible] only two or three times. The sclerites of the zooid in [illegible] are moreover of a quite different type and are also [illegible] smaller than those of *C. orientalis* and *C.* [illegible]. From the [illegible] species, which have the same $^{2}/_{5}$ turn dextrorse branching [illegible] *C. agassizii* is easily distinguished partly by its [illegible] partly by its few internodes, which apart from [illegible] only bear one zooid each.

[illegible] The species is previously known from off Georges Bank in 2271–2491 m and from the Bay of Biscay in [illegible] (recorded by ROULE in 1896). The "Ingolf" localities [illegible] what south and west of Iceland in 1192–2118 m. [illegible] above the species is probably also found off the [illegible] Cape Verde (1311–3018 m). Chart of distribution, fig. 46. [illegible] 570–2491 (3018) m.

Chrysogorgia campanula n. sp.

[illegible] 2 W., 2118 m, [illegible] "Ingolf" St. 11. 1 colony.

[illegible] turn sinistrorse. Branches [illegible] pseudo-dichotomously branched with [illegible] between successive branches usually [illegible] internode 2.5–9 mm. Zooids standing [illegible] to the branches though also [illegible] zooid on each internode, with the [illegible] two zooids may occur. Size [illegible] 2.5–3.2 mm in height by [illegible] like oblong with a narrowed [illegible] covering stem, branches, [illegible] Scales of stem measuring up to about 3.5 × 2 mm. Scales of branches somewhat narrower, measuring up to about 3.5 × 1 mm. Scales of zooid body typically measuring about 3.5 mm in length having a width of 0.1 mm at the narrowed middle. Scales of tentacle dorsum typically about H-shaped, curved, transversely arranged and reaching a length of about 3.5 mm. No cnidal papillae.

Type. In the Zoological Museum of Copenhagen.

Description. The single colony is somewhat damaged, it is without base and tip and measures in this condition about 85 mm in height, and it may be supposed that the entire colony has not been very much larger as 1) the interval between the scar of the broken off base and the lowermost scar of a branch measures about 4 mm, whereas the successive intervals between the nearest eight branches do not exceed 2 mm, and as 2) the diameter of the uppermost left part of the stem is only slightly thicker than the diameter of the proximal internodes of the upper branches.

The stem is slightly bent in zigzag fashion and gives rise to a branch at each bend. The branches are slightly ascending, forming an angle on about 60–70° with the longitudinal axis of the colony, and placed along the stem in a shrew-line which turns towards the left from the bottom upwards, every sixth branch being placed nearly exactly in the same vertical plane and the shrew-line turning twice round the stem between them. This regular mode of branching is, however, interrupted in one place in the lower part of the colony, where diametrically opposite a branch an extra very small one with only one zooid issues. The colony has altogether 26 branches, many of which, however, are broken off. The intervals between successive branches vary from 1.8–4.5 mm but are usually 3–3.5 mm. The shortest intervals are found in the lower part of the colony.

The branches themselves may be pseudo-dichotomously divided as many as six times, still they (the preserved ones) are usually furcated only two or three times and this applies especially to the lowermost. The most furcated branch is the eighth reckoned from the broken tip of the colony. Usually the branching takes place in such a manner that the first furcation and thus the intervals of second order lie in a nearly horizontal plane, whereas the third furcation and thus the intervals of fourth order lie in a nearly vertical plane. The angle of bifurcation is generally about 90° (varying from 80–100°) and also the angle between the branches and the stem is usually about 90°.

The size of the internodes may vary somewhat, e. g. the size of the internodes of first order (the inner) varies from about 3.5 to 8 mm and is usually about 5 mm. The size of the internodes of second order varies between 2.5 and 9 mm, and most frequently they are of about the same size as the corresponding inner internode. The outermost internode may be as long as 9 mm but is general much shorter. The shortest intervals are found in the lowermost preserved branch which is the sixth reckoned from the base. Though the pseudo-dichotomous branching is often symmetrical, this is not always the case. In one branch, e. g. the internodes of second order are 2.5 and 8.5 mm respectively, and whereas the one part of the branch bifurcates six times the other bifurcates only three times.

The zooids stand at right angles to the branches and are placed in a number of one on each internode. Only on the outermost internode there may be another, sometimes young, zooid besides the tip-zooid, whereas the inner internode may be quite without zooids, or, if there is one, this is usually placed at the point of bifurcation. Apart from the tip zooids, which are placed lateral to the ends of the branches so that the branch tips projects beyond them, the zooids are very clearly distinguished from the branches. Generally speaking, the zooids are placed on the branches in such a manner that their mouths point upwards, but some are found directed downwards. Most of them are rather contracted and have their tentacles curved in over their mouth, and in this condition the largest measure about 3.2 mm in height; the most common size is, however, 2.5–2.7 mm and some are also found which measure only 2 mm. The tip zooids are generally the largest (highest and broadest) having a diameter of 1.5–1.7 mm

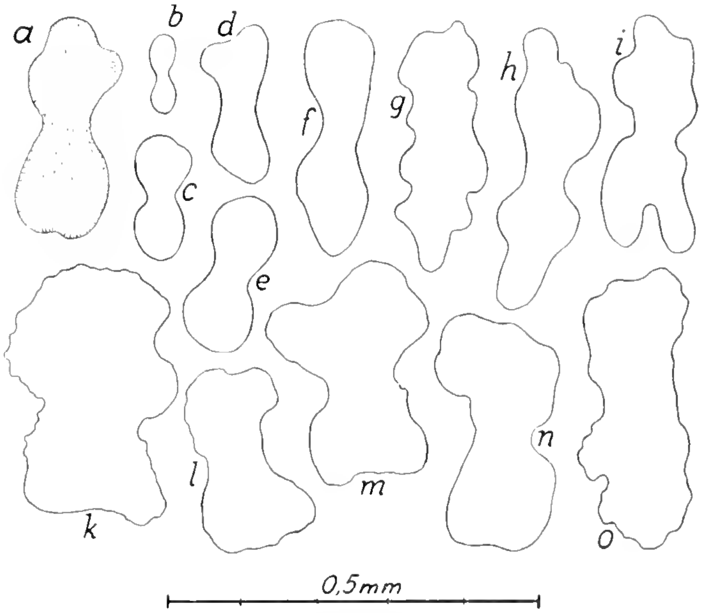


Fig. 48. *Chrysogorgia campanula* n. sp. *a–i*, sclerites of branches. *a–f*, of the typical shape. *a*, with the finely toothed surface indicated. *g–i*, of the largest size. *k–o*, sclerites from lower part of stem.

(fig. 50 *b*). The other zooids are usually somewhat more slender, having a diameter of about 1 mm, most of them being contracted about the middle and thus becoming bell-shaped (fig. 50 *a*).

On most of the stem the coenenchyma is rubbed off. In the upper third of the colony, however, where it is partly preserved, there is a single zooid placed on the stem itself opposite a branch.

The basal part of the stem is about 1 mm in diameter. The coenenchyma is fairly thin and the round axis measures here about 0.7 mm in diameter. The diameter of the stem in the top of the colony is about 0.45 mm, and the diameter of the internodes of first order may be about 0.6 mm; it is, however, usually only 0.5–0.4 mm and sometimes even less. The outer internodes are much thinner, only about 0.2 mm in diameter. The axis of the branches is tapering, being hairfine at the point. In some of the preparations it was observed that the medulla runs quite excentrically in the axis where a new branch issues.

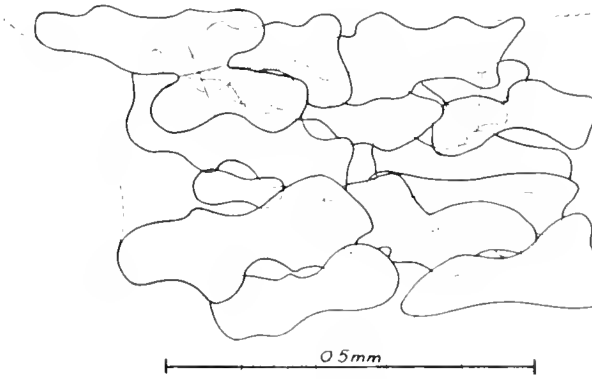


Fig. 49. *Chrysogorgia campanula* n. sp. Sclerites from a branch in natural position.

No cnidal papillae were noticed.

The colour of the specimen in alcohol is white, and the colour of the axis is light yellow-brown and light blue green iridescent.

The sclerites are all thin and scale-like and provided with numerous small spines which, especially at the ends, give the edges a finely denticulate appearence (as indicated on fig. 48 *a*), and they are all of about the same type, derived from an oblong form, with rounded ends and constricted middle, as shown in fig. 48 *b*, *c*.

In the coenenchyma of the stem and branches the scales form a close overlapping layer which in the lower part of the stem may be three sclerites thick, but in the branches is mainly only one sclerite thick. The scales from the stem may reach a length of 0.4 mm and a width of 0.25 mm; besides these, however, also scales of the same type as those from the branches are found which, though they may reach the same length as the largest from the stem, are always much narrower. These sclerites of branches are typically beautifully 8-shaped (fig. 48 *a–f*) and measure generally about 0.35 mm in length by 0.08–0.1 mm in width at the extended oval ends, and about 0.5 mm in width at the narrowed middle. The broadest of the sclerites have with a length of about 0.4 mm, a width of about 0.13 mm at the ends, and somewhat less at the middle. Several of the scales are, however, rather irregular, with forked ends or with more narrowed parts, but even in the most diverging sclerites the 8-shaped type is always discernible. Scales of fairly small size may be found sporadically between the others, and both in stem and branches twin and quadruplets-formations are common. The scales are all placed in the longitudinal direction of the stem or the branches (fig. 49).

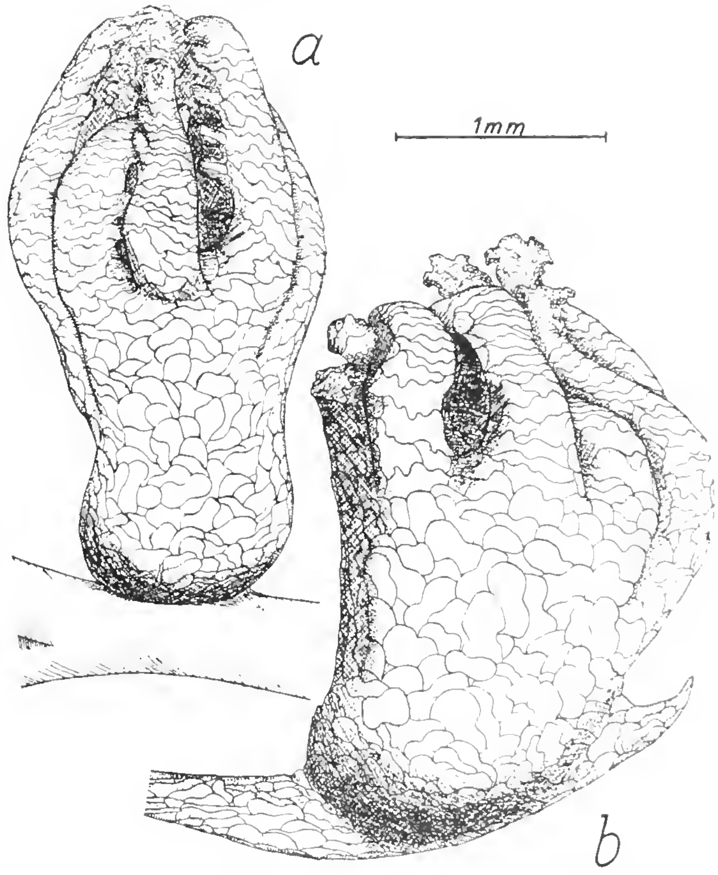
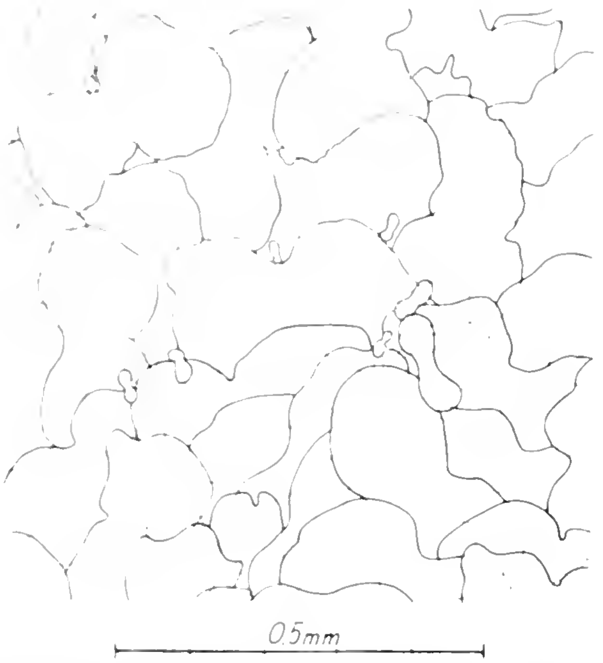


Fig. 50. *Chrysogorgia campanula* n. sp. Two zooids, *b* a tip-zooid. Some zooids are, though of the same height, somewhat slimmer than that figured fig. *a*.

The scales of the zooid body overlap each other mainly in a direction from the bottom upwards. They are at the base of the zooid placed transversally (i. e. lengthwise to the stem), become in the upper portion of the base more obliquely directed, and are in the main zooid body arranged quite irregularly (fig. 50 and 51). The zooid scales are beautifully 8-shaped and fairly broad with nearly circular ends. They measure generally about 0.33 mm in length by about 0.16 mm in width at the ends and [illegible] being about [illegible] are very small [illegible] scattered or



[illegible] Scales of zooid body in natural [illegible] possibly represent developmental [illegible] not found in the zooid body.

[illegible] fully developed ones (fig. 51). It is [illegible] of the eight other full grown [illegible] young one (about 0.8 mm in length) [illegible]. In the young zooid it was, however, [illegible] from the zooid body were some[illegible] from the full grown zooids, only mea[illegible] length.

[illegible] the sclerites are transversely arranged, [illegible]. The scales in the above mentioned young [illegible] about the middle, else however [illegible] shape. Those of the full grown zooids are [illegible] typically broad V-shaped with [illegible] reaching down on the sides [illegible] 52 [illegible] of the sclerites of the tentacle dorsum reach, however, only down on the one side of the tentacle and have correspondingly only the one end extended and forked. The tentacles are thus laterodorsal covered with the ends of the dorsal sclerites, but besides sclerites may be found arranged lengthwise to the tentacle. The lateroventral part of the tentacle is bare or has small transversely arranged sclerites.

The tentacles have six to ten pairs of pinnulae which are provided with sclerites of a very varying size. These sclerites have typically a forked end which reaches into the tentacle among the lateral sclerites, and a rather long, "gutter"-formed part which reaches into the pinnule with the open part of the "gutter" pointing downwards (fig. 52 *b*). They may reach a length of about 0.15 mm but are usually much smaller. In each pinnule there may be a few sclerites; generally, however, only one of these is of a larger size, and very often all the pinnulae sclerites are rather small. Many of them, especially the smaller ones, are not "gutter" shaped.

The peristome is devoid of sclerites.

Discussion. The species belongs to the group *Squamosae typicae* Versluys and seems to be most nearly related to *C. acanthella* (Wright & Studer) from which it may, however, be distinguished by its larger zooids, the absence of cnidal papillae, and its much closer layer of scales in the coenenchyma.

Distribution. Only known from one locality, in the Danmark Strait south of the Wyville Thomson Ridge. Depth 2418 m. Chart of distribution, fig. 37.

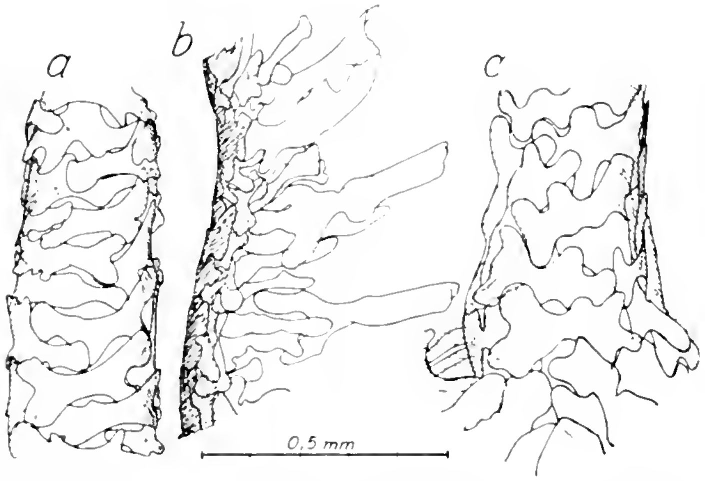


Fig. 52. *Chrysogorgia squamata* n. sp. Sclerites in natural position in tentacles. *a*, tentacle dorsum, *b*, part of tentacle from the side showing the sclerites in the pinnulae, *c*, tentacle base.

Family **Isididae** Studer 1878

Diagnosis. Vide Kükenthal 1919, p. 556.

[illegible] **Acanella** Gray 1870.

[illegible] 1919, p. 573.

Acanella arbuscula (Johnson) 1862

[illegible] 216 [illegible] 31 fig. 1, 1a.
[illegible] 1878 [illegible]
[illegible] 1883 [illegible] 1916 [illegible] 2, 2a, 2b.
[illegible] 1484, 1486.
[illegible] 1917 [illegible] 21.
[illegible] 578, 580 [illegible] 44, fig. 75.
[illegible]
[illegible] 215, 216.
[illegible] 1917 (Kükenthal).

Description. Vide Verrill 1883 and Kükenthal 1919.

Material.
Off Marthas Vineyard, 375–1130 m. U. S. F. Comm.
66 19 N 56 28 W 410 m. Wandel.
64 21 N 28 50 W 1484 m. 3.5 C "Ingolf" St. 10.
63 06 N 56 00 W 2258 m. 2.4 C 21.
63 30 N 54 25 W 1096 m. 3.3 C 25.
65 14 N 55 42 W 791 m. 3.5 C 28.
62 00 N 22 38 W 1629 m. 2.9 C 39.
62 00 N 21 36 W 1591 m. 3.3 C 40.
63 33 N 15 02 W 595 m. 5.9 C 55.
62 40 N. 19 05 W 1506 m. 4.0 C 63.
62 06 N 19 00 W 1960 m. 3.1 C 64.
61 30 N 22 30 W 1836 m. 3.0 C 67.
62 06 N 22 30 W 1587 m. 3.4 C 68.

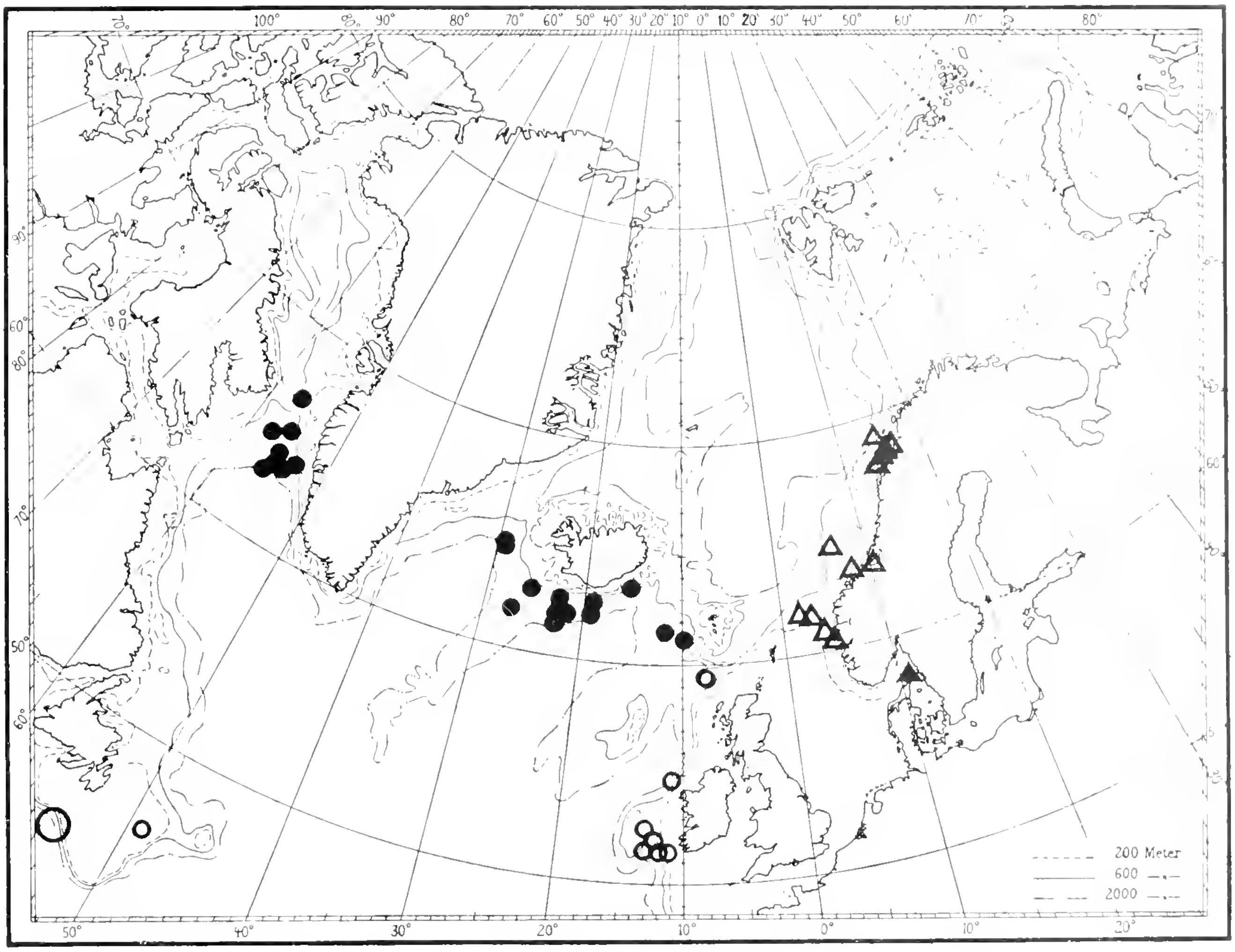


Fig. 53. ● *Acanella arbuscula* (Johnson).
▲ *Isidella lofotensis* M. Sars.

62°40′ N. 22°17′ W. 1109 m, 3°9 C. "Ingolf" St. 69.
61°14′ N. 27°00′ W. 913 m, 6°1 C. - 84.
62°58′ N. 25°24′ W. 1192 m, 1°8 C. - 81.
61°45′ N. 29°06′ W. 1070 m, 4°4 C. - 90.
61°08′ N. 9°16′ W. 847 m, "Michael Sars" St. 79.
64°05′ N. 55°20′ W. 1100 m, "Tjalfe" St. 337.
64°10′ N. 56°37′ W. 750 m, - 402.
63°54′ N. 53°15′ W. 988 m, - 428.
63°51′ N. 53°15′ W. 988–1100 m, "Tjalfe" St. 429.
63°36′ N. 55°15′ W. 1200 m, 3°28 C. (1150 m) "Godthaab" St. 179.

Apart from the Nephthyidae *Acanella arbuscula* is by far the most common of the North-Atlantic Octocorals. At the stations where it was secured by the "Ingolf" it usually occurred in fairly great quantities.

JUNGERSEN (1915 p. 1186), besides the above-mentioned material, also mentions specimens taken by the Danish research vessel "Thor" south-west and south of Iceland, and south-west of Ireland at a depth of 2100 m. This material is, however, not preserved.

Distribution: The species is very common in the North-Atlantic Ocean north of 0° latitude and south of the submarine ridges which connect Scotland, Iceland, Greenland and Baffin Land. Undoubtedly the species will prove to occur in the deeper part of the whole Atlantic Ocean. Chart of distribution, fig. 53.

Vide further JUNGERSEN 1915 and 1917.

Bathymetrical distribution: about 375–3173 m.

Genus: **Isidella** Gray 1870.

Diagnosis: Vide KÜKENTHAL 1919, p. 561.

Isidella lofotensis M. Sars 1868.

Isis hippuris (pars) Gunnerus, 1768, p. 70–71, fig. 8.
Isidella lofotensis M. Sars, 1868, p. 22–23.
Mopsea borealis M. Sars, 1869, p. 250.
Mopsea borealis G. O. Sars, 1872, p. 50–57, pl. 5 figs. 1–23.
Isidella hippuris Grieg, 1891, p. 3–11, figs. 1–22.
Acanella hippuris Broch, 1912 c, p. 39–45, figs. 26–29.
Isidella hippuris Jungersen, 1917, p. 21–25.
   lofotensis Kükenthal, 1924, p. 415–416.
      Pax, 1936, p. 259.
      Carlgren, MS.

For further references vide JUNGERSEN 1917 and KÜKENTHAL 1924.

Description: Vide BROCH 1912 c.

Material:

Lofoten, 560 m, Cotype to *Mopsea borealis* M. Sars, 1 colony.
58°06′ N, 9°00′ E, 660–420 m, "Thor" St. 1571, 1 colony.

Distribution: The species is at present only known from off the Scandinavian coast from Lofoten in the north to the Skagerrak in the south (the above mentioned localities represent the northernmost and the southernmost finds). The westernmost find hitherto made is in 61°52′30″ N. 4°12′06″ E. Chart of distribution, fig. 53.

Bathymetrical distribution. About 200–700 m.

Zoogeographical and Ecological Remarks.

[illegible] ecology of these animals [illegible] the study of the collection [illegible] the following remarks may [illegible]

[illegible] Octocorals is not known with cer- [illegible] stated after experiments in aquaria, [illegible] was entirely carnivorous, and [illegible] specimens of the Pennatulid *Virgu-* [illegible] the Sound between Denmark and Sweden) [illegible] specimens of *Radicipes gracilis* [illegible] St. 40 (1591 m) the author found larvae [illegible] gastral cavities of several zooids, but else [illegible] examined no other traces of food [illegible] many zooids are found stuffed [illegible] Foraminiferans especially Globi- [illegible] material is found not only in the [illegible] the stomodaeum and in the space [illegible] without doubt be supposed that it [illegible] in question was caught by [illegible] material and on this disturbance [illegible] retraction of its zooids. We may guess [illegible] Octocorals mainly feed upon living prey and [illegible] the fact that the single zooids only [illegible] access to food, are the reasons [illegible] are found in the zooids, but we [illegible] about the question.

[illegible] possible that detritus falling down from above [illegible] important part of the food, and though [illegible] Foraminiferans may not be supposed to [illegible] such might no doubt be a valuable [illegible] great depths where living prey may [illegible] Wright & Studer (1889 p. XIII) also pointed [illegible] deep-sea species of Octo- [illegible] the zooids have an equal [illegible] falls from above". It may, [illegible] *Chrysogorgia agassizii* so many zooids [illegible] that their mouth is directed [illegible]

[illegible] the reproduction of the [illegible] treated in this paper [illegible] *Capnella glomerata* [illegible] have [illegible] in the [illegible] specimens refer- [illegible] with larvae in [illegible]

[illegible] it has [illegible] *Anthomastus* [illegible] objects and [illegible] irregular [illegible] like [illegible] expansion [illegible] anchors the [illegible]

Among the Gorgonacea there are both species which are attached to solid subjects 1) by an expansion of the base of the stem, e. g. *Anthothela grandiflora*, 2) by a basal disk formed by extension of the horny axis, e. g. *Acanthogorgia armata* and 3) by a calcareous basal disk, e. g. *Primnoella jungerseni*, and species which are anchored into the mud by a calcareous root-like base as e. g. *Acanella arbuscula*. It is noteworthy that also one of the Gorgonaceans provided with a calcareous base, viz. *Chrysogorgia agassizii*, is rather independent on the condition of the bottom in a similar way as the Nephthyidae. Its base may be developed either as a calcareous disk attached to a solid object or as a hollow calcareous formation which comprises a lump of clay and in this manner anchors the colony into the bottom, and moreover the West Atlantic form of *Chrysogorgia agassizii* is found with a root like calcareous base such as in *Acanella arbuscula*.

A few concluding remarks may be made about the zoogeographical position of the deep-sea species dealt with in this paper. Undoubtedly, these species are extremely stenotherme and therefore quite unable to live in lesser depths where the temperature is subject to any significant variations during the year. However, the Nephthyidae form an exception from the general rule as these forms occasionally, although only in arctic areas, are met with in rather shallow water.

As mentioned in the introduction several species of Octocorals not dealt with in this paper have been found in deep waters off the coast of Ireland. Apart from *Acanella arbuscula* and *Anthothela grandiflora* (if identical with *Gymnosarca bathybius* Kent) none of the species found in this area have been taken by the "Ingolf" or other research vessels investigating the North Atlantic Ocean south of the Faroes and Iceland, and the whole distribution supports the supposition that most of the forms found off the coast of Ireland require temperatures not below about 8° C. Thus their distribution in the eastern part of the Atlantic Ocean is, generally speaking, limited in the north at the course of the 8° isotherm in 1000 m depth.

Several of the species dealt with in this paper have only been found in the North Atlantic Ocean south of the ridges in the Davis Strait, the Danmark Strait and between Iceland and the Faroes, viz. *Clavularia grandis*, *Cl. borealensis*, *Cl. venustella*, *Cyathopodium ingolfi*, *Telestula septentrionalis*, *Acanthogorgia armata*, *Primnoella jungerseni*, *Chrysogorgia agassizii*, *C. campanula*, *Radicipes challengeri*, *R. gracilis*, and *Acanella arbuscula*. These species have mainly been met with at depths greater than about 1000 m. *Acanthogorgia armata* and *Acanella arbuscula* have, however, also been taken in depths of only a few hundred metres and the first-mentioned species possibly even in only 20 m depth. Several of the species mentioned here have a rather wide distribution in the North Atlantic Ocean and probably several of them may prove to occur in the whole abyssal Atlantic, at any rate down to about 3000 m. They have mainly lived at temperatures about 3° C. and though most of them have also been found at somewhat lower temperatures, none have been found at temperatures below zero. The temperatures at which they have been taken vary from 1.5–6.1° C.

South of and on the submarine ridges in the North-Atlantic Ocean several species are also found which besides are distributed in the warm area of the Norwegian Sea, i. e. along the Norwegian coast between the Skagerrak in the south and Lofoten in the north. These species are *Anthelia borealis*, *Anthomastus grandiflorus*, *Anthothela grandiflora*, *Paramuricea placomus*, and *Trachymuricea kükenthali*, and in this group probably also the following boreal Atlantic species should be ranged, viz. *Stenogorgia borealis* which, however, has not hitherto been found east of the Faroes, and *Stenogorgia rosea* and *Isidella lofotensis* which, however, have not hitherto been found far away from the Scandinavian coast and always at moderate depths (down to about 100 m and 700 m respectively), and probably also *Anthelia fallax* which, however, is only known from the Trondheim Fjord. The temperatures which are required by this group of species seem on an average to be slightly higher than those required by the preceding group, i. e. between about 3° and 8° C. The Danish expeditions in the North Atlantic have taken them at temperatures between 2.4° C. and 7.2° C.

Also *Clavularia arctica* belongs to the abyssal Atlantic + boreal Atlantic species. This species is, however, also found north of Lofoten in the Barents Sea, here, however, only at depths less than 120 m (55–120 m), whereby the cold water of the Norwegian Sea has been avoided. South of Lofoten the bathymetrical distribution of the species is between 180 and 300 m.

Two species, viz. *Paragorgia arborea* and *Primnoa resedaeformis*, are found besides in the boreal Atlantic also in the boreal Pacific but only at moderate depths (down to about 850 m). The temperatures required by these species seem mostly to vary between 5° and 8° C.

The only one of the Octocorals of the groups dealt with in this paper which for the present may be said to be true arctic is *Ceratocaulon wandeli* which is known from some localities on the northern side of the Wyville Thomson Ridge mainly at temperatures a little below zero (−0.75° C.), though in one locality at −0.44° C.

Also the three Nephthyidae and *Clavularia alba* have been found at temperatures below zero, and at present *Capnella glomerata*, *Gersemia rubiformis* and *Cl. alba* are the only ones which have been taken in the main part of the Norwegian Sea. These species have a fairly wide distribution. *Gersemia rubiformis*, which also has been found in the northern Pacific, is arctic — subarctic and circumpolar. *Capnella glomerata* is arctic — arctic boreal, and *C. florida* is arctic boreal. *Cl. alba* is mainly arctic. They are usually met with at temperatures between about −1° C. and 6° C. However, *C. florida* is mainly found in the temperature interval between 3° and 6° C. (also found at temperatures up to 8.4° C.), whereas the other species seem to prefer somewhat lower temperatures, mainly between −1° and +1° C.

Of the species dealt with in this paper only *Sarcodictyon catenatum*, *Alcyonium digitatum* and *Stenogorgia rosea* are normally met with in the littoral zone. The zoogeographical position of *Alc. digitatum* has been discussed by the author in a small paper of 1943, and probably similar conditions apply to *Sarcodictyon catenatum*. *Stenogorgia rosea* seems to be an endemic Scandinavian species.

During the "Ingolf" Expedition Octocorals were secured at altogether 66 stations, and at 62 of the stations species of the orders dealt with in this paper were taken, yet larger forms, i. e. Gorgonaceans, were only taken at 21 of the stations.

List of Synonyms.

[illegible] May 1900 Gersemia rubiformis [illegible]

[illegible] 1887 Gersemia rubiformis (Ehrbg.).

[illegible] 1912 Gersemia rubiformis (Ehrbg.).

[illegible] 1887 Gersemia rubiformis (Ehrbg.).

[illegible] Studer 1901 Anthomastus grandiflorus [illegible]

[illegible] Versluys 1902 Chrysogorgia agassizii [illegible]

[illegible] Verrill 1883 Chrysogorgia agassizii (Verr.).

[illegible] Molander 1929 Clavularia alba (Grieg).

[illegible] Hickson 1894 Clavularia alba (Grieg).

[illegible] 1916 Clavularia alba (Grieg).

[illegible] Grieg 1888 Clavularia alba (Grieg).

[illegible] 1851 Paragorgia arborea (L.).

[illegible] Milne Edwards 1857 Paragorgia arborea (L.).

[illegible] 1887 Gersemia rubiformis (Ehrbg.).

[illegible] Danielssen 1887 Capnella florida (Rthk.).

[illegible] Kükenthal 1906 Capnella [illegible]

[illegible] May 1900 Capnella florida (Rthk.).

[illegible] 1758 Paragorgia arborea (L.).

[illegible] 1846 Paragorgia arborea (L.).

[illegible] Gray 1870 Acanella arbuscula (Johns.).

[illegible] 1915 Acanella arbuscula (Johns.).

[illegible] Johnson 1862 Acanella arbuscula (Johns.).

[illegible] 1875 Capnella glomerata (Verr.) f. flavescens.

[illegible] Koren & Danielssen 1883 Clavularia arctica [illegible]

[illegible] Molander 1929 Clavularia arctica (M. Sars).

[illegible] 1906 Gersemia rubiformis (Ehrbg.).

[illegible] Molander 1915 Gersemia rubi[illegible]

[illegible] 1887 Capnella glomerata (Verr.).

[illegible] resedaeformis (Gunn.).

[illegible] 1887 Gersemia rubiformis (Ehrbg.).

[illegible] glomerata (Verr.).

[illegible] arctica (M. Sars).

[illegible] 1758.

[illegible] 1927 Anthelia borealis (Kor. & [illegible]

[illegible] florida (Rthk.).

[illegible] Kükenthal 1906 Capnella [illegible]

[illegible] Rthk.

[illegible] Kor. & Dan. [illegible]

[illegible] 1918 Anthelia [illegible]

[illegible] Anthelia borealis [illegible]

[illegible] M. Sars [illegible]

[illegible] L.

borealis, Stenogorgia, Jungersen 1915 Stenogorgia borealis Kramp.

caduca, Paraspongodes, May 1900 Capnella florida (Rthk.).

campanula, Chrysogorgia, F. J. Madsen 1944.

canadensis, Gersemia, Verrill 1922 Gersemia rubiformis (Ehrbg.).

candida, Gersemia, Koren & Danielssen 1883 Capnella glomerata (Verr.), f. flavescens.

Paraspongodes, May 1900 Capnella glomerata (Verr.) f. flavescens.

capitata, Paraspongodes, May 1898 Gersemia rubiformis (Ehrbg.).

Voeringia, Danielssen 1887 Gersemia rubiformis (Ehrbg.).

carnea, Gersemia, Verrill 1922 Gersemia rubiformis (Ehrbg.).

carneum, Alcyonium, Verrill 1864 Gersemia rubiformis (Ehrbg.).

catenata, Clavularia, Hickson 1894 Sarcodictyon catenatum Forbes.

Evagora, Aurivillius 1926 Sarcodictyon catenatum Forbes.

Sarcodictyon, Forbes 1847 Sarcodictyon catenatum Forbes.

catenatum, Sympodium, Molander 1915 Sarcodictyon catenatum Forbes.

challengeri, Lepidogorgia, Versluys 1902 Radicipes challengeri (Wright & Studer).

Radicipes (pars) Jungersen 1916 Radicipes challengeri (Wright & Studer).

Strophogorgia, Wright & Studer 1889 Radicipes challengeri (Wright & Studer).

cinerea, Duva, Danielssen 1887 Capnella florida (Rthk.).

Paraspongodes, May 1900 Capnella florida (Rthk.).

clavata, Eunephthya, Kükenthal 1906 Gersemia rubiformis (Ehrbg.).

Gersemia, Molander 1915 Gersemia rubiformis (Ehrbg.).

Paraspongodes, May 1898 Gersemia rubiformis (Ehrbg.).

Voeringia, Danielssen 1887 Gersemia rubiformis (Ehrbg.).

crassa, Gersemia, Kükenthal 1907 Gersemia rubiformis (Ehrbg.).

Gersemia rubiformis forma, Molander 1915 Gersemia rubiformis (Ehrbg.).

Sarakka, Danielssen 1887 Gersemia rubiformis (Ehrbg.).

cydonium, Alcyonium, Abildgaard 1789 Alcyonium digitatum (L.).

danielsseni, Gersemia, Marenzeller 1886 Gersemia rubiformis (Ehrbg.).

Paraspongodes, Studer 1901 Gersemia rubiformis (Ehrbg.).

Voeringia, Studer 1891 Gersemia rubiformis (Ehrbg.).

digitata, Lobularia, Lamarck 1836 Alcyonium digitatum (L.).

Paraspongodes, May 1900 Gersemia rubiformis (Ehrbg.).

digitatum, Alcyonium, Linné 1758.

Enalcyonium, Broch 1912 Alcyonium digitatum (L.).

digitatus, Barathrobius, Danielssen 1887 Gersemia rubiformis (Ehrbg.).

dryopsis, Voeringia, Danielssen 1887 Gersemia rubiformis (Ehrbg.).

elegans, Nannodendron, Danielssen 1887 Gersemia rubiformis (Ehrbg.).

elegans, Paramuricea, Grieg 1887 = Paramuricea placomus (L.).
fallax, Anthelia, Broch 1912.
Anthothela grandiflora var., Molander 1918 = Anthelia fallax Broch.
filiformis, Clavularia, Hickson 1894 = Sarcodictyon catenatum Forbes.
— Rhizoxenia, M. Sars 1856 = Sarcodictyon catenatum Forbes.
flabelliformis, Gorgonia, Gunnerus 1765 = Paramuricea placomus (L.).
flava, Duva, Danielssen 1887 = Capnella florida (Rthk.).
— Paraspongodes, May 1900 = Capnella florida (Rthk.).
flavescens, Eunephthya glomerata var., Kükenthal 1907 = Capnella glomerata (Verr.) f. flavescens.
Eunephthya, Molander 1915 = Capnella glomerata (Verr.) f. flavescens.
Nephthya, Danielssen 1887 = Capnella glomerata (Verr.) f. flavescens.
— Paraspongodes, May 1899 = Capnella glomerata (Verr.) f. flavescens.
florida, Capnella, Broch 1939 = Capnella florida (Rthk.).
— Duva, Koren & Danielssen 1883 = Capnella florida (Rthk.).
Eunephthya, Kükenthal 1906 = Capnella florida (Rthk.).
Gersemia, Marenzeller 1878 = Gersemia rubiformis (Ehrbg.).
Gorgonia, Rathke 1806 = Capnella florida (Rthk.).
Paraspongodes, May 1900 = Capnella florida (Rthk.).
frielei, Briareum, Koren & Danielssen 1853 = Paragorgia arborea (L.).
frigida, Clavularia, Danielssen 1887 = Gersemia rubiformis (Ehrbg.).
Duva, Danielssen 1887 = Capnella florida (Rthk.).
Paraspongodes, May 1900 = Capnella florida (Rthk.).
fruticosa, Eunephthya, Kükenthal 1906 = Gersemia rubiformis (Ehrbg.).
Gersemia, Molander 1915 = Gersemia rubiformis (Ehrbg.).
— Paraspongodes, May 1898 = Gersemia rubiformis (Ehrbg.).
— Voeringia, Jungersen 1887 = Gersemia rubiformis (Ehrbg.).
fruticosum, Alcyonium, M. Sars 1860 = Gersemia rubiformis (Ehrbg.).
glacialis, Duva, Danielssen 1887 = Capnella florida (Rthk.).
Paraspongodes, May 1900 = Capnella florida (Rthk.).
Paraspongodes, May 1898 = Gersemia rubiformis (Ehrbg.).
globosa, Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).
glomerata, Ammothea, Carter 1880 = Capnella glomerata (Verr.).
— Capnella, Broch 1939 = Capnella glomerata (Verr.).
Drifa, Verrill 1922 = Capnella glomerata (Verr.) f. lütkeni + f. flavescens.
Eunephthya, Verrill 1869.
gracilis, Lepidogorgia, Verrill 1884 = Radicipes gracilis (Verr.).
— Radicipes (?) Jungersen 1916 = Radicipes gracilis (Verr.).
grandiflora, Anthothela, Verrill 1879 = Anthothela grandiflora (M. Sars).
Anthothelia, Molander 1915 = Anthothela grandiflora (M. Sars).
grandiflorum, Briareum, M. Sars 1856 = Anthothela grandiflora (M. Sars).
grandiflorus, Anthomastus, Verrill 1883.
griegii, Clavularia, F. J. Madsen 1944.
griegi, Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).
groenlandica, Eunephthya, Molander 1915 = Capnella glomerata (Verr.) f. groenlandica.
hippuris, Acanella, Broch 1913 = Isidella lofotensis M. Sars.
Isidella, Grieg 1891 = Isidella lofotensis M. Sars.
Isis, Gunnerus 1788 = Isidella lofotensis M. Sars.
hyalina, Drifa, Danielssen 1887 = Capnella glomerata (Verr.) f. flavescens.
Eunephthya, Kükenthal 1906 = Capnella glomerata (Verr.) f. flavescens.
Eunephthya flavescens var., Molander 1915 = Capnella glomerata (Verr.) f. flavescens.
hyalina, Haimea, Koren & Danielssen 1883 = Alcyonium digitatum (L.).
Paraspongodes, May 1899 = Capnella glomerata (Verr.) f. flavescens.
hyalinum, Sympodium, Grieg 1887 = Gersemia rubiformis (Ehrbg.).
ingolfi, Cyathopodium, F. J. Madsen 1944.
irramosa, Danielssenia, Grieg 1887 = Stenogorgia rosea Grieg.
Leptogorgia, Molander 1919 = Stenogorgia rosea Grieg.
islandica, Drifa, Danielssen 1887 = Capnella glomerata (Verr.) f. lütkeni.
Eunephthya glomerata var., Kukenthal 1907 = Capnella glomerata (Verr.) f. lütkeni.
Paraspongodes, May 1899 = Capnella glomerata (Verr.) f. lütkeni.
jan-mayeni, Voeringia, Danielssen 1887 = Gersemia rubiformis (Ehrbg.).
jungerseni, Primnoella, F. J. Madsen 1944.
kukenthali, Muriceides, Aurivillius 1931 = Trachymuricea kukenthali (Broch).
Paramuricea, Broch 1912 = Trachymuricea kukenthali (Broch).
Trachymuricea, Deichmann 1936 = Trachymuricea kukenthali (Broch).
lepadifera, Gorgonia, Linné 1767 = Primnoa resedaeformis (Gunn.).
Primnoa, Lamoroux 1816 = Primnoa resedaeformis (Gunn.).
levidensis, Clavularia, F. J. Madsen 1944.
lofotensis, Isidella, M. Sars 1868.
loricata, Gersemia, Marenzeller 1878 = Gersemia rubiformis (Ehrbg.).
Gersemia fruticosa forma Molander 1915 = Gersemia rubiformis (Ehrbg.).
Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).
luetkeni, Ammothea, Marenzeller 1878 = Capnella glomerata (Verr.) f. lütkeni.
— Paraspongodes, May 1899 = Capnella glomerata (Verr.) f. lütkeni.
lutkeni, Alcyonium, Verrill 1879 = Capnella glomerata (Verr.) (f. flavescens?).
Eunephthya, Verrill 1883 = Capnella glomerata (Verr.) (+ Gersemia rubiformis (Ehrbg.)).
margaritaceum, Sympodium, Grieg 1887 = Alcyonium digitatum (L.).
Clavularia, May 1900 = Alcyonium digitatum (L.).
massa, Sympodium, Ehrenberg 1834 = Alcyonium digitatum (L.).
membranea, Gersemia fruticosa forma, Molander 1915 = Gersemia rubiformis (Ehrbg.).
mirabilis, Eunephthya, Kükenthal 1906 = Gersemia rubiformis (Ehrbg.).
Gersemia, Molander 1915 = Gersemia rubiformis (Ehrbg.).
Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).
Voeringia, Danielssen 1887 = Gersemia rubiformis (Ehrbg.).
multiflora, Duva, Verrill 1922 = Capnella florida (Rthk.).
multiflorum, Alcyonium, Verrill 1879 = Capnella florida (Rthk.)
nodosa, Paragorgia, Koren & Danielssen 1883 = Paragorgia arborea (L.).
nordenskioldi, Organidus, Danielssen 1887 = Gersemia rubiformis (Ehrbg.).
normani, Acanella, Verrill 1878 = Acanella arbuscula (Johns.).
norvegicum, Alcyonium, Broch 1912 = Alcyonium digitatum (L.).
Erythropodium, Broch 1912 = Alcyonium digitatum (L.).
Sympodium, Koren & Danielssen = Alcyonium digitatum (L.).
pacifica, Primnoa, Kinoshita 1907 = Primnoa resedaeformis (Gunn.).
pallida, Gersemia fruticosa var., Molander 1915 = Gersemia rubiformis (Ehrbg.).
palmata, Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).

[illegible] Gersemia rubiformis

[illegible] Capnella florida

[illegible] 1907 Gersemia rubi

[illegible] 1915 Gersemia rubiformis

[illegible] Capnella florida (Rthk.).

[illegible] Stenogorgia rosea Grieg.

[illegible] Stenogorgia rosea Grieg.

[illegible] Paramuricea placomus (L.).

[illegible] 1834 Paramuricea placomus (L.).

[illegible] Paramuricea placomus (L.).

[illegible] Danielssen 1887 Gersemia rubiformis

[illegible] 1887 Capnella glomerata (Verr.)

[illegible] 1898 Capnella glomerata (Verr.)

[illegible] 1887 Gersemia rubiformis (Ehrbg.).

[illegible] M. Sars MS Gersemia rubiformis

[illegible] Koren & Danielssen 1883 Capnella florida (Rthk.).

[illegible] May 1900 Capnella florida (Rthk.).

[illegible] May 1900 Anthomastus grandi [illegible] Verr.

[illegible] Koren & Danielssen 1883 Anthomastus [illegible] Verr.

[illegible] Broch 1912 Anthomastus grandi [illegible] Verr.

[illegible] Danielssen 1887 Gersemia rubiformis

[illegible] Verrill 1922 Capnella glomerata Verr. f. fla

[illegible] Studer 1901 Capnella glomerata Verr. f. fla

[illegible] Grieg 1894 Paramuricea placomus (L.).

[illegible] Ehrenberg 1834 Capnella florida (Rthk.).

[illegible] Pallas 1766 Primnoa resedaeformis (Gunn.).

[illegible] Verr. 1864 Primnoa resedaeformis (Gunn.).

[illegible] Gorgonia, Gunnerus 1763 Primnoa resedae-[illegible]

[illegible] Studer 1901 Primnoa resedaeformis (Gunn.).

[illegible] var. Molander 1915 Gersemia rubi-[illegible]

rosea, Duva, Koren & Danielssen 1883 = Capnella florida (Rthk.).

Eunephthya, Kükenthal 1906 = Capnella florida (Rthk.).

Eunephthya glomerata var., Kükenthal 1907 = Capnella glomerata (Verr.) f. flavescens.

Nephthya, Danielssen 1887 = Capnella glomerata (Verr.) f. flavescens.

Paraspongodes, May 1900 = Capnella florida (Rthk.).

Stenogorgia, Grieg 1887.

rubiforme, Alcyonium, Dana 1846 = Gersemia rubiformis (Ehrbg.).

rubiformis, Eunephthya, Kükenthal 1906 = Gersemia rubiformis (Ehrbg.).

Gersemia, Molander 1915 = Gersemia rubiformis (Ehrbg.).

Lobularia, Ehrenberg 1834 = Gersemia rubiformis (Ehrbg.).

rubra, Paraspongodes, May 1898 = Gersemia rubiformis (Ehrbg.).

rubrum, Alcyonium, Abildgaard 1789 = Alcyonium digitatum (L.).

sarsi, Paraspongodes, May 1900 = Capnella glomerata (Verr.) f. flavescens.

schiertzii, Fulla, Danielssen 1887 = Gersemia rubiformis (Ehrbg.).

Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).

septentrionalis, Telestula, F. J. Madsen 1911.

spitsbergensis, Duva, Danielssen 1887 = Capnella florida (Rthk.).

Eunephthya, Kükenthal 1906 = Capnella florida (Rthk.).

Paraspongodes, May 1900 = Capnella florida (Rthk.).

stormi, Clavularia, Koren & Danielssen 1883 = Paramuricea placomus (L.).

Cornulariella, Molander 1929 = Paramuricea placomus (L.).

studeri, Gersemia, Verrill 1922 = Gersemia rubiformis (Ehrbg.).

truncata, Gersemia clavata var. = Gersemia rubiformis (Ehrbg.).

umbellata, Eunephthya rosea var., Kükenthal 1907 = Capnella florida (Rthk.).

uvaeformis, Eunephthya, Kukenthal 1906 = Gersemia rubiformis (Ehrbg.).

Gersemia, Molander 1915 = Gersemia rubiformis (Ehrbg.).

Paraspongodes, May 1900 = Gersemia rubiformis (Ehrbg.).

venustella, Clavularia, F. J. Madsen 1911.

verrilli, Acanthogorgia, Studer 1901 = Acanthogorgia armata Verr.

Lepidogorgia, J. A. Thomson 1927 = Radicipes gracilis (Verr.).

violacea, Duva, Danielssen 1887 = Capnella florida (Rthk.).

Eunephthya spitzbergensis var., Kükenthal 1906 = Capnella florida (Rthk.).

Paraspongodes, May 1900 = Capnella florida (Rthk.).

wandeli, Ceratocaulon, Jungersen 1892.

Xenia, Kükenthal 1906 = Ceratocaulon wandeli Jgrs.

List of Literature.

The list includes only the more important works and the works quoted. References to the rest of the literature on the northern Octocorals are to be found in the works referred to in the text.

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1912 e. Die Alcyonarien des Trondhjemsfjordes. II. Gorgonacea. Det Kgl. Norske Vid. Selsk. Skr. 1912.

1913 a. Arktiske Alcyonarier i Tromso Museum. Tromso Mus. Aarshefter, vol. 34.

1913 b. Die Alcyonarien des Trondhjemsfjordes. III. Pennatulacea und IV. Biogeographische Übersicht. Det Kgl. Norske Vid. Selsk. Skr. 1912.

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Plate I.

Telestula septentrionalis n. g., n. sp.

Fig. 1. Schematic sketch of a retracted zooid cut longitudinally in half (compare textfig. 16, I, II and III) showing where the three sections drawn on the plate have been cut.

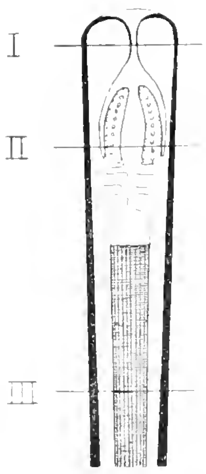
Fig. 2. Transverse section through the distal part of the contracted zooid showing how completely the contracted lower part of the anthocodia closes for the opening to the inverted anthocodie and the coelenteric cavity.

Fig. 3. Transverse section through the zooid a little above the peristome of the inverted anthocodia showing the tentacles and the arrangement of pinnulae and sclerites.

Fig. 4. Transverse section through the "stem" showing the eight "stem" canals.

ec. ectoderm.
en. endoderm.
mes. mesogloea.
me. mesenteries.
t. tentacles.
p. pinnulae.

scl. cavities left by sclerites after decalcification.
st. c. "stem" canals.
en. c. other endodermal canals.
mes. c. mesogloeal cell canals.
cu. cuticula.



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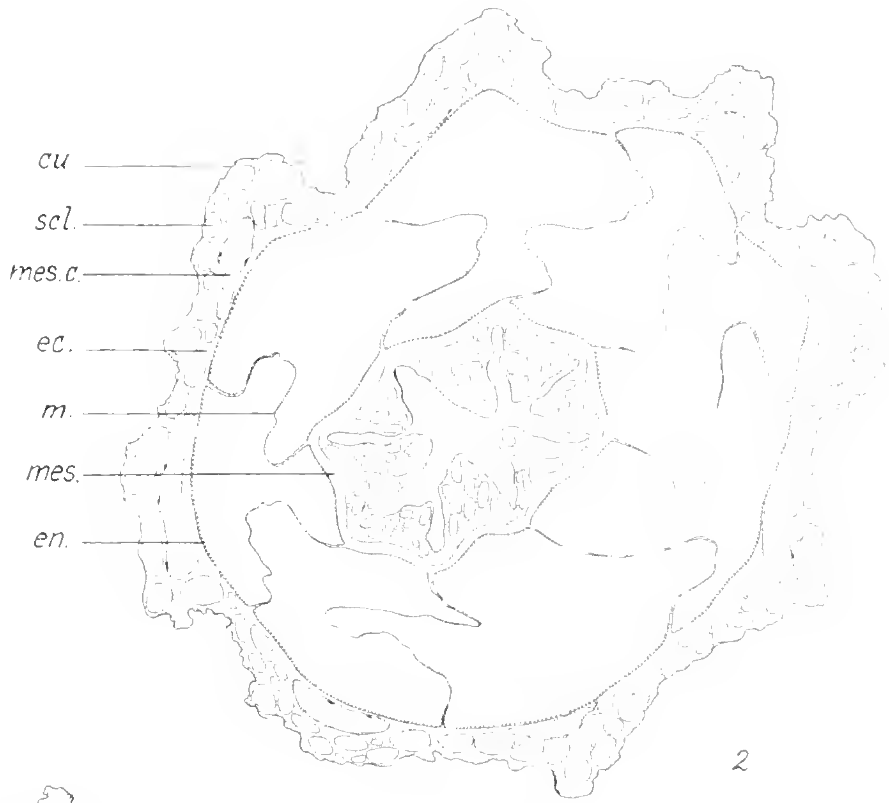

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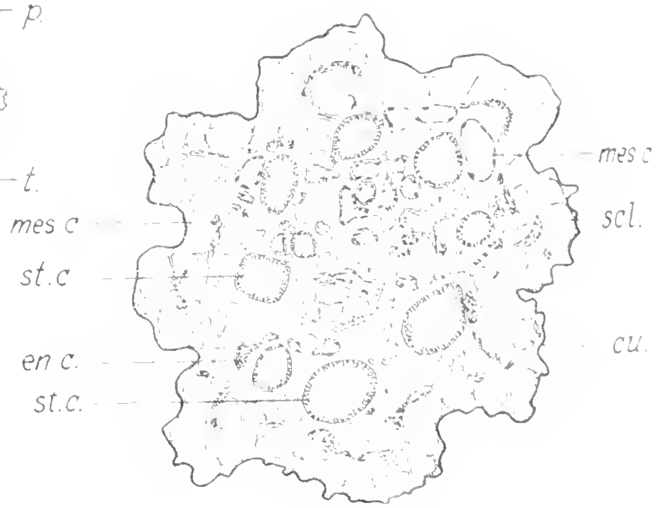

4

AUT. DEL.

THE INGOLF-EXPEDITION

1895—1896

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.	Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.	Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.
	1895												1896				
1	11 - V	62 30'	8 21	249	7 2	24	25 - VI	63 06'	56 00'	2258	2 4	45	11 - V	61 32	9 43	1211	4 17
2	12 -	63 04'	9 22'	493	5 3	25	26 -	63 30	54 25	1096	3 3	46	- -	61 32'	11 36	1356	2 40
3	- -	63 35'	10 24'	512	0 5			63 51	53 03	256		47	12 -	61 32	13 40'	1789	[illegible]
4	13 -	64 07'	11 12'	446	2 5	26	- -	63 57'	52 41	64	0 6	48	- -	61 32'	15 11	2165	3 17
5	- -	64 40'	12 09'	292				64 37'	54 24'	205		49	13 -	62 07	15 07'	2109	2 91
6	16 -	63 43'	14 34'	170	7 0	27	1 - VII	64 54	55 10	740	3 8	50	- -	62 43	15 07	1921	3 13
7	17 -	63 13'	15 11'	1130	4 5	28	- -	65 14'	55 42	791	3 5	51	15 -	64 15	14 22	128	7 32
8	19 -	63 56'	24 40'	256	6 0	29	5 -	65 34	54 31	128	0 2	52	- -	63 57	13 32	791	7 87
9	20 -	64 18'	27 00'	555	5 8	30	10 -	66 50	54 28	44	1 05	53	16 -	63 15	15 07	1497	3 08
10	- -	64 24	28 50'	1484	3 5	31	11 -	66 35'	55 54'	166	1 6	54	18 -	63 08	15 40	1301	3 9
11	21 -	64 34'	31 12'	2448	1 6	32	11 -	66 35'	56 38'	599	3 9	55	19 -	63 33	15 02	595	5 9
12	22 -	64 38	32 37'	1958	0 3	33	12 -	67 57'	55 30'	66	0 8	56	- -	64 00	15 09	128	7 57
13	- -	64 47'	34 33'	1171	3 0	34	18 -	65 17'	54 17'	104		57	20 -	63 37	13 02	659	3 4
14	- -	64 45'	35 05'	331	4 4	35	- -	65 16	55 05	682	3 6	58	- -	64 25	12 09	397	[illegible]
15	4-VI	66 18'	25 59'	621	0 75	36	28 -	61 50'	56 21	2702	1 5	59	-	[illegible]	12 16	584	[illegible]
16	5 -	65 43'	26 58'	471	6 1	37	29 -	60 17	54 05'	3229	1 4	60	21 -	[illegible]	[illegible]	54	[illegible]
17	16 -	62 49'	26 55'	1403	3 4	38	30 -	59 12'	51 05'	3521	1 3	61	-	[illegible]	[illegible]	104	[illegible]
18	17 -	61 44	30 29	2137	3 0	39	9-VIII	62 00'	22 38	1629	2 9	62	31	[illegible]	[illegible]	[illegible]	[illegible]
19	18 -	60 29'	34 14'	2949	2 4	40	- -	62 00	21 36	1591	3 3	63	1-VI	[illegible]	[illegible]	[illegible]	[illegible]
20	20 -	58 20'	40 48'	3192	1 5	41	12 -	61 39'	17 10	2345	2 0	64	-	[illegible]	[illegible]	[illegible]	[illegible]
21	21 -	58 01'	44 45'	2505	2 4	42	14 -	61 41'	10 17	1177	0 4	65	2 -	[illegible]	[illegible]	[illegible]	[illegible]
22	22 -	58 10	48 25'	3474	1 4	43	- -	61 42'	10 11	1215	0 6	66		61 [illegible]	[illegible]	[illegible]	[illegible]
23	24 -	60 43	56 00	[illegible]		44	- -	61 42	9 36	1026	4 8	67		[illegible]	[illegible]	1836	[illegible]

		Station No.	Date	Lat. N	Lon. W	Depth in m	Bottom temp.	Station No.	Date	Lat. N	Lon. W	Depth in m	Bottom-temp.
[illegible]	[illegible]	[illegible]	[illegible]	64 11	[illegible] 52	1858	1.1	118	24-VII	68 27'	8 20'	1996	1.0
[illegible]	[illegible]	[illegible]	25	64 24	[illegible] 14	1443	1.16	119	25 -	67 53'	10 19'	1902	1.0
[illegible]	[illegible]	94		64 56	36 19	384	4.1	120	- -	67 29	11 32'	1666	1.0
[illegible]				65 01	[illegible] 45	401		121	- -	66 59	13 11	996	0.7
[illegible]	[illegible]	[illegible]	[illegible]	65 11	30 39	1416	2.1	122	26 -	66 42'	14 44'	217	1.8
[illegible]	[illegible]	96	28	65 24	29 00	1384	1.2	123	28 -	66 52'	15 40	273	2.0
[illegible]	4.2	97	-	65 28	27 30	847	5.5	124	- -	67 40'	15 40'	932	-0.6
[illegible]		98	-	65 38	26 27	260	5.9	125	29 -	68 08	16 02'	1373	0.8
[illegible]		99	7-VII	66 13	25 53	352	6.1	126	- -	67 19	15 52'	552	0.5
[illegible]	[illegible]	100	9 -	66 25	14 02	111	0.4	127	2-VIII	66 35	20 05'	83	5.6
[illegible]	4.1	101	10	66 23	12 05	1011	0.7	128	- -	66 50	20 02	365	0.6
[illegible]	[illegible]	102	- -	66 23	10 26	1412	0.9	129	3 -	66 35'	23 47	220	6.5
[illegible]	4.5	103	-	66 23	8 52	1060	0.6	130	8 -	63 00'	20 40	636	6.55
[illegible]	4.4	104	11 -	66 23	7 25	1862	1.1	131	- -	63 00'	19 09	1314	4.7
[illegible]	4.0	105	-	65 54	7 31	1435	0.8	132	- -	63 00'	17 04	1407	4.6
	6.1	106	12 -	65 54	8 54	842	0.6	133	9 -	63 14	11 24'	433	2.2
[illegible]	4.1			65 29	8 40	878		134	- -	62 34'	10 26'	563	4.1
[illegible]	[illegible]	107	- -	[illegible]	10 28	926	0.3	135	10 -	62 48	9 48	508	0.4
[illegible]		108	[illegible]	[illegible]	12 [illegible]	183	1.1	136	- -	63 01	9 11	482	4.8
[illegible]		109	18	65 29	13 25	[illegible]	1.5	137	-	63 14'	8 31	559	0.6
[illegible]	4.8	110	19	66 44	11 [illegible]	1471	0.8	138	- -	63 26	7 56'	887	0.6
[illegible]		111	[illegible]	67 14	8 48	1619	[illegible]	139	- -	63 36	7 30	1322	0.6
[illegible]		112		[illegible] 55	6 44	[illegible]	1.1	140	11 -	63 29	6 57'	1169	0.9
[illegible]		113	21	[illegible]	7 06	2465	1.0	141	- -	63 22	6 58'	1279	0.6
	[illegible]	114	22	[illegible]	[illegible]	1456	1.0	142	- -	63 07'	7 05	1105	0.6
	[illegible]	115	23	[illegible]	8 29	162	0.1	143	- -	62 58	7 09'	731	0.4
	4.3	116		[illegible]	8 26	[illegible]	0.4	144	- -	62 49	7 12'	520	1.6
	[illegible]	117	24	[illegible]	8 [illegible]	[illegible]	1.0						

THE DANISH INGOLF-EXPEDITION

VOLUME V

14

MEDUSÆ

PART III.

TRACHYLINA AND SCYPHOZOA

WITH ZOOGEOGRAPHICAL REMARKS ON ALL THE MEDUSÆ
OF THE NORTHERN ATLANTIC

BY

P. L. KRAMP

WITH 6 PLATES AND 20 FIGURES IN THE TEXT

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Contents.

Introduction.

Many years have elapsed, since I published the first two parts of the medusæ of the northern Atlantic in the "Ingolf" publications (Leptomedusæ 1919, Anthomedusæ 1926). For various reasons the treatment of the Trachylina and the Scyphomedusæ was repeatedly postponed: other work, particularly on animals from Greenland waters, occupied much of my time available for scientific work; moreover I wanted the final treatment of the North-Atlantic medusæ to be as complete as possible by including new collections (mainly from the "Dana" expeditions), and also to be better aquainted with the distribution of the oceanic species in other parts of the Atlantic Ocean. In this respect the working out of the extensive collections of Hydromedusæ from the "Dana" expeditions in 1921–22 and 1930 and from the "Discovery" expeditions has given valuable information.

In the meantime it was decided to restrict the "Ingolf" papers still awaiting publication to comprise deep-sea animals only, hoping at last to come to an end with this series. The majority of the Trachylina and some of the Scyphomedusæ are decidedly bathypelagic, and they might therefore be treated to about the same extent as the Leptolina, but in accordance with the new plan the few neritic forms will only be briefly mentioned.

To conclude the present volume a short survey is given of all the medusæ occurring in the areas under consideration, i. e. the Atlantic Ocean north of about 50° N. and adjacent waters, paying regard to new information on the Leptolina.

One new species is described, *Haliscera bigelowi* n. sp.

If nothing else is stated, the material dealt with in the present paper belongs to the Zoological Museum of Copenhagen

I. Trachymedusæ.

Fam. Ptychogastridæ.

Ptychogastria polaris Allman.

Pl. I figs. 1–4, Pl. VI figs. 1–2.

[illegible] records.

[illegible] polaris Allman 1878 p. 290, figs. 1–3.
[illegible] Haeckel 1879 p. 266.
1881 p. 10, Pl. III–IV.
Levinsen 1893 p. 146.
Aurivillius 1896 p. 194.
Maas 1893 p. 20.
[illegible] 1898 p. 465.
Aurivillius 1899 p. 56.
Linko 1900 p. 117.
[illegible] Browne 1903 p. 21, Pl. IV figs. 1–2, Pl. V [illegible]
[illegible] Maas 1906a pp. 182, 192, 509.
Broch 1907 p. 8.
Bigelow 1909b p. 310.
Kramp 1911 p. 427.
Kramp & Damas 1925 p. 316.
[illegible] 1927.
Runnström 1932 p. 30.
Bergström 1934 pp. 9, 25.
Jaschnov 1939 p. 112.
Dunbar 1942 p. 74.
Kramp 1942 p. 69.
1943 p. 6.

M[illegible] [illegible] 1

W[illegible] [illegible] Kramp 1942 p. 71, fig. 21)
[illegible] 73°[illegible] N, 73°20'W. [illegible] 1928, depth 290 m, dredge [illegible] St. 67. 8 specimens.
[illegible] 77°15'N. [illegible] W. [illegible] 1928, depth 930 m, otter [illegible] St. [illegible] specimens.
[illegible] N. [illegible] 1860. 5 specimens (the original [illegible] Haeckel).
[illegible] N. [illegible] 20'W. [illegible] 1890. 1 specimen.
[illegible] 12'N. [illegible] W. Traustedt 1892. 4 spec.
[illegible] N. [illegible] W. [illegible] 1895, depth 128 m. [illegible] St. 2[illegible] specimen.
[illegible] 190 m, dredge [illegible] 1912 [illegible] Kramp 1914.
[illegible] W. [illegible] 1928 [illegible] 75–200 m. [illegible]
[illegible] F[illegible] Scoresb[illegible]
[illegible] 175 m.
[illegible] 700 m.

North of Iceland, 67°19'N., 15°52'W., $^{29}/_{7}$1896, depth 552 m, trawl. "Ingolf" St. 126. 2 specimens.

South-east of Iceland, 65°00'N., 11°16'W., $^{28}/_{5}$1896, depth 581 m, trawl. "Ingolf" St. 59. 1 specimen.

Kara Sea, without further details. "Dijmphna" 1882–83. Numerous specimens.

Norway, off Toskoen in Mangerfjord, near Bergen, July 1932, depth about 300 m, near the bottom. Th. Mortensen. 2 specimens.

Remarks on the morphology.

A thorough description of this interesting medusa was given by E. T. Browne (1903), who had seen Allman's type specimens and also a number of specimens from the Norwegian coast; his description differed in several respects from those given by Allman and Haeckel. Maas (1906) further discussed the morphology of the medusa. Bigelow (1909 and 1913) examined some specimens from Labrador and from the Aleutian Islands; he fully confirmed the correctness of the description given by Browne, and I have very little to add.

As pointed out by Mayer (1910 p. 372), Browne does not mention the number of radiating ridges on the exumbrella of the medusa; but we know from Haeckel that the number is 16. Maas (1906 p. 183) likewise found 16 principal ridges and between them sometimes a number of less prominent folds which partly might be due to contraction. As a matter of fact, the appearance of the exumbrella is much dependent on the state of contraction. I have seen specimens preserved in an expanded state, the umbrella being considerably flatter than a hemisphere; in such specimens the surface of the exumbrella is almost smooth and the ridges hardly to be discerned. In contracted specimens, which have obtained a high and conical umbrella, the ridges are very prominent, with sharp edges; their number is 16, and eight of them, which follow the eight radial canals, are more prominent than the others. In specimens especially strongly contracted a varying number of short accessory ridges appear in the spaces between the sixteen principal ridges.

In the tentacles provided with an adhesive disk the endoderm consists of large cylindrical cells, and the ectodermal epithelium is extremely thin, with only very few scattered nematocysts (Pl. I figs. 1–3). The filiform tentacles, without suckers, likewise have a solid endoderm, but these tentacles are very contractile, and in the contracted state the endoderm cells are very flat, and the ectodermal epithelium is fairly thick and contains several nematocysts scattered throughout the length of the tentacle, though the more dense towards the distal end (Pl. I fig. 4).

The size of the medusa is usually given as 10–15 mm in diameter, but several of the specimens examined by me are larger, 18–22 mm in diameter.

In adult specimens there are 18 clusters of tentacles; I have however seen some young individuals, 4–8 mm wide, with only

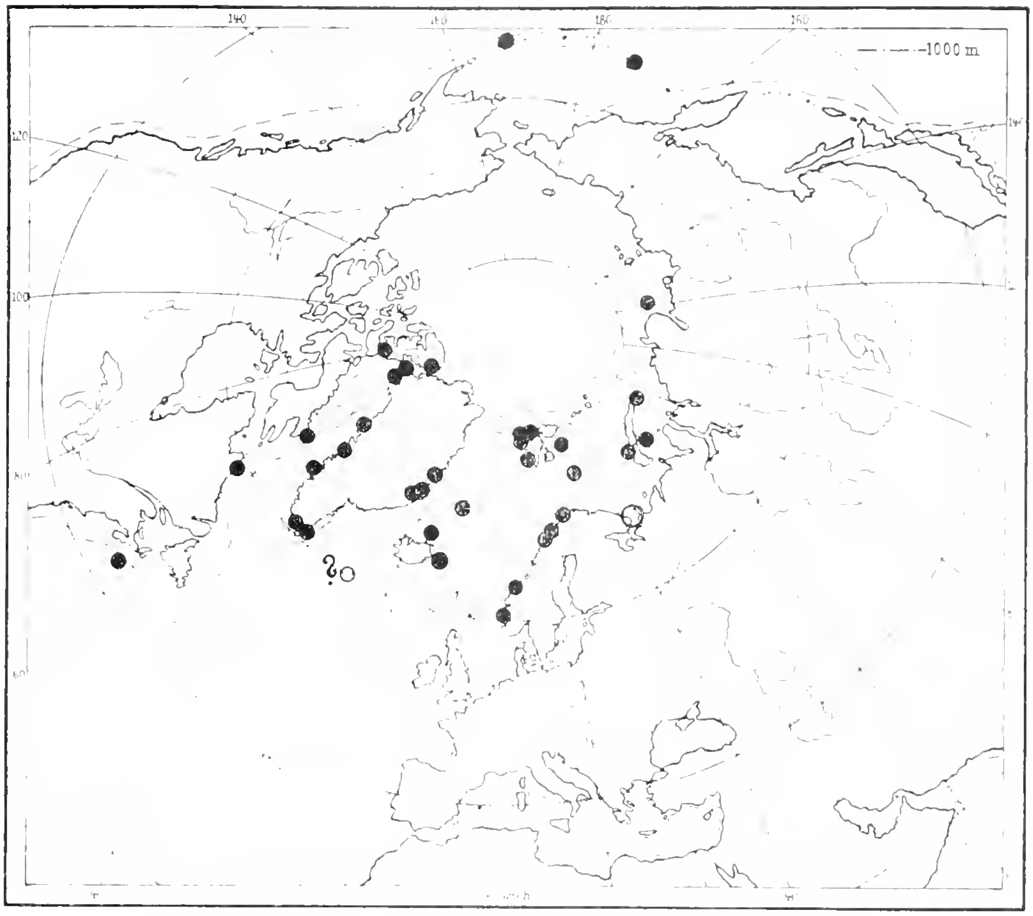

Fig. 1. Distribution of *Ptychogastria polaris* exact locality unknown.

16 clusters; in all other respects these young specimens resemble the adult, and the gonads are already visible on the eight stomachal lobes which are all of equal size.

Colour: According to sketches, made on board the "Ingolf", St. 126, the colour of the subumbrella is a light pink, the gonads are scarlet, the stomach a deep red (Pl. VI figs. 1–2).

Comparison with other species. I quite agree with **VANHÖFFEN** (1912a p. 386) that *Ptychogastria antarctica* (Haeckel) differs too much from *P. polaris* to be placed in the same genus, or even in the same family. The genus is, however, really represented in the Antarctic by *P. opposita* Vanhöffen (1902 b), a species greatly resembling the arctic *P. polaris*. *P. asteroides* (Haeckel) from the Adriatic Sea and the Straits of Gibraltar likewise seems to be a true *Ptychogastria*, though there is one feature which (provided that the description is correct) presents a serious obstacle against its affinities to this genus: the adhesive tentacles are said to be hollow, and in **HAECKEL**'s figure of a transverse section (1881, Pl. 7 fig. 4) the central canal is seen to be surrounded by an epithelium of endoderm cells with cilia waving into the hollow space, and the ectoderm is remarkably thick: these tentacles are, accordingly, fundamentally different from those of *P. polaris*, and from the tentacles of any other Trachymedusa as well.

Systematic position. As far as the systematic position of *Ptychogastria* is concerned, I absolutely disagree with the supposition put forth by **MAAS** (1906a p. 481) and provisionally followed by **BIGELOW** (1909 b p. 311) that *Ptychogastria* should be associated with *Crossota* on account of "the arrangement of the several rows of tentacles". In *Ptychogastria* the tentacles are placed in distinct clusters, whereas in *Crossota* they make an uninterrupted whorl: and as previously pointed out by me (1942 p. 80) the tentacles of *Crossota* are not arranged in several rows or series. Thus the only point of connection supposed to exist between these two genera does not hold good, and in all other respects they are highly different. The species of *Ptychogastria* constitute a distinct family with an isolated position within the Trachymedusæ.

Occurrence:

Almost all the specimens in our collections were collected at the bottom of the sea, with dredge or trawl, at very different depths, varying from about 10 m (in East Greenland) to 930 m (Inglefield Bay, West Greenland); most of the records in the literature are from depths of less than 200 m. **HAECKEL** (1881) records it from off Halifax, Nova Scotia, at a depth of 2200 m, but the specimen in question may possibly have been caught pelagically in a higher level. In all parts of the area of distribution the medusa has most frequently been collected at the bottom, where it most likely attaches itself to solid objects by means of the adhesive disks of its tentacles. It appears to **BROWNE** (1903 p. 29) that "a medusa, which has exceptionally powerful circular muscles lining the whole sub-umbrella and a strong muscular velum of exceptional width, would be a strong and active swimmer and not likely to spend much of its time crawling about the bottom of the sea". As a matter of fact, the vast majority of the specimens hitherto observed have actually been stationed on or near the bottom, but occasionally the medusa is met with swimming in the upper strata, sometimes even very near the surface of the water. It seems most likely, therefore, that the habit of the medusa is to spend some of its time attached to the bottom, usually at rather considerable depths, but occasionally to ascend to higher levels, and for such a habit of living the possession of strong muscles is highly required. Very likely **MAAS** (1906 a p. 481) [illegible] with that of [illegible] to great depths [illegible] in order to [illegible]

[illegible] map (textfig. 1) [illegible] species penetrating [illegible] to deep water south- [illegible] the map seems to me [illegible] MAAS 1893 p. 20) was based upon [illegible] that I feel sure that the iden- [illegible]

Fam. **Halicreasidæ** Fewkes 1896.

[illegible] radial canals, with numerous ten- [illegible] all structurally alike and arranged [illegible] divisible into a soft flexible proximal [illegible] distal region; with free sensory clubs, with [illegible] proboscis (BIGELOW 1919 p. 324, slightly [illegible]

[illegible] BIGELOW that the medusae which agree with [illegible] constitute a separate family, and also that the [illegible] manubrium is the most characteristic [illegible]. It is to be deplored, therefore, that another [illegible] (THIEL 1928 p. 80) not only reduces [illegible] of a subfamily (Halicreasinae), but will [illegible] genus *Homoeonema* in which a proper manu- [illegible] present.

[illegible] have been advanced concerning the [illegible] the limitation of its genera and species, [illegible] arisen on account of too vague descrip- [illegible] I hope before long to be able to enter into [illegible] of these problems, based upon examination [illegible] from various parts of the world. [illegible] must, however, be forwarded on the [illegible]

[illegible] to MAAS's varying conceptions [illegible] *H*[illegible] erected by himself in 1893. I shall [illegible] account of the fate of that genus in the [illegible] remark that it seems to me highly [illegible] medusae described and figured by [illegible] 21 [illegible] *Homoeonema platygonon* [illegible] species, which is the type species [illegible] provided with four lips, [illegible] to the Halicreasidae. Some further *H*[illegible] below under the discussion [illegible]

[illegible] of genera and species of the [illegible] completeness of the descrip- [illegible] the Valdivia medusae [illegible] beyond doubt [illegible] the first genus, [illegible] has been derived. [illegible] *Halicreas mini-* [illegible] described [illegible] by BIGELOW [illegible] *H*[illegible] few [illegible] Browne [illegible] *H*[illegible] *H*[illegible] MAAS [illegible]

which I have seen a few specimens, is certainly a distinct species, probably of *Haliscera*.

The specific value of VANHÖFFEN's several species has been doubted by various authors, but none of them have come to definite conclusions. THIEL (1936) certainly went much too far in reducing the number of species to only two: 1) *Halicreas album* Vanhöffen (with only one kind of tentacles) also comprising *H. conicum* (Vanhöffen) and *H. racovitzæ* (Maas), 2) *Halicreas papillosum* Vanhöffen (with eight long and numerous short tentacles), also comprising *Halicreas glabrum* Vanhöffen and *Halicreas rotundatum* Vanhöffen. RANSON (1936) maintains the genera *Halicreas* (with more than 15 tentacles in each octant) and *Haliscera* (with 12 or less tentacles in each octant), and he also observed a characteristic difference in the conformation of the umbrella in these two genera; he retains all VANHÖFFEN's species of *Halicreas*, and refers *Homoeonema platygonon* Maas to *Haliscera*. According to BIGELOW (1938 p. 121) it is obvious that "the five named representatives of the smooth-belled subdivision of the genus (*conicum*, *album*, *glabrum* and *rotundatum* Vanhöffen 1902, *racovitzæ* Maas, 1906) stand in need of drastic reduction, successive studies (Bigelow 1909, Ranson 1936) having proved that the features on which Vanhöffen (1902) laid chief stress (degree of doming of the exumbrella, and precise location of the gonads on the radial canals), are too variable to be of taxonomic significance."

I am however not quite sure that the number of species may be much reduced; my own studies have convinced me that a number of distinct species exist, but I find it difficult to bring them into concordance with VANHÖFFEN's descriptions. As a matter of fact, no proper descriptions were given, except of *H. papillosum*, but only scattered remarks on certain distinguishing features, and the beautiful coloured figures are more artistic than elucidating. After I wrote my paper on the medusae in the waters west of Greenland (KRAMP 1912) I have seen numerous specimens of *Botrynema brucei* Browne from almost every part of the Atlantic Ocean, which further confirmed my supposition that *Halicreas glabrum* Vanhöffen belongs to the same genus, and probably even to the same species; the peculiar structure and position of the tentacles thus entirely escaped the attention of VANHÖFFEN. In the uncoloured figure of *Halicreas papillosum*, seen from the exumbrella (Pl. IX fig. 8), the difference in size of the eight perradial and the other tentacles is clearly shown, but in the lateral view (fig. 7) nothing of the kind is indicated. One might be inclined to think that the artist has taken similar liberties in his delineation of some of the other figures.

Halicreas rotundatum is expressly stated to have 20 tentacles in each octant when 18 mm in diameter; it also has an evenly rounded, dome shaped umbrella. I have not seen any medusa corresponding to this species; none of the dome-shaped specimens which I have seen had more than about 12 tentacles in each octant, nor has any other author. (Cfr. *Haliscera bigelowi*, p. 9).

The most characteristic feature of *Haliscera conica* is the conical shape of the umbrella; it was taken in one or two localities, south of Africa and in the Indian Ocean; one of the specimens was 18 mm in diameter, and according to fig. 33 on Pl. 11 it had 9 tentacles and two statocysts in each octant (fig. 6 on Pl. 9 shows 11 tentacles). Various authors have doubted the specific value of the shape of the umbrella; it should be pointed out, however, that the jelly of the Halicreasidae is rather firm and resistent and apparently not very liable to alter its shape by preservation. As a matter of fact, all the numerous specimens of *Haliscera* which I have seen in the "Discovery" collections from the southern Atlantic and the Antarctic Ocean have the conical shape characteristic of *H. conica* and agree very well with that species, with the exception that the number of tentacles rarely exceeds 8 in each octant. It is the same species which occurs in the Mediterranean.

On the other hand, all the numerous specimens of *Haliscera*

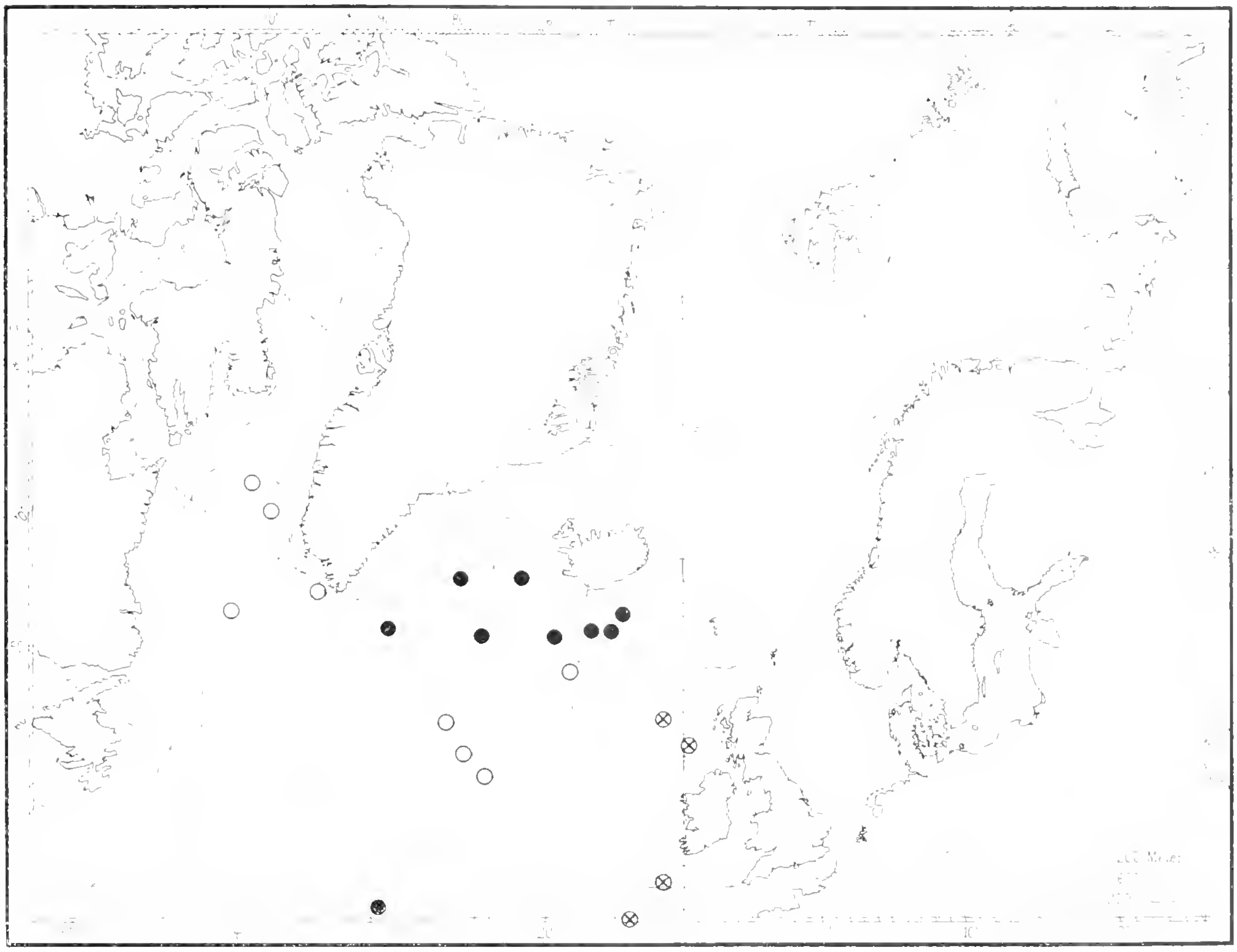

Fig. 2. Distribution in the northern Atlantic of *Halicreas minimum* ● new records previous records, records not yet published.

from the northern Atlantic examined by me, and further mentioned below, have an evenly rounded, dome-shaped umbrella with a thick jelly. They are about 17 mm in diameter, with about 12 tentacles in each octant. They agree fairly well with the specimens from the eastern tropical Pacific described and figured by BIGELOW (1909 a p. 142) under the name of *Homoeonema alba* (Vanhöffen); but it seems to me doubtful to refer them to that species. VANHÖFFEN's description of *Halicera alba* was based on one specimen from the South Atlantic, a large medusa 35 mm in diameter, yet with only 8–10 tentacles in each octant. Moreover its gonads are described and figured as lancet-shaped, occupying a rather considerable portion of the radial canals, whereas in the Pacific as well as in the North-Atlantic specimens the gonads are short and broadly oval or nearly circular in outline. I prefer, therefore, to describe this form as a new species and name it in honour of professor H. B. BIGELOW, *Haliscera bigelowi* n. sp.

Genus **Halicreas** Fewkes 1882

Halicreasidæ with eight radial canals; with a continuous row of tentacles; with perradial, gelatinous papillæ on the exumbrella.

Halicreas minimum Fewkes.

Pl. VI fig. 3.

Principal references.

Halicreas minimum Fewkes 1882 p. 306.
papillosum Vanhöffen 1902 b p. 68, Pl. IX figs. 7–8, Pl. XI fig. 30.
Halicreas papillosum Bigelow 1909a p. 138, Pl. 3 fig. 3, Pl. 33 figs. 8, 9, Pl. 34 figs. 1–3, 5, 8, 10, 11.
Halicreas minimum Bigelow 1938 p. 122.

North-Atlantic records:

Halicreas minimum Fewkes 1882 p. 306, 1886 p. 953
papillosum Kramp 1920 p. 5
Bigelow 1926 p. 67.
Ranson 1936 p. 164
minimum Kramp 1942 p. 70.

Material (see the map, textfig. 2)

61 34'N 19 05 W., $^{10}_{7}$1904,	"Thor"	St. 180	2 specimens
61 30'N 17 08'W., $^{11}_{7}$1904,		183	6
63 19'N, 26 50'W., $^{24}_{5}$1928,	"Godthaab"	St. 1, 1000 m wire	2 spec
59 30'N, 45 23'W., $^{29}_{5}$1928		5, 300 m	1
56 56'N, 51 17 W., $^{3}_{6}$1928,		10, 3000 m	7
62 19 N 56 00'W., $^{14}_{6}$1928,		21, 1000 m	6
		21, 2500 m	1
60 59'N 22 29 W., $^{29}_{5}$1925,	"Dana"	St. 2306 3000 m wire	9
60 20'N 29 21'W., $^{31}_{5}$1925,		2307 1500 m	1
59 21'N 37 56'W $^{1-2}_{6}$1925,		2308 3000 m	115
		2308 1000 m	58
61 17 N, 52 55 W $^{9}_{7}$1925		2401 1900 m	2
62 35 N, 32 53 W., $^{27}_{7}$1925		2437 1900 m	1
47 02 N 31 15 W., $^{27-28}_{6}$1931		4201, 2000 m	7
		4201, 3000 m	70
		4201 4000 m	40
		4201, 5000 m	33
		4201 6000 m	25
62 23 N 16 05 W., $^{25}_{6}$1932		4402 3000 m	13
		4402 4000 m	17
62 36'N 32 18 W $^{16}_{8}$1933		4687 2000 m	7

[illegible] localities in which [illegible] Michael Sars' North Atlantic [illegible] these specimens, but [illegible] They were taken in [illegible]

[illegible] Vanhöffen (1902 b), more- [illegible] excellent figures illustrating [illegible] The majority of the numer- [illegible] a poor state of preservation, [illegible] ever with some of the ten- [illegible] retained they fully agree with [illegible] A discussion on the individual [illegible] localities is better postponed for [illegible] with the extensive collections from [illegible] have been placed at my disposal.

[illegible] of the medusa are not quite as given by Van- [illegible] 1902 Pl. IX [illegible] 7 the gonads are a pure scarlet, the [illegible] canals pink, the tentacle stumps carmine [illegible] coloured sketch made by me on board the [illegible]

H[illegible] is a bathypelagic medusa with a world- [illegible] The map textfig. 2 clearly shows that its [illegible] the northern Atlantic is limited by the [illegible] the submarine ridges connecting Scotland, [illegible] Baffin Land. With one exception ("Godt- [illegible] North Atlantic localities are all outside the [illegible] St. 5 was near the south point of Green- [illegible] 294 [illegible] and one single specimen was taken [illegible] below the surface in water with a salinity of 34.91 ‰ [illegible] deep strata outside the shelf, where the medusa [illegible] the only instance of the medusa occurring [illegible] this geographical region; all other North- [illegible] were taken in hauls with at least 1000 m wire [illegible] below the surface. The species was nowhere [illegible] less than about 2000 m below the surface, [illegible] of the hauls taken with 3000–6000 m wire out [illegible] 2000–4000 m below the surface) brought forward a large [illegible] The vertical distribution is particularly well [illegible] "Dana" St. 4201 the ring trawl with [illegible] an opening diameter of 150 cm, towed [illegible] hours and with 2000 m wire out, caught [illegible] whereas a considerable number were taken in [illegible] towed simultaneously with 3000 m wire [illegible] (40), and 5000 m wire (33); the deepest [illegible] made with a larger net, diameter 300 cm, [illegible] it took 25 specimens during the [illegible] taken in still greater numbers in a [illegible] "Dana" St. 2308, where 115 specimens [illegible] during a haul of 2 hours' [illegible] 58 specimens in the haul [illegible] were taken in the hauls made

[illegible] Atlantic Ocean the occurrence [illegible] to the deep strata. [illegible] distribution in the [illegible] about 7 [illegible] to about 800 m [illegible] between 50 and 100 m, [illegible] to be recorded. [illegible] *H. papillosum* [illegible] *H. mini-* *H*[illegible] his [illegible] of the [illegible] right up [illegible] principal [illegible] deep as-

Thiel (1935 p. 46) found an increase of the average size of the specimens from the upper strata downwards, and he concluded that the eggs or young larvae rise towards the surface, whereas the medusae, while growing larger, gradually sink back into the deep-sea (the specimens at his disposal were all young ones, less than 10 mm in diameter). A tendency in the same direction is indicated by the North-Atlantic collections examined by me, as seen from the accompanying table showing the size limits of the individuals taken at different depths. I would, however, not attach too much importance to these figures which may prove to be entirely casual; but I shall return to the question, when my studies on the collections from the central and southern parts of the Atlantic Ocean are finished.

m wire out	Diameter of specimens, mm
1000	22–29
2000	9–26
3000	9–35
4000	12–35
5000	20–30
6000	22–30

Geographical distribution: *Haliereas minimum* occurs in the deep parts of all the oceans, except in the arctic seas. There are regions of the Indian and Pacific Oceans, from which it has not yet been recorded, but there is every reason to believe that its distribution in these oceans really comprises the entire deep-sea areas. In the Atlantic Ocean it is generally distributed in the deep basins from the submarine ridges in the North Atlantic to the shelf of the Antarctic Continent. In the Pacific its area of distribution comprises the Bering Sea, the deep-sea of that water is in direct connection with the deep-sea of the Pacific Ocean and forms a continuous part of it, in the same manner as the deep-sea areas west and east of the southern part of Greenland are continuous portions of the Atlantic deep-sea basin.

Genus **Haliscera** Vanhöffen 1902.

Haliereasidae with eight radial canals; with a continuous row of tentacles; without exumbral papillae.

Haliscera bigelowi n. sp.

Pl. I figs. 5–8, Pl. II figs. 1–2.

Homoeonema alba Bigelow 1909 a p. 112, Pl. 3 figs. 1, 2, Pl. 33 figs. 6, 11, Pl. 34 fig. 9.

Material (see the map, textfig. 3).

57°03'N, 11°20'W., $^{28}_{5}$1908.	"Thor" St. 12,	300 m wire,	2 specm.
63°19'N, 26°50'W., $^{21}_{5}$1928.	"Godthaab" St. 1,	1000 m wire,	1 spec.
63°32'N, 26°23'W., $^{28}_{7}$1925.	"Dana" St. 2138,	1500 m wire,	75
62°23'N, 16°05'W., $^{25}_{6}$1932.	4102,	3000 m	6
62°23'N, 16°05'W., $^{25}_{6}$1932.	4102,	3000 m	6
	4102,	4000 m	1
62°36'N, 32°48'W., $^{16}_{5}$1933	4687,	1000 m	5
62°45'N, 16°01'W., $^{7}_{5}$1934	5083,	1000 m	1
	5083,	1500 m	30
	5083,	2000 m	20

Moreover taken by the "Michael Sars" in the following localities.

47°31'N, 43°11'W., $^{11}_{7}$1910.	"Michael Sars" St. 80,	950–525 m
48°02'N, 39°55'W., $^{12}_{7}$1910	81,	2000 m wire
46°48'N, 27°46'W., $^{17}_{7}$1910	87,	1900–0 m
45°26'N, 25°45'W., $^{18}_{7}$1910	88,	1000 m wire
48°29'N, 13°55'W., $^{23-24}_{7}$10	92,	600 m
50°13'N, 11°23'W., $^{26}_{7}$1910	94,	600 m
56°33'N, 9°30'W., $^{5}_{8}$1910	98,	1000 m
	98,	1500 m
57°41'N, 11°48'W., $^{6-7}_{8}$1910	101,	1000 m
	101,	2000 m

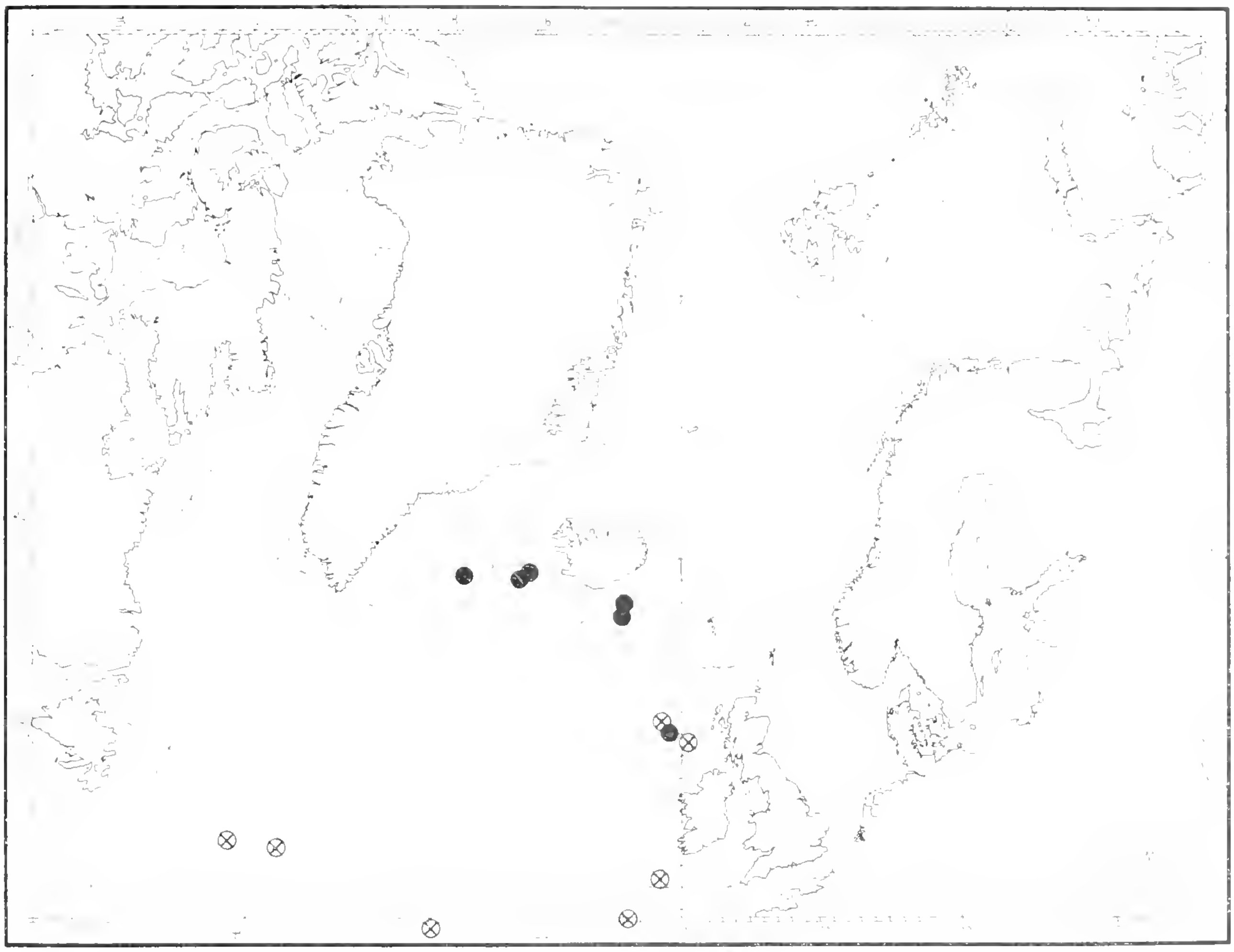

Fig. 3. Distribution in the northern Atlantic of *Haliscera bigelowi.* ● new records; records not yet published

Description: (Pl. I fig. 5) Umbrella almost hemispherical, its central portion consisting of a thick, hemispherical mass of jelly, by a slight constriction separated from the marginal portion which has fairly thin walls, the apical gelatinous portion comprises nearly two thirds of the entire height of the medusa.

The stomach (Pl. I fig. 6) is very broad and flat, slightly conical in shape, it has a circular outline, and the mouth is a circular opening varying in width according to the state of contraction. There are eight broad radial canals and a broad circular vessel. The gonads (Pl. I fig. 6) are broadly oval, comprising about two fifths of the length of the radial canals and placed somewhat nearer to the stomach than to the circular vessel: in female specimens each gonad contains about seven large eggs in one layer. The gonad is usually rather flat, but in certain states of contraction it is doubled up after a longitudinal line and thereby attains a laterally compressed appearance.

In the specimens examined almost all the tentacles are broken off, leaving only the basal stumps (Pl. I fig. 7); a few small tentacles are retained, showing that they have the same structure as in other species of Halicreasidae (Pl. I fig. 8). The number of tentacles is usually about 96 (12 in each octant): in some of the octants there may be 11 or 13; the full number of tentacles is attained at an early stage of development; in the smallest specimen examined, which is 5 mm in diameter, there are about 80 tentacles; another small specimen, 6 mm wide, has about 96, and in the largest specimen, 19 mm in diameter, the number does not exceed 100. The tentacles are all of the same structure, but varying in size; the eight perradial tentacles are not distinctly larger than the others. The distribution of large and small tentacles between the perradials is rather irregular, two small ones or two fairly large ones are frequently placed side by side.

The statocysts (Pl. II figs. 1–2) are elongated club-shaped, as in other species of Halicreasidae; the endoderm core consists of about 10 cells each with a large nucleus except the two or three distal cells, in which no nuclei are seen; as all the specimens are preserved in formalin, the statoliths have completely disappeared. The ectoderm consists of two different kinds of cells: in the distal half or two thirds of the club there are two lateral rows of rectangular cells, rather high and rich in protoplasm, they have most probably carried sensory hairs; in the proximal portion of the club and on the abaxial and adaxial sides of the distal portion the epithelium consists of large, flattened cells with irregular outlines, usually somewhat elongated in the longitudinal direction of the club.

There are three statocysts in each octant and their position among the tentacles is very characteristic and rather constant (Pl. I fig. 7): when the number of tentacles in an octant is 12 we shall almost always find the statocysts placed as follows (the medusa seen from the exumbral side, the bell margin downwards): to the right hand side of a perradial tentacle we first see another tentacle and then a statocyst followed by 3 tentacles, one statocyst, 3 more tentacles, and again one statocyst; but between the third statocyst and the first one in the next octant there are 6 tentacles.[1] A statocyst in the middle of this group of six tentacles would result in a completely symmetrical and regular position of statocysts round the umbrella margin, with three tentacles between each successive pair of statocysts; but I have never seen a statocyst on the left hand side of a perradial [illegible]

[illegible] broken [illegible] they are [illegible] specimens [illegible] variations [illegible] in an octant is [illegible] asymmetrically [illegible] in the same manner

[illegible] but with a weak mus-

[illegible] 15-17 mm., height

[illegible] seen alive ("Godthaab"

[illegible] is chosen as the **type specimen** [illegible] individual, fairly well preserved, with the [illegible] is damaged. The above description [illegible] gonads is based on other specimens. [illegible]

[illegible] species. The North Atlantic [illegible] agree in almost all respects with the [illegible] BIGELOW (1909a) of the medusa from the P[illegible] to *Haliscera alba* Vanhöffen; the [illegible] I feel almost sure they belong to the [illegible] to BIGELOW the female gonads contain [illegible] stated), whereas in the North-A[illegible] rarely more than seven eggs in each [illegible] number observed. BIGELOW describes [illegible] not flat, as stated above, the [illegible] sometimes flat, sometimes laterally [illegible] serious obstacle against uniting the Pacific [illegible] one species, is the relative size of [illegible] according to BIGELOW "the radial ones are [illegible] than those between the canals," whereas [illegible] is a difference, it is not distinctly pro[illegible] specimen the eight perradial ten[illegible] of somewhat varying size, and the [illegible] the Pacific specimens, as seen from [illegible] bell margin, Pl. 33 fig. 11, in which the [illegible] groups are of very different size, and one [illegible] than some of those between the two [illegible] remarked that apparently the tentacles [illegible] off exactly at their point of issue from [illegible] we cannot be sure that the size of the [illegible] the endodermal core gives a true im[illegible] tentacle which in the living specimen [illegible] difference in the descriptions by [illegible] does not seem to me to be of [illegible] a specific difference between [illegible] As mentioned above (p. 7) [illegible] *Haliscera alba* Van[illegible] from *Haliscera conica*, [illegible] tentacles and 16 stato[illegible] *H*[illegible] Vanhöffen, which has 160

H[illegible] pelagic medusa, [illegible] North Atlantic [illegible] N. It was taken [illegible] south and [illegible] in 1908 [illegible] Thor, and [illegible] expedition in [illegible] and south [illegible] of the New [illegible] eight localities in the eastern tropical Pacific between about 0° and 25° S., where it was taken in vertical hauls from 300 fathoms to the surface. If the medusae found in these two widely separated areas really belong to one species, it is to be expected that this species will prove in future to have an extensive distribution in the deepsea areas of the oceans.

Genus **Botrynema** Browne 1908

Halicreasidae with eight radial canals, with sixteen groups of tentacles (two groups containing many tentacles in a single row in each octant) and eight solitary perradial tentacles.

In a previous paper (KRAMP 1942 p. 73) I have discussed this genus and its species. Numerous specimens had been collected in the deepsea areas west of Greenland, and I pointed out that all specimens from the Baffin Bay had an evenly rounded umbrella, whereas in all specimens taken in the Atlantic water south of the submarine ridge across Davis Strait the apical jelly had an enormous thickness and was provided with a very distinct and sharply defined apical knob (Pl. VI fig. 4). Though the two forms were alike in all other respects, I concluded that they belonged to two different species, the northern form, from the arctic basin of the Baffin Bay, certainly belongs to *Botrynema ellinorae* (Hartlaub), the southern form agrees perfectly with *B. brucei* Browne, originally described from the Antarctic Ocean. Later on I have examined extensive collections of *Botrynema brucei* from almost all parts of the Atlantic Ocean, and all these numerous specimens, except very young ones, possess the remarkably thick jelly and the distinct apical knob, which I had observed in the specimens from Davis Strait. They confirm, therefore, my supposition that the arctic *B. ellinorae* and the Atlantic *B. brucei* are two distinct species, though they differ from each other only in colour and in the shape of the umbrella, this difference however being remarkably constant.

In the paper quoted above I also called attention to the possibility that *Halicreas glabrum* Vanhöffen might be identical with *Botrynema brucei* Browne. The name *Halicreas glabrum* was given by VANHOEFFEN (1902 b) to a medusa taken by the "Valdivia" expedition in the tropical and southern parts of the Atlantic; the species was not properly described, and if the figure (Pl. 9 fig. 3) really has been drawn after a specimen of *Botrynema*, it gives an altogether wrong conception of the bell margin. I am therefore still of the opinion, expressed in my former paper (1942 p. 77) that "the name of the cosmopolitan species must remain *Botrynema brucei* Browne and should not be replaced by *glabrum*, because the description of that species is really beyond recognition."

The identity of the genera *Botrynema* Browne 1908 and *Allonema* Hartlaub 1909 was pointed out by BIGELOW (1913 p. 52); he examined some specimens taken in the northern Pacific and referred them to *B. ellinorae* (Hartlaub), but they most certainly belong to *B. brucei* (see KRAMP 1942 p. 76).

Both species are now so well known that I have very little to say about their morphology. I am able to state, however, that the tentacles have the same structure as in other species of Halicreasidae; in all specimens hitherto observed the tentacles are all broken off near their base, but in some of the specimens at my disposal I have found a few very young tentacles fully preserved (Pl. I fig. 9). The statocysts are likewise very similar to those of *Halicreas* and *Haliscera* (Pl. II fig. 3). They are placed in the 16 spaces between the groups of tentacles; in both species there are usually 3 statocysts in each of the interradial spaces and one or two on either side of the perradial tentacles, but in a few specimens of *B. brucei* I have found a perradial tentacle flanked by 3 statocysts on either side.

Fig. 4. Distribution in the northern Atlantic of: ● *Botrynema brucei*, new records; ⊗ do. records not yet published. × *Botrynema ellinoræ*

Botrynema ellinoræ (Hartlaub).

Alloionema ellinoræ Hartlaub 1909 p. 8, Pl. 76 figs. 3, 4, 6.
Botrynema ellinoræ Kramp 1912 p. 77.

I have seen no other specimens of this species than those taken by the "Godthaab" expedition 1928 and mentioned by me in 1942; they were taken in three localities in the deep basin of Baffin Bay, about 1000–1800 m below the surface at temperatures between 0° and ÷ 0.4°.

Further distribution (see the map, textfig. 4): Between East Greenland and Spitzbergen and north of Norway, in deep water (Hartlaub).

Botrynema brucei Browne.

Pl. I fig. 9, Pl. II fig. 3, Pl. VI fig. 1.

? Halicreas glabrum Vanhöffen 1902 b p. 70, Pl. 9 fig. 3
Botrynema brucei Browne 1908 p. 239, Pl. 1 figs. 8–9, Pl. 2 fig. 1.
Vanhöffen 1912 a p. 382, textfigs. 18–19, Pl. 25 fig. 5.
Botrynema ellinoræ Bigelow 1913 p. 53, Pl. 4 figs. 1–4.
? Halicreas glabrum Ranson 1936 p. 167
Bigelow 1938 p. 124.
Botrynema brucei Kramp 1942 p. 77.

North-Atlantic record:
Botrynema brucei Kramp 1912 p. 77.

Material (see the map, textfig. 4):

61°34'N, 19°05'W., $^{10}_{7}$1901, "Thor" St. 180		1 specimen.
62°19'N, 56°00'W., $^{11}_{6}$1928, "Godthaab" St. 21, 1000 a. 2500 m wire		
59°21'N, 37°56'W., $^{1-2}_{6}$1925, "Dana" St. 2308, 3000 m wire		70 spe
	2308, 4000 m	24
61°47'N, 52°55'W., $^{9}_{7}$1925	2404, 1900 m	8
61°13'N, 40°57'W., $^{25}_{7}$1925	2436, 1700 m	1
47°02'N, 31°15'W., $^{27-28}_{6}$31	4201, 4000 m	85
	4201, 5000 m	235
	4201, 6000 m	12
62°23'N, 16°05'W., $^{25}_{6}$1932	4402, 1000 m	20

In the map, textfig. 4, are included the localities in which this species was collected by the "Michael Sars" North Atlantic Deep-Sea Expedition 1910.

This species is easily recognizable, even if badly preserved. The gelatinous substance is very resistent and the medusa is, therefore, at once conspicuous by the characteristic shape of the umbrella. Moreover, in all the numerous specimens I have seen, traces of the sixteen groups of tentacles are always distinguishable even in specimens in a very poor condition. The female gonads have never been properly described, and unfortunately none of the female specimens at my disposal are sufficiently well preserved to allow a closer examination of their gonads. I am, therefore, unable to state whether they have contained many small eggs or few large ones. The male gonads are shield shaped, with the apex pointing towards the bell margin, and rather flat.

Colour. The stomach and the radial canals are bright scarlet, the circular vessel somewhat lighter, the tentacle stumps [illegible]

[illegible] made by [illegible] to the deep [illegible] deep strata in the [illegible] Greenland ("Dana" [illegible] and with bag [illegible] with 5000 m wire [illegible] 24 specimens with 1000 m [illegible] between Newfound[illegible] several different [illegible] were taken with less than [illegible] the 1½ m ring [illegible] 4000 m wire out, and [illegible] the deepest haul at this station, [illegible] larger net, 3 m in diameter, [illegible] captured only 12 specimens [illegible] records of this species likewise show [illegible] deepest strata of the oceans.

[illegible] Most of the localities men[illegible] part of the Atlantic deep [illegible] Greenland and south of Ice[illegible] was taken by the "Michael Sars" [illegible] 1910 [illegible] series of stations east of [illegible] hauls with 1500–3000 m [illegible] Browne (1908) [illegible] South America, and Vanhöffen [illegible] Ocean N.W. of the Gauss [illegible] Discovery collections I have seen [illegible] southern Atlantic, south of about [illegible] Ocean as far as about 140° E. [illegible] Vanhöffen is identical [illegible] North Atlantic and South Atlantic areas [illegible] several finds off the west coast [illegible] 42° S. and 25° N. (Vanhöffen 1902 b), [illegible] near the Bermudas (Bige[illegible] also found it in the Indian Ocean. As [illegible] Bigelow (1913) from the Bering Sea [illegible] belongs to *R. brucei*, it seems [illegible] occurs in other parts of the Pacific [illegible] world-wide distribution in the [illegible] except in the arctic seas, where it [illegible]

Fam. Trachynemidæ Gegenbaur 1856.

A[illegible] Halicreasidae constitute a well-[illegible] Trachynemidae s. str. and [illegible] a division into [illegible] the Aglauridae in [illegible] Halicreasidae as a [illegible] Trachynemidae [illegible] the Halicreas-[illegible] Aglaurinae, in [illegible] Uchida (1928) [illegible] apparently [illegible] others, since [illegible] Statocysts [illegible] is [illegible] 1856 follows [illegible] Trachy-[illegible] genera [illegible] of a [illegible] fairly sharp, in so far as the Aglaurinae all possess a well developed peduncle, whereas only one species of the Rhopaloneminae (*Crossota pedunculata* Bigelow) has a short peduncle. There are, however, other characters which might seem to be of no less taxonomic importance than the peduncle, particularly the shape of the gonads. In the majority of the Rhopaloneminae the gonads are linear along the radial canals, in most of the Aglaurinae they are sausage-shaped, pendent, hanging free in the bell cavity; but within both groups we also find globular gonads (*Sminthea* and *Arctapodema*, *Amphogona* and *Stauraglaura*), in *Homoeonema* the gonads form a continuous band around the base of the manubrium with outgrowths along the radial canals, and in two genera usually placed among the Rhopaloneminae (*Tetrorchis* and *Crossota*) they are pendent and very similar to the gonads of *Aglantha*. Finally in the peculiar species *Aglantha krampi* Ranson the gonads are linear, discontinuous, and placed along that part of the radial canals running down the stomachal peduncle.[1]) Uchida (1928) was probably not altogether wrong in referring *Crossota* to the Aglaurinae, though most of the species of that genus are destitute of a peduncle; in the shape of the gonads, however, *Crossota* resembles Aglantha.

A subdivision of the Trachynemidae into two sub-families, with or without a peduncle, thus seems somewhat artificial, but with our present imperfect knowledge of the minor structure of the various organs it is premature to attempt a natural classification of the several genera. At present I, therefore, follow Bigelow (1909 a pp. 101 and 117) and simply include the genera, formerly divided into two families or sub-families, into the one family Trachynemidae with the following definition, proposed by Bigelow and only slightly altered.

Trachymedusae with eight or more radial canals; without blind centripetal canals, with well-developed manubrium; with numerous tentacles, of either one or two kinds, but arranged in a single series, with or without a gelatinous peduncle; gonads either linear, globular, or pendent.

In the northern Atlantic the following genera are represented: *Rhopalonema*, *Homoeonema*, *Colobonema*, *Pantachogon*, *Crossota*, and *Aglantha*. An altogether uncertain species was described by Hartlaub (1909 p. 6) as *Trachynema arctica* from the arctic sea between Spitzbergen and Greenland; it was referred, with doubt, to the genus *Sminthea* by Broch (1929 p. 499) and Thiel (1932 a p. 152).

Genus Rhopalonema Gegenbaur 1856

Trachynemidæ with 32 tentacles, of two kinds, *i. e.* radial clubs, and inter- and adradial cirri; with enclosed statocysts; without a stomachal peduncle.

This is the definition as expressed by Bigelow (1909 a p. 127) in accordance with Vanhöffen's conception of the genus (1902 b p. 59).

I still believe that *Rhopalonema funerarium* Vanhöffen is a proper species distinct from *R. velatum* Gegenbaur, whereas *R. coeruleum* Haeckel is most probably identic with this latter.

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[1]) *Aglantha krampi* was described by Ranson (1932 pp. 1–19, fig. p. 6), and I appreciate the honour he bestowed upon me in naming it after me. Before publishing his description Mr. Ranson sent the specimens to me, and I can state that it really is a most peculiar species; in general appearance it is very like *Aglantha digitale*, but the gonads are entirely different in structure and position from those of *Aglantha*; moreover it differs from *Aglantha* in lacking the characteristic bands along the sides of the radial canals (Ranson calls them radial muscular bands, but I cannot see any muscle fibres in them). It therefore seems unavoidable to erect a new genus for this species, and I propose the generic name **Ransonia** nov. genus. The species should accordingly be named *Ransonia krampi* (Ranson).

Fig. 5. Distribution in the northern Atlantic of: ● *Rhopalonema velatum* *Rhopalonema funerarium*

Rhopalomena velatum Gegenbaur.

North-Atlantic records:

Rhopalonema coeruleum Browne 1906 p. 172.
- velatum Vanhöffen 1912a p. 371.
- Bigelow 1914 p. 20.
1918 pp. 388, 433.
1926 p. 54
Ranson 1936 p. 137.

Material (see the map, textfig. 5):

57°47′N, 11°13′W., $^{7}{}_{6}$1905. "Thor" St. 71. 1 specimen
49°01′N, 14°52′W., $^{6}{}_{6}$1906. 65. 300 m wire. 1 spec.
56°56′N, 9°01′W., $^{28}{}_{5}$1908. 11. 65 m 1
47°02′N, 31°45′W., $^{27\text{–}28}{}_{6}$31. "Dana" St. 1201. 50–6000 m wire
49°19′N, 30°22′W., $^{30}{}_{6}$1931. 1203. 50–600 m

In the two last-mentioned localities the species was taken at different depths, from very near the surface to about 1000 m down, though it is possible that some of the specimens taken in the deepest hauls were actually captured during the hauling in of the nets. At both stations the four uppermost hauls, with 50–600 m wire out, were made with the 2 m ringtrawl (S 200) with bag of stramin; at stat. 1201 four deeper hauls, with 2000–5000 m wire out, were made with a somewhat smaller net, 1½ m in opening diameter; in the deepest haul at each station the appliance (E 300) was much larger, 3 m in diameter, but with a bag of coarser net, not suitable to catch this small medusa. The duration of the hauls was also different. For the sake of comparison between the catches it is necessary, therefore, to re-calculate the number of specimens to a certain standard. In the table below are given: the appliance used at each haul, the duration of the haul, the actual number of specimens caught, and the number of specimens reduced to number per one hour's haul with S 200.

Stat.	m wire out	Appliance used	Duration of haul	Actual number of specimens	Reduced number	Diameter of specimens
1201	50	S 200	60 min	115	115	4–8 mm
	100			500	500	4–8
	300			20	20	
	600			10	10	4–8
	2000	S 150	240 min	55	15	6–8
	3000			55	15	5–8
	4000			60	25	5–8
	5000			60	25	4–9
	6000	E 300		1	1	7
1203	50	S 200	120 min	8	4	6–8
	100			9	4.5	6–9
	300			13	6.5	6–8
	600			10	5	6–9
	1000	E 300		0	0	

[illegible] at the upper [illegible] distribution in [illegible] areas of the [illegible] the "Dana" show [illegible] latitudes it mainly occurs [illegible] that the medusa was very [illegible] St. 4201 [illegible] of the Gulf Stream, [illegible] at St. 4203 which was near [illegible] Stream at St. 4205, still further [illegible] N. [illegible] W.) it was not taken at all.

[illegible] *R.* [illegible] certainly belongs to the upper [illegible] frequently found in deeper water layers, [illegible] far below the surface. At "Dana" St. 4201 [illegible] the haul with 100 m wire out [illegible] surface, but several specimens were also [illegible] deepest hauls and it is not likely that all of [illegible] in the upper strata during the hauling in of [illegible]

[illegible] of the specimens do not show any remark[illegible] distribution of the various size classes.

Geographical distribution: *Rhopalonema velatum* is a [illegible] medusa in the warmer parts of all the oceans, including [illegible] Mediterranean. In the western Atlantic its northern limit of [illegible] is off Georges Bank, about 40° N. On the European [illegible] known from the Bay of Biscay, and, as appears from [illegible] collections, it follows the Gulf Stream towards the western coasts of the British Isles, where it has been found as far north as 57°47' N., west of Scotland.

Rhopalonema funerarium Vanhöffen.

Pl. II figs. 4–5.

Dianaea funeraria Quoy & Gaimard 1827.
Rhopalonema funerarium Vanhöffen 1902 b p. 61, Pl. 9 fig. 2, Pl. 10 fig. 17, Pl. 11 fig. 31.
Rhopalonema funerarium Maas 1904 p. 28.
Rhopalonema coeruleum Maas 1905 p. 51, Pl. 10 figs. 67, 68.
funerarium Bigelow 1909 a p. 132.
coeruleum Mayer 1910 p. 380.
funerarium Vanhöffen 1912 a p. 372.
Bigelow 1917 p. 306.
Kramp 1921 p. 22.
Broch 1929 p. 496.
Ranson 1936 p. 114.
[illegible] Thiel 1936 p. 40.

North Atlantic record[illegible]
Rhopalonema funerarium Kramp 1921 p. 22.

M[illegible] (text-fig. 5).

[illegible] N. [illegible] W. [illegible] 1905 [illegible] St. [illegible] 2 specimens.
[illegible] N. [illegible] W. [illegible] 1906 [illegible] 1800 m wire 7 spec[illegible]

[illegible] "Thor" St. 181 S.W. of Ireland [illegible] previous paper (KRAMP 1921). [illegible] former opinion that [illegible] from *R. velatum* [illegible] preserved in formalin, but later [illegible] are not in very [illegible] could be referred to [illegible] VANHÖFFEN (1902 b) as *Rho*[illegible] MAAS 1905 [illegible] *R. coeruleum*. In [illegible] young *Colobonema* [illegible] of the gonads.

[illegible]

which nearly reach to the circular vessel, and by the configuration of the subumbrellar musculature in its upper parts around the manubrium, forming a star-shaped figure, as neatly represented in VANHÖFFEN's figures and similar to that found in *Colobonema*. In four of the specimens examined by me the manubrium is very short, only about one fourth as long as the height of the subumbrella cavity, but in one specimen it is more than half the height of the bell cavity, and the distal half part of the manubrium is narrowed and terminates in four distinct mouth lips (Pl. II fig. 4). The eight perradial tentacles have a broad and bulbous base, but are all broken off short. Most of the adradial cirri have disappeared leaving only a tiny protuberance on the bell margin, but some of the interradial cirri are present (Pl. II fig. 5); they are club-shaped with an almost spherical distal knob and a thin pedicel, in which the endoderm consists of one row of elongated, cylindrical cells surrounded by an ectodermal epithelium of large, flat cells. Several of the statocysts are preserved, and they are placed in the middle of the spaces between the other marginal organs (tentacles and cirri); they are not in such a condition that I can give a description of their minor structure, but I can state that they are enclosed in the same manner as in *R. velatum*. The diameter of the specimens is 9–17 mm, the height 7–12 mm (see KRAMP 1921).

This species clearly differs from *R. velatum* by the much greater length of the gonads, by the greater number of statocysts, and particularly by the position of these latter; the 8 or 16 statocysts in *R. velatum* are placed close by the base of the perradial tentacles and interradial cirri, whereas the 32 statocysts in *R. funerarium* alternate with the tentacles and cirri and are situated in the middle of the spaces between them. In the apex of the umbrella the mesogloea may be somewhat thickened in *R. funerarium*, but it never has a distinct apical knob as in *R. velatum*. *R. funerarium* also differs from the various species of *Rhopalonema* described by HAECKEL (*clavigerum*, *coeruleum*, and *polydactylum*) all of which are most probably identic with *R. velatum* Gegenbaur. It also seems to me improbable that, as indicated by BIGELOW (1909 a), *R. funerarium* should be identic with *R. striatum* Maas 1905; in *R. striatum* the gonads are broadly oval and situated in the proximal parts of the radial canals.

I cannot agree with THIEL (1936) in uniting all species of *Rhopalonema*, including *R. funerarium*, into one species, *velatum*, and when THIEL remarks (p. 45): "Nur KRAMP (1921) hat noch einmal *Rh. funerarium* als gute Art erwähnt," I may refer to BIGELOW (1909 and 1917) and BROCH (1929) who likewise retain *R. funerarium* as a distinct species.

Geographical distribution: *Rhopalonema funerarium* occurs in the deep and intermediate strata, and it seems to have its principal distribution in the tropical parts of the oceans. It is recorded from the eastern tropical Pacific (BIGELOW 1909 a), the Malayan Archipelago (MAAS 1905), the warm parts of the Indian Ocean (VANHÖFFEN 1902 b), the tropical Atlantic from the Cape Verde Islands southwards (VANHÖFFEN 1902 b and 1912 a), near Monaco in the Mediterranean (RANSON 1936), the surroundings of the Azores (RANSON 1936); in the western Atlantic it has been taken in one locality, off Georges Bank, 40°06' N., 68°06' W., at a comparatively high level, *viz.* in a vertical haul from 300 m (BIGELOW 1917). The localities south-west of Ireland mentioned above are the northernmost localities in which this species has been taken up to now.

Genus Homoeonema Maas 1893; Browne 1903.

The genus *Homoeonema*, erected by O. MAAS in 1893, has a very sad history, which is rather difficult to unravel, and the confusion is partly due do MAAS himself who, in some subsequent papers (1897 and, especially, in 1906 b) referred a number of quite different species to the same genus and thoroughly altered its definition. Several authors have attempted to solve the intricate taxonomic problems which have arisen around this genus, and their opinions are very different. As the genotype, *Homoeonema platygonon* Maas, belongs to the fauna of the North-Atlantic area, I take this opportunity to make a new attempt to settle the question as to what generic names ought to be applied to the several species which from time to time have been provided with the name of *Homoeonema*. I am quite aware that I cannot reach a final result, because some of the species are still unknown to me, so that I must rely on the descriptions in the literature. Nevertheless, the attempt must be made, and I hope that the following considerations may serve to elucidate the matter.

In Maas' original description (1893) *Homoeonema* was a genus of the family Trachynemidæ, and his definition is as follows. "Tentakel alle unter sich gleich, aber nicht in bestimmter, an die Zahl der Radiärkanäle gebundener Anzahl (8 oder 16) vorhanden, sondern zahlreich, 32 bis 64 und mehr."

The actual number of tentacles is usually not a character of generic value, but in connection with other features it is certainly of considerable importance whether the number is fixed or varying. The above definition excludes the genera *Rhopalonema* and *Sminthea* Gegenbaur 1856 and *Pantachogon* Maas 1893, as also the subsequently described *Colobonema* Vanhöffen 1902. On the other hand, if *Halicreas* and *Aglantha* and their allies are reckoned among the Trachynemidæ, as actually done by various authors, these are all covered by the definition of *Homoeonema*.

The genus originally comprised three species: *platygonon* nov., *militare* nov., and *elongatum* which was proposed as a new name for *Rhopalonema polydactylum* Haeckel; this latter is, however, most certainly a *Rhopalonema*, probably identic with *R. velatum*. *H. militare* is evidently a Trachynemid, as it has a distinct prismatic manubrium with four mouth-lips; it has broad, oval gonads in the distal half of the radial canals which, in the description, are said to be broad, though in the figure (Pl. I fig. 1) they appear to be fairly narrow. Vanhöffen (1902 b p. 56), Bigelow (1913 p. 14), and Thiel (1936 p. 21) refer this species to *Pantachogon*, because they regard this genus in a wide sense as comprising all Trachynemidæ with numerous tentacles, in one row, and all alike, without a stomachal peduncle (Bigelow 1913). Maas (1905 p. 51) is opposed to the transmission of *H. militare* to *Pantachogon*, because, in his opinion, *Pantachogon* is mainly characterized by discontinuous gonads which, however, is not correct (see below, p. 19). Considering that the number of tentacles in *H. militare*, according to the figure, is 48 as in *P. haeckeli*, I am inclined to think that the said authors are right in transferring it to *Pantachogon*, but I would not go so far as Thiel and identify it with the species *P. haeckeli*.

Homoeonema platygonon was a small medusa with broad gonads on the proximal portions of the radial canals, which likewise are remarkably broad; the species therefore bears a great resemblance to a Halicreasid, and several authors, including Maas himself in some of his later papers, really refer it to the Halicreasidæ.

A small Norwegian medusa was described by E. T. Browne (1903 p. 21, Pl. 2 figs. 2, 3) and by him referred to *H. platygonon* Maas; one of the difficulties in the forthcoming discussions is due to the uncertainty of this identification. The specimens were taken in Skjerstadfjord and Byfjord in Norway; I myself have seen 19 specimens from Herlofjord exactly agreeing with Browne's description (Kramp & Damas 1925 p. 318); two of them are now in the Zoological Museum of Copenhagen, and I have been able to re-examine them. This Norwegian medusa certainly belongs to the Trachynemidæ, because it possesses a prismatic manubrium and a mouth opening provided with four short lips, whereas the Halicreasidæ all have a large, circular stomach and a wide, circular mouth opening without indication of lips. But it differs from all other Trachynemidæ in the shape of the gonads, which are remarkably broad, occupying the proximal halves of the radial canals and connected with each other around the base of the stomach; it therefore cannot be included in any of the known genera of Trachynemidæ, except perhaps in *Homoeonema* sensu Maas 1893.

The stomach and its surroundings are not seen in Maas' figure of *H. platygonon*, but in the text he expressly states that the stomach is "gleich dem der typischen Formen," i. e. the species of *Rhopalonema* described on the preceding pages. It seems to me, therefore, that in spite of the deficiency of the figure we must regard *Homoeonema platygonon* Maas as belonging to the Trachynemidæ sensu strictu. When further comparing it with Browne's Norwegian medusa we will find that both of them have a small but distinct apical knob, numerous tentacles, and only four statocysts which, in both of them, are described as vesicular. The only difference is that the circular canal and the distal halves of the radial canals, beyond the broad gonads, in Browne's medusa "are not so broad and conspicuous as those figured by Maas." If Maas' medusa were a Halicreasid, it would be the only member of that family with vesicular statocysts; it is also much smaller than any known species of Halicreasidæ, and owing to the advanced development of the gonads it cannot be a young individual.

It therefore seems to me very likely that the medusæ described by Maas and by Browne really belong to the same species, *Homoeonema platygonon*; and if this is agreed upon, it becomes the only species which can bear the generic name *Homoeonema*, because no other known medusa can be congeneric with it such as we know it from Browne's description. Their identity, it is true, cannot be decided with certainty; but even if the supposed identity of the two medusæ be denied, it seems to me that the generic name ought never to be attached to any other species either of Trachynemidæ or of Halicreasidæ (see below). In such case *Homoeonema platygonon* Maas must be regarded as an obsolete species, and, if the rules of nomenclature were to be stictly followed, the medusa described by Browne should be provided with a new name; but as the Norwegian medusa, which was well described by Browne, has ever since been known under the name of *Homoeonema platygonon* and has repeatedly been recorded from new localities (Kramp & Damas 1925, Runnström 1932, Bernstein 1934, Jaschnov 1939), it seems wise to retain this name and designate Browne as its author, adding *Homoeonema platygonon* Maas as a doubtful synonym.

In his paper on the "Albatross" medusæ, Maas (1897 p. 22) described a new species, *Homoeonema typicum*; he referred it to *Homoeonema* because it was a "Trachynemide mit zahlreichen und gleichartigen kurzen Tentakeln," but it is entirely different from *H. platygonon*, and in 1905 Maas himself transferred it to *Colobonema* Vanhöffen 1902 together with a number of specimens taken by the "Siboga" and presumably belonging to the same species; this view has been accepted by the majority of subsequent authors, who only differ as to the question of whether the two species, *typicum* Maas and *sericeum* Vanhöffen, are identic or not.

In his "Valdivia" paper (1902 b) Vanhöffen gives a new definition of *Homoeonema*: »Trachynemide mit 8 perkanalen und 72 oder mehr interkanalen Tentakeln, mit am proximalen Ende der Radiärkanäle dem Magen anliegenden Gonaden,« in contradistinction to *Pantachogon*, in which the number of intercanal tentacles does not exceed 56, and the oval or spindle shaped gonads are placed along the radial canals. He transfers *Homoeonema militare* Maas to *Pantachogon*, and describes two new species of *Homoeonema*, *H. amplum* and *H. macrogaster*; both of them have club-shaped statocysts and numerous (more than 80) tentacles, and the gonads are almost spherical swellings on the eight radial canals close by the stomach. They differ so considerably from *Homoeonema platygonon* (sensu Maas as well as sensu Browne) that they cannot belong to the same genus, and it is also impossible to place them within any other of the genera known by then. It was fully justified, therefore, when Maas (1906 b) erected a new genus, *Isonema* (by Ranson 1936 altered to *Arctapodema* [illegible] as the geno[illegible] some of the Hali[illegible] history of *Homoe*[illegible]

[illegible] Siboga paper (1905 [illegible] discussion of the matter [illegible] the Belgica Antarctic Expedi[illegible] Fauna Arctica (1906a [illegible] of the new genus *Isonema* [illegible] entirely new definition of *Homoe*[illegible] Gonaden, mit breiten [illegible] mit weitem ringförmigem Magen. [illegible] Octanten von gleicher Structur, [illegible] Mit freien Sinneskolben." [illegible] is completely identic with *Haliscera* [illegible] 1902 [illegible] comprises VANHOEFFEN's species of that [illegible] species *Homoeonema (Haliscera) racovitzai*" (which [illegible] see above p. 6[illegible], and also *Homoeonema* [illegible] MAAS to unite these species into one [illegible] compared the original specimen of *Hali*[illegible] with supposed new specimens of *Homoeonema* [illegible] collected in the subtropical Atlantic by the [illegible] no further information of these specimens is [illegible] E. T. BROWNE. These latter specimens, [illegible] were collected in the Bay of Biscay, are [illegible] BROWNE (1906 p. 174), and I have not [illegible] they were small specimens of a Hali[illegible] of the same species which I have described [illegible] sp. They are very different from [illegible] specimens of *Homoeonema platygonon* previously [illegible] BROWNE 1903 as he was uncertain as to their [illegible] to MAAS, and on his authority they [illegible] in BROWNE's paper on the medusae [illegible] MAAS was certainly right in referring [illegible] same genus as *Haliscera alba* and the new [illegible] he must have forgotten the exact appear[illegible] specimen of *Homoeonema platygonon*; it [illegible] that he now refers that species to the [illegible] expressly states 1906a p. 190 that in BROWNE's [illegible] of the Norwegian medusa he recognizes [illegible] and as emphasized above the [illegible] to Halicreasid, but belongs to [illegible]

[illegible] the two alternatives: 1) If *Homoe*[illegible] BROWNE 1903 is the same as *Homoeonema* MAAS 1893, *Homoeonema* is a genus of the Trachyne[illegible] *Haliscera* Vanhöffen 1902 must [illegible] 2) If BROWNE's Norwegian medusa is something [illegible] Maas 1893 as an obsolete genus, [illegible] replace that of *Haliscera* [illegible] from the subtropical [illegible] 1906 were referred [illegible] specimens of Hali[illegible]

[illegible] from the [illegible] conception [illegible] of *Hali*[illegible] MAAS [illegible] of [illegible] of the type [illegible] above, [illegible] Vanh. and [illegible] *platy*[illegible] [illegible] of [illegible] has

In MAYER's Medusae of the World (1910 pp. 383 ff.) *Homoeonema* comprises the species *platygonon* Maas, *militare* Maas, *typicum* Maas (including *Colobonema sericeum* Vanh.), *amplum* Vanhöffen, and *macrogaster* Vanhöffen. MAYER thus does not accept *Isonema*. VANHOEFFEN, on the other hand, in his paper on the craspedote medusæ of the German South-Polar Expedition (VANHOEFFEN 1912a p. 371) approves of *Isonema* as the generic name of *I. amplum* and describes three new species which he refers to the same genus: *antarcticum*, *australe*, and *tetragonicum*; the affinities of these three species seem to me very doubtful, but will not be discussed in this place.

UCHIDA (1928 p. 76) places *Homoeonema* in the subfamily Halicreasinæ, but includes *H. typicum* Maas in the genus. BROCH, in the "Nordisches Plankton" (1929) follows MAYER, and THIEL (1931) provisionally takes the same position. THIEL also records *Homoeonema platygonon* and *militare* from localities in the Antarctic Ocean, but the specimens were so badly preserved that the identification seems to me open to doubt. In his papers on the Hydromedusæ of the "Meteor" Expedition (1935 and 1936) THIEL has yielded to a most deplorable tendency to unite as many different species as possible. He recognizes only two species of *Halicreas* (including *Haliscera*): *Homoeonema militare* Maas, *H. typicum* Maas, and *Colobonema sericeum* Vanhöffen are united with *Pantachogon rubrum*; and *Isonema amplum*, *macrogaster*, *tetragonicum*, *antarcticum*, and *australe* are regarded as synonyms of *Homoeonema platygonon* sensu Browne together with *Pantachogon scotti* Browne (pars). On the present occasion I shall not enter upon the critical remarks which involuntarily are called forth by this astonishing assertion.

RANSON (1936) has treated in detail the difficulties of *Homoeonema* and put forth some well chosen remarks, with which I fully agree, though I cannot follow him in his final conclusion. He deplores the confusion brought into the nomenclature of *Homoeonema* and says (p. 137): "Les synonymies sont devenues incompréhensible," and he deplores (p. 170) that "O. MAAS (1906) n'a pas voulu accepter le nom *Haliscera* Vanhöffen dont il a fait un synonyme de *Homoeonema*. Cet auteur a eu tort de vouloir conserver, à tout prix, un nom de genre créé par lui, mal défini d'après de mauvais échantillons, et dont il a changé complètement le sens plusieurs fois." RANSON thus retains the name *Haliscera* sensu Vanhöffen, and he will regard *Homoeonema* as a synonym of *Haliscera*; he has seen the specimen from the subtropical Atlantic (near the Azores) mentioned by MAAS (1906) as *Homoeonema platygonon*, and he states that it belongs to *Haliscera*. But then he takes it for granted that the original specimen of *H. platygonon* was the same species, and he therefore records the specimen from the Azores under the name of *Haliscera platygonon*. In this respect I cannot agree with RANSON. I have no doubt that the specimen from the Azores is a *Haliscera*, but as stated above, various details in MAAS' description (1893) make it probable that the original specimen was a Trachynemid; at any rate, its supposed affinity to the Halicreasidæ is far from being established and cannot justify a decisive reference of the species into the genus *Haliscera*.

RANSON's list of synonyms (p. 175) also seems to me objectionable; it includes *Homoeonema platygonon* Browne 1903 which certainly is no *Haliscera*, and THIEL 1931 which is a doubtful record.

The above considerations on the synonymy of "*Homoeonema*" may be summarized as follows:

Species belonging to the Family **Trachynemidæ**.

Homoeonema platygonon Browne 1903 **Genotype.**

? Homoeonema platygonon Maas 1893
Homoeonema platygonon Browne 1903

non Homoeonema platygonon Maas 1906 b.

non Homoeonema platygonon Browne 1906.
non Haliscera platygonon Ranson 1936.

Pantachogon militare (Maas 1893).

Homoeonema militare Maas 1893.
Pantachogon militare Vanhöffen 1902 b.

Colobonema typicum (Maas 1897).

Homoeonema typicum Maas 1897.
Colobonema typicum Maas 1905.

Arctapodema amplum (Vanhöffen 1902). Genotype.

Homoeonema amplum Vanhöffen 1902 b.
Isonema amplum Maas 1906 b.
Isonema amplum Vanhöffen 1912 a.
Pantachogon amplum Bigelow 1913.
Arctapodema amplum Ranson 1936.

Arctapodema macrogaster (Vanhöffen 1902).

Homoeonema macrogaster Vanhoffen 1902 b.
Isonema amplum Maas 1906 b.
Pantachogon macrogaster Bigelow 1913.
Arctapodema? amplum Ranson 1936.

Isonema antarcticum, australe, and *tetragonium* Vanhoffen 1912 a are Trachynemidæ of doubtful systematic position.

Species belonging to the family Halicreasidæ.

Haliscera alba Vanhöffen 1902. Genotype.

Haliscera alba Vanhöffen 1902 b.
Homoeonema album Maas 1906 a.
Halicreas alba Mayer 1910.
Haliscera alba Vanhöffen 1912 a.

non Homoeonema album Bigelow 1909 a.

Haliscera racovitzæ (Maas 1906).

Homoeonema (Haliscera) racovitzæ Maas 1906 b.
Homoeonema recovitzæ Bigelow 1909 a.
Halicreas racovitzæ Mayer 1910.
Haliscera racovitzæ Vanhöffen 1912 a.

Haliscera bigelowi Kramp 1946.

Homoeonema album Bigelow 1909 a.
Haliscera bigelowi Kramp 1947.

? Homoeonema platygonon Maas 1906 a.
? Homoeonema platygonon Browne 1906.
? Haliscera platygonon Ranson 1936.

The genus *Homoeonema* may now be defined as follows: Trachynemidæ with eight radial canals; with numerous tentacles structurally alike; with gonads forming a continuous band around the base of the stomach extending outwards along the radial canals, without a stomachal peduncle. Only species: *platygonon* Browne 1903.

Homoeonema platygonon Browne.
Pl. II fig. 6.

North-Atlantic records:
? Homoeonema platygonon Maas 1893 p. 15, Pl. 1 fig. 8.
Homoeonema platygonon Browne 1903 p. 21, Pl. 2 figs. 2–3.
Kramp & Damas 1925 p. 318.
Runnström 1932 p. 30.
Homoeonema platygonon Bernstein 1934 pp. 26, 53.
Jaschnov 1939 p. 111.

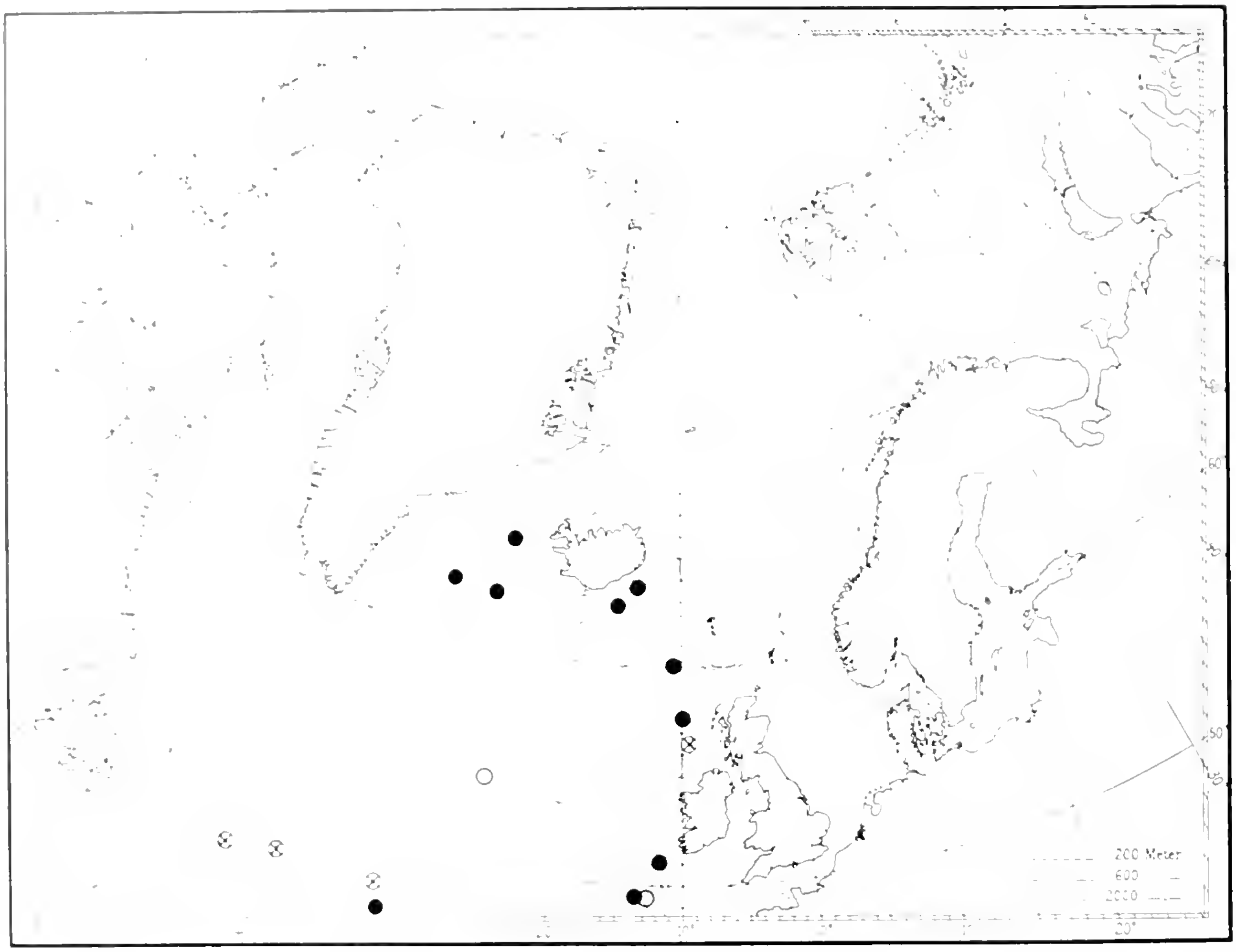
Material:
Herlofjord, Norway, October 1908, 300 m.

Herlofjord is in the neighbourhood of Bergen, where professor D. Damas collected 19 small specimens (1–2 mm in diameter) of this medusa. I saw these specimens, when I stayed with prof. Damas at Liége in 1920; later on they were sent to Bergens Museum, except two specimens which I secured for our museum at Copenhagen. The shape of the umbrella is not quite as high as shown in the figure by Browne, somewhat more like Maas' figure. The gonads (Pl. II fig. 6) have a somewhat wavy outline and are attached to the subumbrella along fairly narrow lines; on the subumbrella side of the radial canals the gonads are continuous, as also seen in Browne's figure, and the gonads are likewise confluent in the interradii. As a matter of fact, therefore, the gonads form one uninterrupted band around the base of the stomach with outgrowths along the eight radial canals, about halfway to the bell margin. In the specimens examined by me there are about 10–11 tentacles in each octant, thus altogether 80 or more.

The specimens described by Browne were taken in Skjerstadfjord (about 67¼° N.) in April and in Byfjord (near Bergen) in November, the present specimens were found in Herlofjord (= Herdlafjord) in October; Runnström (1932) also found it in the neighbouring Hjeltefjord, and he gives valuable information on its occurrence in Herdlafjord, where he has taken it throughout the year, with maximal occurrence in the autumn and minimum in spring; the largest specimens (2–3 mm) occur in the autumn, but in March only very small specimens (about ½ mm) are found. Runnström further states that it belongs to the deep strata in the fjord, mainly between 200 and 400 m, but during the autumn young specimens may be found at higher levels, 50–100 m below the surface. This species thus is quite common in the fjords in the surroundings of Bergen.

It is very interesting that *Homoeonema platygonon* also has been found in some localities in the northern part of the Kara Sea, partly in fairly deep water (155–100 m), partly in the upper strata, 17–0 and 10–0 m (Bernstein 1934). This Russian author takes it for granted that the specimen taken by the German "Plankton-Expedition" between Iceland and the south point of Greenland (Maas 1893) belongs to the same species as the Norwegian specimens, and he discusses its geographical distribution: "The zoogeographical character of this form remains uncertain. Our knowledge is not sufficient to explain its appearance in the Kara Sea. It is possible that this small medusa . . . has escaped the attention of the planktonists, and that it has a greater distribution in the arctic seas. If between Iceland and Greenland it lives in a region of cold currents, it is even possible that *Homoeonema platygonon* is an arctic medusa. Future investigations may probably bring this information. So far it thus seems probable that the connection between the western distribution of this medusa and its occurrence in the Kara Sea may be accomplished as well through the Barents Sea as through the Polar Basin."

In the intermediate and deep strata in Hjeltefjord, Herdlafjord, and Byfjord in Norway the temperature of the water is about 7° C., with only slight variations during the year (rarely below 6° and rarely above 8°), and the plankton consists of a mixture of boreal and arctic species. The zoogeographical character of *Homoeonema platygonon*, therefore, is not determined by its occurrence in these fjords; its occurrence in the Kara Sea, however, seems to indicate that it is an arctic species. Its presence in the Atlantic between Iceland and the south point of Greenland is not very elucidating, partly because we are not sure of the identity of the medusa found there, partly because the locality is in a mixed area with water masses of different origin. Bernstein is right, therefore, that the zoogeographical character of this species



[illegible] Atlantic of *Colobonema sericeum*. ● new records; previous records, records not yet published.

[illegible] has been found in other regions. [illegible] from numerous localities in the central [illegible] Atlantic [illegible] antarctic seas and illustrates its [illegible] 1936, fig. 5 p. 321) but, as mentioned [illegible] unreliable because he identifies *H. platy*[illegible] number of other species.

[illegible] Colobonema Vanhöffen 1902

[illegible] of one kind, 32 in number, [illegible] 16 radial, and finally the 8 inter[illegible] free club-shaped statocysts. [illegible] radial canals without a stoma [illegible] of the subumbrella muscular [illegible]

[illegible] (1938) that *Colo*[illegible] from *Panta*[illegible] succession in the [illegible] of the configura[illegible] *Pantachogon*, [illegible] around the [illegible] corresponding [illegible] pointed rays [illegible] radial canals [illegible] out by [illegible] Russell as [illegible] The dia[illegible]

Colobonema sericeum Vanhöffen.

Principal references

Colobonema sericeum Vanhöffen 1902 b p. 57, Pl. IX fig. 1, Pl. XII figs. 39–42.
Colobonema typicum Maas 1905 p. 53, Pl. X figs. 62–65
sericeum Bigelow 1909 a p. 133, Pl. 2 figs. 1, 5, Pl. 15 fig. 12.
Homoeonema typicum Mayer 1910 p. 385.
Colobonema sericeum Vanhöffen 1912 a p. 372.
typicum Bigelow 1913 p. 46.
typicum Bigelow 1919 p. 322.
Homoeonema (Colobonema) sericeum Broch 1929 p. 500.
Colobonema sericeum Ranson 1936 p. 152, Pl. II figs. 11–15.
typicum Bigelow 1938 p. 117.

North-Atlantic records

Colobonema sericeum Browne 1906 p. 172.
Kramp 1920 p. 5.
1921 p. 28.

Material (see the map, textfig. 6)

62°25′ N 28°30′ W, $^{11}/_{6}$1896	"Ingolf" St.	83.	1 specimen
65°00′ N 28°10′ W, $^{19}/_{6}$1904	"Thor" St.	152.	1 specimen
51°00′ N 11°13′ W, $^{15}/_{6}$1905		82.	4 specimens
60°00′ N 10°35′ W, $^{28}/_{6}$1905		165.	1000 m wire, 1 spec.
57°46′ N 9°55′ W, $^{1}/_{9}$1905		167.	1 specimen
49°27′ N 13°33′ W, $^{11}/_{6}$1906		76.	2 specimens
49°22′ N 12°52′ W, $^{4}/_{6}$1906		181.	1800 m wire, 3 spec.

62°35'N. 32°53'W., $^{27}_{7}$1925.	"Dana" St. 2437, 1900 m wire	1 spec.
17°02'N. 31°45'W., $^{27-28}_{6}$31.	4201, 2000 m	15
	4201, 1000 m	7
	4201, 5000 m	2
62°45'N. 16°01'W., $^{7}_{5}$1934.	5083, 2000 m	6
63°38'N. 11°13'W., $^{18}_{5}$1934.	5113, 2000 m	1

The morphology of *Colobonema sericeum* is comparatively well known, with only a few uncertain points still awaiting elucidation. Bigelow (1938 p. 118) is of the opinion that the stump-like appearance of the tentacles is normal, and not the result of mutilation; I do not think this view is correct; in several specimens the tips of the tentacle stumps show distinct marks of being broken, so that evidently the tentacles have been longer. An account of the rate of development of the tentacles and the gonads in relation to size of specimens will be postponed to another occasion, when I have finished the examination of the extensive collections from other geographical areas.

As a rule the manubrium of the preserved specimens is strongly contracted and very short; but sometimes the manubrium has been preserved in a more or less extended condition, and such specimens perfectly resemble that figured by Maas (1905, Pl. X fig. 62) from the "Siboga" collection. We can therefore state with certainty that the Siboga specimens of *Colobonema* belong to *C. sericeum*. But I must still maintain my former opinion (Kramp 1924 p. 28) that the "Albatross" specimen, as it is described and figured by Maas (1897, *Homoeonema typicum*) cannot be referred to the same species, partly on account of the much greater number of tentacles, and also because the gonads are much shorter. Ranson (1936 p. 153) has ably expressed the same opinion of *H. typicum* in the following way: "elle est différente de *Colobonema sericeum* ou la description . . . est tellement défectueuse que nous ne devons pas en tenir compte." There is no reason, therefore, to introduce the specific name of *typicum* for the well described and well known medusa *Colobonema sericeum* Vanhöffen.

Remarks on the vertical distribution: In the northern Atlantic as well as in its other areas of distribution, *Colobonema sericeum* is a distinctly bathypelagic medusa. At the "Dana" St. 4201 the hauls containing specimens of this species were all made with the 1½ m ringtrawl with bag of stramin ("S. 150") hauled horizontally during four hours; the greatest number of specimens were taken in the haul with 2000 m wire out, and several of them were young ones (height of bell 4–27 mm), unfortunately, they are all in a bad state of preservation, unsuitable for closer examination; the specimens caught with 1000 and 5000 m wire out were 21–36 and 25–33 mm respectively. This indicates that the young individuals preferably occur at a higher level than the fully developed ones. The other North-Atlantic catches, from which the depth of capture is known, seem to confirm this (e. g. the only specimen taken with 1000 m wire out, "Thor" St. 165 (1905), was only 14 mm high); but further investigations must decide, whether this is the general rule.

Horizontal distribution: The three specimens from "Thor" St. 181 (1906) S. W. of Ireland, were mentioned by me in a previous paper (Kramp 1921); moreover one specimen is recorded from a locality, 51°05' N. 26°08' W., taken by the Norwegian ship "Armauer Hansen" (Kramp 1920). On the map, textfig. 6, are also included some localities in which this species was taken by the "Michael Sars" North Atlantic Expedition in 1910, not yet published. Browne (1906) records a specimen from the Bay of Biscay.

Colobonema sericeum is apparently generally distributed in the deep parts of all the great oceans; it has never been taken in the Mediterranean, and its distribution northwards in the Atlantic is evidently limited by the continental shelves and the submarine ridges between Scotland, Iceland, and Greenland. It has not yet been found in the southern part of Davis Strait, where several others of the bathypelagic medusæ from the Atlantic Ocean are known to occur.

Genus Pantachogon Maas 1893

Trachynemidæ with 64 or more tentacles all of one kind; with gonads extending along the radial canals, with free, club-shaped statocysts; without a stomachal peduncle; with the apical outlines of the subumbrella muscular fields forming an entire circle.

In the original definition of this genus, Maas (1893 p. 17) emphasized the supposed discontinuity of the gonads as the most characteristic feature, and in his "Siboga" paper (1905 p. 51) he maintains that this is not due to the state of preservation; but it must now be regarded as an established fact that it really is so (see Kramp 1912 p. 78). We can also state that *Pantachogon rubrum* Vanhöffen (1902 b) is identical with the genotype, *P. haeckeli* Maas (1893). Adult specimens of this species always have 64 tentacles; only two more species are known, *P. scotti* Browne (1910) with about 120 tentacles and *P. militare* (Maas) (formerly *Homoeonema militare*, see above, p. 15). The relation between *Pantachogon* and *Colobonema* has been discussed above (p. 18).

Pantachogon haeckeli Maas.

Pl. II figs. 7–8

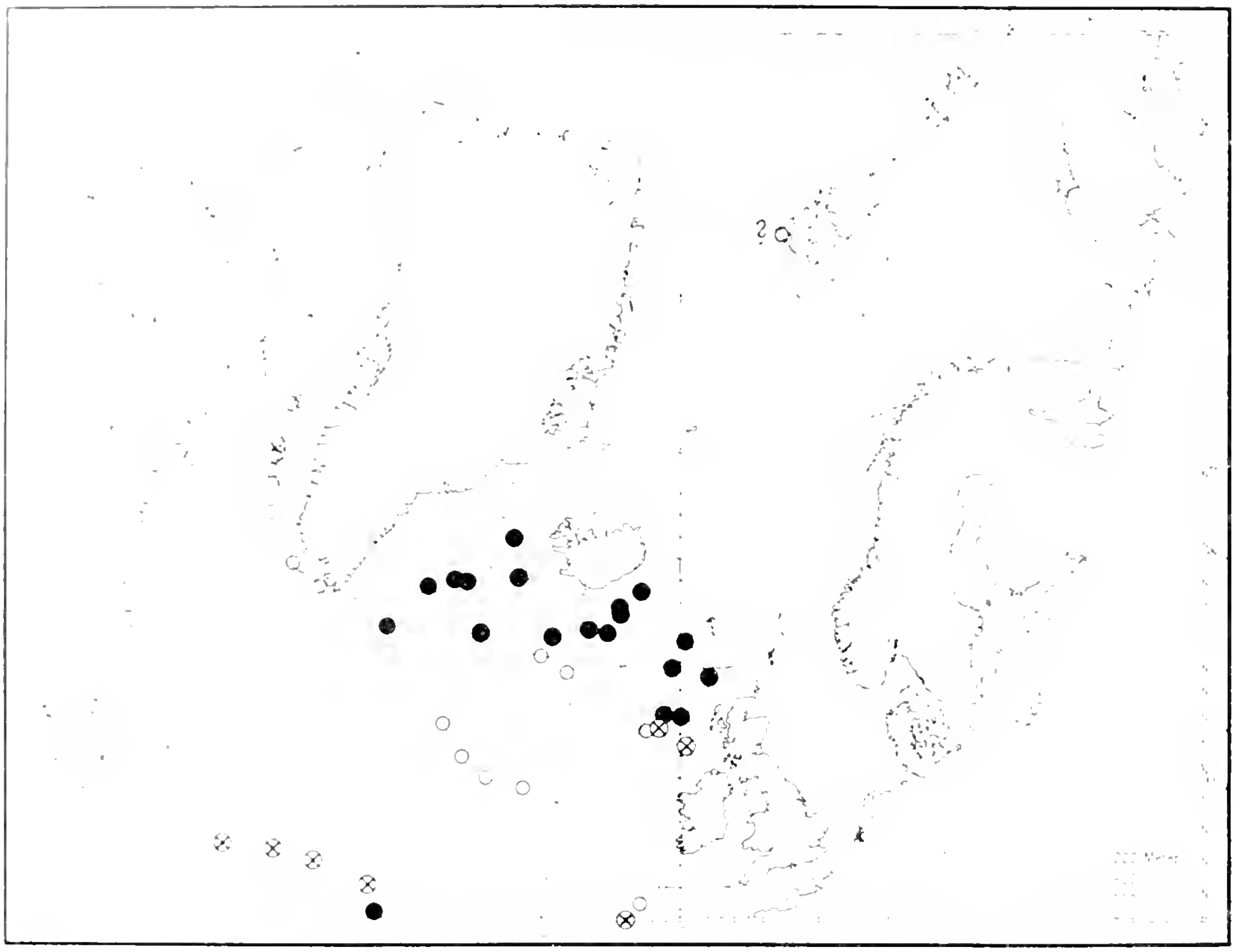
North-Atlantic records.

Pantachogon haeckelii Maas 1893 p. 17, Pl. I fig. 2.
? - - 1901 p. 29.
rubrum Kramp 1913 a p. 271.
1914 p. 133.
1920 p. 5.
1921 p. 22.
haeckeli Kramp 1912 p. 78.

Material (see the map, textfig. 7).

61°15'N. 9°35'W., $^{21}_{5}$1904.	"Thor" St. 93,	1 specimen
65°00'N. 28°10'W., $^{19}_{6}$1904.	152	5 specimens
64°30'N. 17°08'W., $^{11}_{7}$1904.	183,	7
57°17'N. 11°33'W., $^{7}_{6}$1905.	71,	3
60°00'N. 10°35'W., $^{29}_{8}$1905.	165, 1000 m wire	1 spec.
57°16'N. 9°55'W., $^{1}_{9}$1905.	167, 1500 m	5
60°59'N. 22°29'W., $^{29}_{5}$1925.	"Dana" St. 2306, 2000 m wire,	125 sp.
60°20'N. 29°21'W., $^{31}_{5}$1925.	2307, 1500 m	65
59°21'N. 37°56'W., $^{1-2}_{6}$1925.	2308, 4000 m	2
	2308, 3000 m	1200
62°35'N. 32°53'W., $^{27}_{7}$1925.	2437, 1900 m	1
63°19'N. 26°50'W., $^{24}_{5}$1928.	"Godthaab" St. 1 1000 m	20
17°02'N. 31°45'W., $^{27-28}_{6}$31.	"Dana" St. 4201, 2000 m	270
	4201, 3000 m	630
	4201, 4000 m	180
	4201, 5000 m	180
62°23'N. 16°05'W., $^{25}_{6}$1932.	4402, 2000 m	235
	4402, 3000 m	250
	4402, 4000 m	500
61°52'N. 35°30'W., $^{15}_{8}$1933.	4686, 600 m	
62°36'N. 32°18'W., $^{16}_{8}$1933.	4687, 2000 m	250
62°45'N. 16°01'W., $^{7}_{5}$1934.	5083, 2000 m	33
63°38'N. 11°13'W., $^{18}_{5}$1934.	5113, 1800 m	165
	5113, 2000 m	200

Among these numerous specimens very few are in such condition that a closer examination of their morphology can be carried out; in a few cases, however, I have seen tentacles which are somewhat more than "stump-like", i. e. they are broken at some distance from their base, and I have no doubt that they have been of greater length.



[illegible] Atlantic [illegible] *Pantachogon haeckeli* ● new records; ○ previous records; ⊗ records not yet published.

[illegible] each of them containing one [illegible]

[illegible] looked for young specimens which might [illegible] development of the tentacles, but they [illegible] bad state of preservation. I shall com- [illegible] observations which I was able to make.

[illegible] 2 mm high there are 2 tentacles and one [illegible] between every successive pair of radial [illegible] where there is one, interradial. [illegible] In a few specimens 3 mm [illegible] between the radial canals, but it cannot [illegible] youngest. When the height of [illegible] number of tentacles between the canals [illegible] the middle one (the [illegible] In one specimen, 5 mm high, [illegible] all alike, and in three [illegible] of the seventh, final [illegible] the left. In the [illegible] *Pantachogon haeckeli* [illegible] in which [illegible] four other tentacles

[illegible] tentacle does not [illegible] appears that in [illegible] interradial. I have [illegible] found that [illegible] radial canal [illegible] exceptionally, [illegible] be called se- [illegible] sectors between the four mouth lips, whereas there is always a tentacle exactly opposite the "primary" canals which agree in position to the lips; as, however, the cases observed are very few, I am not sure that it is the general rule.

Occurrence in the North Atlantic. MAAS (1893) originally recorded *Pantachogon haeckeli* from a locality south of Iceland, Lat. 60° N., and in 1904 he referred, with some doubt, a mutilated specimen from Spitzbergen to the same species. In three papers (KRAMP 1913, 1914, and 1942) I have dealt with its occurrence in the waters west of Greenland, and moreover I have seen a number of specimens collected by the "Armauer Hansen" in six localities in deep water west and east of the Rockall plateau (KRAMP 1920). Some few specimens, taken by the "Thor" south-west of Ireland in 1906 and in the Bay of Biscay in 1909, were recorded by me in 1924. On the map, textfig. 7, are also given the localities, at which it was taken by the "Michael Sars" North-Atlantic Expedition in 1910 within the area dealt with here.

The species seems to be generally distributed over the deep-sea areas of the northern Atlantic; in the north-eastern part the distribution is limited by the continental shelves and the submarine ridges Scotland-Iceland-Greenland (apart from the doubtful record from Spitzbergen, MAAS 1904); the finds in this area are all outside the 600 m line. In the waters west of Greenland, on the other hand, it has occasionally been taken in more shallow water. It has its main occurrence in the deep strata, but is not strictly limited to the deep sea. Within the area under consideration it has been taken in altogether 75 hauls from which the depth of the haul is known; an enumeration of the catches made by the "Tjalfe", "Godthaab", "Thor", "Dana", "Armauer Hansen", and "Michael Sars" will show that 65 catches were made with 1000–5000 m wire out (about 660–3300 m below the surface); west of Greenland the "Tjalfe" took numerous specimens in two hauls with 800–900 m wire out, and on five occasions it has been taken with 600 m wire out. Exceptionally it has even been found at still higher levels: 400 m wire ("Godthaab" St. 18, 1 specimen), 300 m wire ("Godthaab" St. 5, 4 specimen), and 400 m wire ("Michael Sars" St. 81, east of the Newfoundland Bank, 9 specimens). In hauls with less than 800 m wire the number of specimens caught has always been very small, but from about 500 m below the surface downwards the species is frequently taken in great abundance: at the "Dana" St. 2308, east of the south point of Greenland, no less than about 1200 specimens were taken in a haul of 2 hours' duration with the 2 m ringtrawl with 3000 m wire out. *Pantachogon haeckeli* is thus a predominantly bathypelagic medusa, though occasionally it may ascend into higher strata, especially in colder regions; in certain areas, e. g. in the waters west of Greenland, it may therefore be carried with the currents into the coastal waters; thus it was taken by the "Godthaab" expedition near the south point of Greenland and off the entrance to Hudson Strait, and it is also able to cross the submarine ridge in Davis Strait and penetrate into the deep basin of Baffin Bay (for details, see KRAMP 1942 pp. 78–79).

In the hauls from the "Dana" the specimens caught in the stramin-nets varied in size from 3 or 5 mm to 10 or 11 mm in diameter; specimens more than 11 mm wide were found on two occasions only: St. 4201, 5000 m wire (12 mm), and St. 2308, 3000 m wire (13 mm). (In Baffin Bay, "Godthaab" St. 51, one specimen 11 mm wide was taken in a haul with 3000 m wire out). The measurements of the specimens present no evidence of a difference in the vertical distribution of the various size classes of individuals.

Geographical distribution: *Pantachogon haeckeli* is generally distributed over the deep parts of all the oceans from the slopes of the antarctic continent to the Bering Sea and to the submarine ridges separating the North-Atlantic deep-sea area from the arctic basins.

Genus **Crossota** Vanhöffen 1902.

Trachynemidæ with 8 or more radial canals; with numerous densely crowded tentacles all of one kind; with pendent, sausage-shaped gonads on the radial canals; with free, club-shaped statocysts; with or without a short stomachal peduncle.

Since this genus was established by VANHÖFFEN (1902 b p. 72) the supposed multiserial position of the tentacles has been emphasized by all subsequent authors as the most characteristic feature of the genus. In my paper on the "Godthaab" medusæ (KRAMP 1942 p. 80) I expressed a different opinion and doubted the correctness of one of VANHÖFFEN's figures (Pl. 12 fig. 17), and now, having examined a large number of well-preserved specimens of the genotype, *Crossota brunnea* Vanhoffen, I can state that I was entirely right in my view: the tentacles of *Crossota* are not placed in several rows; they all make their appearance on the bell margin proper in close connection with the ring canal, but during growth their basal portion becomes adnate to the lower margin of the exumbrella; in older tentacles, therefore, the point of issue of the free portion is gradually displaced a little outwards on the exumbrella. If this should be called an arrangement in several rows, it is at least effected in quite another way than that illustrated by VANHÖFFEN in his figure 17, in which the youngest tentacles are the farthest removed from the ring canal, implanted in the jelly of the exumbrella without the slightest connection with the ring-canal. In the other species which I have seen, the arrangement is the same as in *C. brunnea*, but the displacement of the free portion is less pronounced (see below).

VANHÖFFEN gave no definition of the genus but a comparatively thorough description of the species *Crossota brunnea*, which was found to be widely distributed in the deep-sea of the Atlantic and Pacific Oceans between the equator and about Lat. 60° S. He also mentioned another new species, *Cr. norvegica*, from the Norwegian Sea, but he gave no description of it, beyond stating that it was characterized by its cherry red colour and smaller size as compared with *C. brunnea*.

BIGELOW (1909 a p. 134) showed that *C. brunnea* also occurs in the tropical Pacific; he considered *C. norvegica* (which he only knew from VANHÖFFEN's insufficient description) a synonym of *C. brunnea* and placed the genus in the family Pectyllidæ, whereas MAYER (1910 p. 395) placed it near *Botrynema*, *Halicreas*, and "*Homoeonema*".

In 1913 a (pp. 47 ff.) BIGELOW found that *Crossota* was not related to *Ptychogastria* but to *Aglantha* and *Aglaura*, and he described two new species from the north-western Pacific, *C. alba* and *C. pedunculata*, the latter characterized by the presence of a short, solid, gelatinous peduncle. He also found numerous specimens of a *Crossota* which he called *C. brunnea* var. *norvegica*. I have seen two of these specimens, kindly sent to me by professor BIGELOW; they are very similar to the North-Atlantic species *C. rufobrunnea*, which I described in the same year (KRAMP 1913 a p. 273), and undoubtedly belong to the same species (see below).

When I described this species from the deep strata in the Davis Strait, I saw that it resembled an *Aglantha* in the pendent, sausage-shaped gonads, the ribbon-like radial canals, and the shape of the stomach, and I even thought I saw a trace of a stomachal peduncle; it also had a great resemblance to "*Melicertum proboscifer*" Maas (1897 p. 19, Pl. II figs. 5–7), which was provided with a long gelatinous peduncle and undoubtedly was closely allied to *Aglantha*; I therefore also referred my new species to *Aglantha*. Later on I was very sorry that I had made such a mistake, but now I am aware that I was not altogether wrong; *Crossota* is undoubtedly closely allied to *Aglantha*. Shortly after my paper had been published, I recieved a letter from professor VANHÖFFEN who was inclined to think that my "*Aglantha rufobrunnea*" was identical with his *Crossota norvegica*, and I, being young and inexperienced, naturally complied with such an authority and in a subsequent paper (KRAMP 1920 p. 5) referred some other North-Atlantic specimens, collected by the Norwegian vessel "Armauer Hansen", to *C. norvegica*. At about the same time I found in the collections of the Zoological Museum of Copenhagen some specimens of a larger *Crossota* with a cherry red colour and with 10–11 radial canals, collected by the "Ingolf" Expedition in deep water in the Norwegian Sea, north-east of Iceland; they were labelled by G. M. R. LEVINSEN *Crossota* n. sp. How I wished to know what VANHÖFFEN's *C. norvegica* was really like! My curiosity was soon disposed of, for during my stay with professor D. DAMAS at Liége in Belgium in the autumn of 1920 I saw VANHÖFFEN's original specimens and found that they had 10–12 radial canals (a fact overlooked by VANHÖFFEN) and in every respect were similar to the specimens which I had seen in our own museum. This discovery was published in KRAMP & DAMAS (1925 p. 317) with an addition that *Crossota rufobrunnea* Kramp was a distinct species occurring in the northern Atlantic, but not in the Norwegian Sea nor in the Polar Sea. Unfortunately, the specimens of *C. rufobrunnea* from the "Armauer Hansen" (KRAMP 1920) are still mentioned under *C. norvegica* in the "Nordisches Plankton" by BROCH (1929 p. 507).

As mentioned above (p. 12), UCHIDA (1928 p. 80) refers *Crossota* to the sub-family Aglaurinae.

RANSON (1936 pp. 160 ff.) describes a specimen of *C. rufobrunnea* from the Bay of Biscay and discusses the genus, which he places near *Octapodema*; he will not admit the presence of a gelatinous peduncle in *C. pedunculata* Bigelow, and he is cer-

[illegible] trace [illegible] of contraction (V[illegible] Bigelow in C. pedun[illegible] contraction [illegible] specimen of [illegible] M[illegible] expedition takes this [illegible] species of *Crossota*. In his [illegible] species with a mouth tube [illegible] rows of tentacles. He there- [illegible] *rufobrunnea* Kramp, [illegible] of tentacles, and *pedunculata* [illegible] therefore probably is an [illegible] *C. alba* Bigelow 1913, *C. brunnea* [illegible] 1909, *C. norvegica* Kramp 1920 (the [illegible] H[illegible] synonyms of *rufobrunnea*, see above) are [illegible] varieties, and a map of distribution [illegible]. I shall return to these assertions

[illegible] It is difficult to give a precise defini- [illegible] concludes that it seems simplest to confine [illegible] with sausage-shaped gonads hanging [illegible] subumbrella and with many closely crowded ten- [illegible] one row, irrespective of whether or not there [illegible] peduncle. Bigelow has seen several fragmentary [illegible] collected in deep water in the neighbourhood [illegible] Bermuda Islands and he refers them with some doubt to [illegible] description it seems to me more probable [illegible] *C. rufobrunnea*.

[illegible] Kramp 1942 p. 79 I have recorded some more speci- [illegible] from the Davis Strait, which gave me [illegible] remarks on the "multiserial" arrangement [illegible] discussed in detail above.

Remarks on the species of Crossota. — Besides the characters [illegible] in the definition above, the following [illegible] common to all the species. The umbrella is [illegible] rounded, the exumbrella provided with [illegible] grooves. The shape of the umbrella varies [illegible] state of contraction but is usually somewhat [illegible] Velum broad but usually thin and [illegible]. The [illegible] of the subumbrella and velum is weak [illegible] which I have seen, but in the two Pacific [illegible] *pedunculata*, it is said to be powerful.

[illegible] of the radial canals will be further discussed [illegible] fairly broad and ribbon-like, in the [illegible] *Aglantha*. Also the structure of the manu- [illegible] in connection with a discussion [illegible] of a peduncle. The peculiar [illegible] already been mentioned; it is evidently [illegible] *Crossota*, though the prolongation [illegible] tentacles and the corresponding [illegible] the free portion is more [illegible] species; it is a feature [illegible]. The dark, brown [illegible] dilatation [illegible] dense accumulations of [illegible] tissues.

[illegible] all valid. [illegible] considerably [illegible] wide with [illegible] correctly [illegible] the [illegible] in [illegible]

from the Norwegian Sea where it occurs in the deep strata under purely arctic conditions.

C. rufobrunnea Kramp 1913 is a comparatively small species, up to 15 mm in diameter, with about 200–250 tentacles. It also differs from *C. brunnea* in some minor details. It occurs in the northern Atlantic south of the submarine ridges but not in the arctic basins further north; probably also in the northern Pacific.

C. alba Bigelow 1913 is 22 mm wide, with 179 tentacles, the dark pigmentation seems to be restricted to the manubrium. It differs from the other species (except *pedunculata*) by the situation of the gonads "only about one-third of the meridional distance above the margin," which seems to me sufficient to maintain it as a proper species distinct from *brunnea* and *rufobrunnea*. Two specimens were found in Japanese waters.

C. pedunculata Bigelow 1913 may attain a size of 25 mm in diameter with 640 or more tentacles. According to Bigelow the gonads progressively attain a lower and lower position with the growth of the bell, terminating at about one-third of the meridional distance above the margin. The reddish-brown pigmentation covers the entire subumbrella. It seems to me that we must accept Bigelow's definite statement of the presence of a solid gelatinous peduncle, about 5 mm long; it is very improbable that this should merely be the result of contraction as implied by Ranson. On the other hand, we must strongly disagree with Thiel who will refer this species to *Aglantha* on account of the peduncle; in all other respects it is a typical *Crossota*. Four specimens were taken near the mouth of the Columbia River on the west coast of North America, and it is the only species of *Crossota* occurring in the upper strata, 50–0 fathoms.

It should still be mentioned that "*Melicertum proboscifer*" Maas 1897 has been supposed to be a *Crossota*. It was taken in the Gulf of Panama. Apart from the low shape of the umbrella (15 mm high and 10 mm wide) it greatly resembles an *Aglantha* in all respects, including the colour which seems to be very nearly the same as that seen in the large *Aglantha digitale* in arctic regions and quite different from the dark pigmentation of *Crossota*. I have not the slightest doubt that it should be referred to *Aglantha*, as already supposed by Mayer (1910 p. 209).

Most other bathypelagic medusæ have a world-wide distribution in the oceans between the continental shelves in the south and the north, but this does not apply to any of the species of *Crossota*. Besides *C. norvegica* which is an arctic deep-sea medusa, and *C. alba* and *pedunculata* which are only known from restricted areas in the northern Pacific, we have two widely distributed species, but they do not occur within the same areas: *C. brunnea* is a common deep-sea species in all the oceans from the continental shelf of the Antarctic Continent northwards, but its northward distribution ends at or about the equator, and in the northern parts of the Atlantic and Pacific Oceans it is replaced by *C. rufobrunnea*; these two species seem to be about equally abundant, each within its area, but none of them has extended its distribution into the area of the other species.

Crossota rufobrunnea Kramp.

Pl. II figs. 9–10, Pl. III figs. 1–8, Pl. IV figs. 1–4, Pl. VI fig. 5.

Crossota brunnea var. norvegica Bigelow 1913 p. 48.
Aglantha rufobrunnea Kramp 1913 a p. 273, figs. 1–2.
1914 p. 433.
Crossota norvegica Kramp 1920 p. 5.
rufobrunnea Kramp & Damas 1925 p. 317.
Broch 1929 p. 506, fig. 17.
norvegica pars Broch 1929 p. 507.
rufobrunnea Thiel 1932 a p. 153.
Thiel 1932 b pp. 141, 156, 159, 162, 166, 167, 186, 199.
Crossota rufobrunnea Ranson 1936 p. 162.

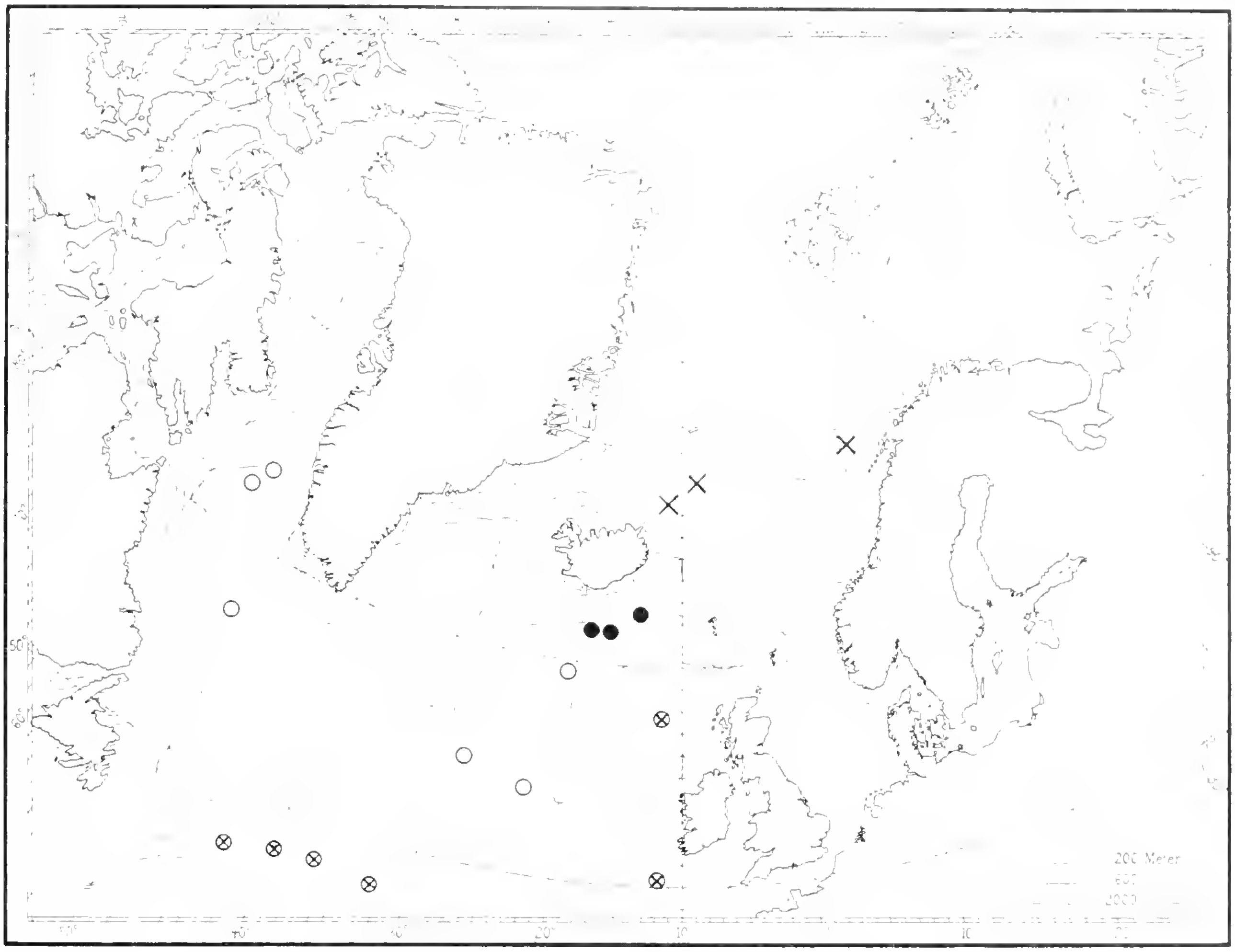


Fig. 8. Distribution in the northern Atlantic of: ● *Crossota rufobrunnea*, new records; *Crossota rufobrunnea*, previous records. *Crossota rufobrunnea*, records not yet published; *Crossota norvegica*.

Crossota brunnea Bigelow 1938 p. 119.
– rufobrunnea Kramp 1942 p. 79.

North-Atlantic records:
Kramp 1913, 1920, 1912; Ranson 1936.

Material (see the map, textfig. 8):

61°31′N, 19°05′W., $^{10}_{7}$1904. "Thor" St. 180. 1800 m wire. 2 spec.
61°30′N, 17°08′W., $^{11}_{7}$1904. – 183. 4 specimens
62°23′N, 16°05′W., $^{25}_{6}$1932. "Dana" St. 4102. 3000 m wire. 35 spec.
– – – 4102. 4000 m – 220

Description: Umbrella (Pl. VI fig. 5), when moderately contracted, somewhat higher than a hemisphere, up to 15 mm in diameter and 10 mm in height, evenly rounded; gelatinous substance fairly thin, about 1.5 mm at the apex, gradually tapering in thickness towards the bell margin. Exumbrella with about 20 meridional grooves in each octant, running from the bell margin upwards and all of equal length, terminating at about the level of the base of the manubrium, leaving the top of the umbrella smooth. The circular musculature of the subumbrella is weak. Velum broad, but thin and with weak muscles.

Manubrium (Pl. III figs. 1–2) bottle-shaped, its length about one-third of the height of the subumbrella cavity, varying according to state of contraction. The basal part, the stomach proper, is rather broad, the mouth-tube somewhat narrower and shorter than the stomach, mouth with four short but well-developed, outturned lips. In transverse section the mouth-tube is quadrangular with thin walls, in each corner is a string of large, vacuolated endoderm cells covered by a thin ectoderm and visible on the external side as a prominent edge, on the internal side marked by a sharp groove (Pl. III figs. 1, 2, 3); these four strings and the corresponding grooves are continued to the points of the lips and upwards to the top of the stomach. The attachment of the stomach to the subumbrella is star shaped, corresponding to the eight radial canals. The walls of the stomach are rather thin and provided with two whorls of deep folds. Those of the upper whorl are eight small, narrow lappets hanging down into the cavity of the stomach (Pl. III fig. 2); their inner edges almost meet in the centre (Pl. III fig. 1), they are hollow, and their cavities communicate with the bell cavity through eight small, radiating fissures in the apical wall of the stomach between the radial canals. The lower whorl consists of eight large elongated pouches, placed immediately below those of the upper whorl, sharply marked off from them, and gradually tapering downwards towards the distal portion of the stomach (Pl. III fig. 2). On the external side of the stomach they are seen as eight deep, open grooves (Pl. III fig. 1); when the stomach is strongly contracted in circular direction, these grooves may become so narrow as to be termed fissures, and the spaces between them may then protrude like eight longitudinal ridges. The large pouches of the lower whorl are not quite equidistant, the four spaces with the above mentioned four prominent edges being somewhat broader than the four other spaces (Pl. III fig. 1). The endoderm of the pouches is slightly thickened and has a papillose surface.

Externally no trace of a stomachal peduncle is observed.

[illegible] seen [illegible] states of [illegible] somewhat [illegible] flattened conical [illegible] with the proximal [illegible] section of the upper [illegible] a section of the [illegible] epithelium con[illegible] diagrams, textfig. 9 [illegible] of the stomach and the [illegible] base of the peduncle [illegible] with the radial canals [illegible] the apical wall of the [illegible] the radial canals, section *c* [illegible] ring surrounding the upper [illegible] their inner edges adnate to [illegible] the free hanging upper pouches are [illegible] of the peduncle, section [illegible] of pouches seen as eight deep, broad [illegible] indicated in sections *c* and *d*. [illegible] The longitudinal sections, [illegible] to elucidate the mode of attach[illegible] subumbrella; in fig. 5 the section [illegible] the middle of the peduncle, on the [illegible] it has also passed through one of [illegible] the corresponding large pouch of the lower [illegible] a little beside their middle, on the [illegible] the section passes a radial canal and has [illegible] pouches cutting it open in one side. [illegible] somewhat beside the central axis of [illegible] across two of the upper pouches [illegible] plate of one more, showing [illegible] between its interior and the subumbrella [illegible] figure is seen a section through one [illegible] lower whorl.

[illegible] the structure of the manubrium is the [illegible] as will appear from the above descrip[illegible] that depicted by VANHÖFFEN, and [illegible] other Trachynemida so far [illegible]

[illegible] of equal width throughout their [illegible] the stomach. In superficial view [illegible] like, but a closer examina[illegible] is fairly narrow, bordered [illegible] less conspicuous lateral band con[illegible] parts of the subumbrella wall. The [illegible] preserved for histological studies [illegible] acetic acid [illegible] better results than those [illegible] comparison between a [illegible] sections permits [illegible] the accompanying [illegible] sections of the [illegible] Pl. III [illegible] the dense accu[illegible] in the ectodermal [illegible] lamella. The [illegible] 1902 Pl. 12 [illegible] pigmented [illegible] the [illegible] two [illegible] continuous epithelium, but in the lateral bands this epithelium is gradually dissolved into a meshwork of branched cells winding themselves in the spaces between the flattened, pigmented cells of the endoderm lamella, which, outside the border of the "lateral band", becomes directly adnate to the thin supporting lamella separating it from the muscular layer of the subumbrella. The "lateral bands" of the radial canals are the portions where two layers of endoderm cells are present without being separated by a cavity. Moreover the bands are made conspicuous by a difference in configuration of the cells of the endoderm lamella; the exumbrellar, pigmented epithelium of the canal consists of small cells, fairly high and with large, round vacuoles; in the lateral bands the pigmented cells are flattened, large, roundish, and separated by rather broad spaces partly filled by the branching non-pigmented cells; outside the bands the cells are somewhat smaller, with wavy outlines and closely set. Sometimes the lateral bands of the radial canals are very sharply marked out by a clear line on each side; this is undoubtedly due to artificial rupture of the tissues caused by strong contraction at the moment of fixation. In the material available no specially developed musculature may be observed in the lateral bands of the radial canals.

The ring canal is fairly broad; its subumbrellar epithelium is unpigmented and similar to that of the radial canals.

The eight sausage-shaped gonads are attached to the eight radial canals near the stomach (Pl. III fig. 2); they are hollow, their internal cavity communicating with the radial canals. In fully developed specimens the gonads are somewhat shorter than the manubrium, in young individuals they are small globular swellings.

The length of the tentacles cannot be decided, as in all the specimens available they are broken off at some distance from their base, but from what remains they seem to have been rather long. The abaxial side of their basal portion is adnate to the lower margin of the exumbrella (Pl. IV figs. 1–2), and the point of issue of their free portion is therefore somewhat removed from the ring-canal, mainly in the oldest tentacles, but the displacement is less pronounced in this species than in *C. brunnea*. The tentacles are provided with a large and broad endodermal spur protruding into the gelatinous substance of the umbrella in front of the ring-canal. Tentacles in different stages of development are always present simultaneously, but they are not regularly alternating. The tentacles are usually separated from each other by spaces similar to their own breadth.

The total number of tentacles in fully developed individuals is usually about 250. It is rarely possible to count the tentacles within every single octant, partly because some of the radial canals in badly preserved specimens often cannot be exactly located right out to the bell margin. The radial canals are not always quite equidistant, and the number of tentacles per octant varies accordingly; in a specimen 10 mm high with altogether 240 tentacles the number per octant varied from 16 to 37; in some other specimens of similar size I have counted the following numbers:

27	22	23	26	28	25	28	26	205
36	34	35	26	34	34	33	25	251

The statocysts are evidently readily lost; even among the best preserved specimens I have seen only a few statocysts; they agree with those found by BIGELOW (1913 p. 49 and 50, Pl. 9 fig. 12) in the Pacific specimens and in *C. alba*; two of them are seen in Pl. IV figs. 3–4.

Colour (Pl. VI fig. 5). Fresh or well preserved specimens are so densely pigmented that they are almost completely opaque; the colour is a deep reddish brown and, as mentioned above, it is due to dense accumulations of minute pigment granules in the cells. The pigmentation comprises the following tissues: the

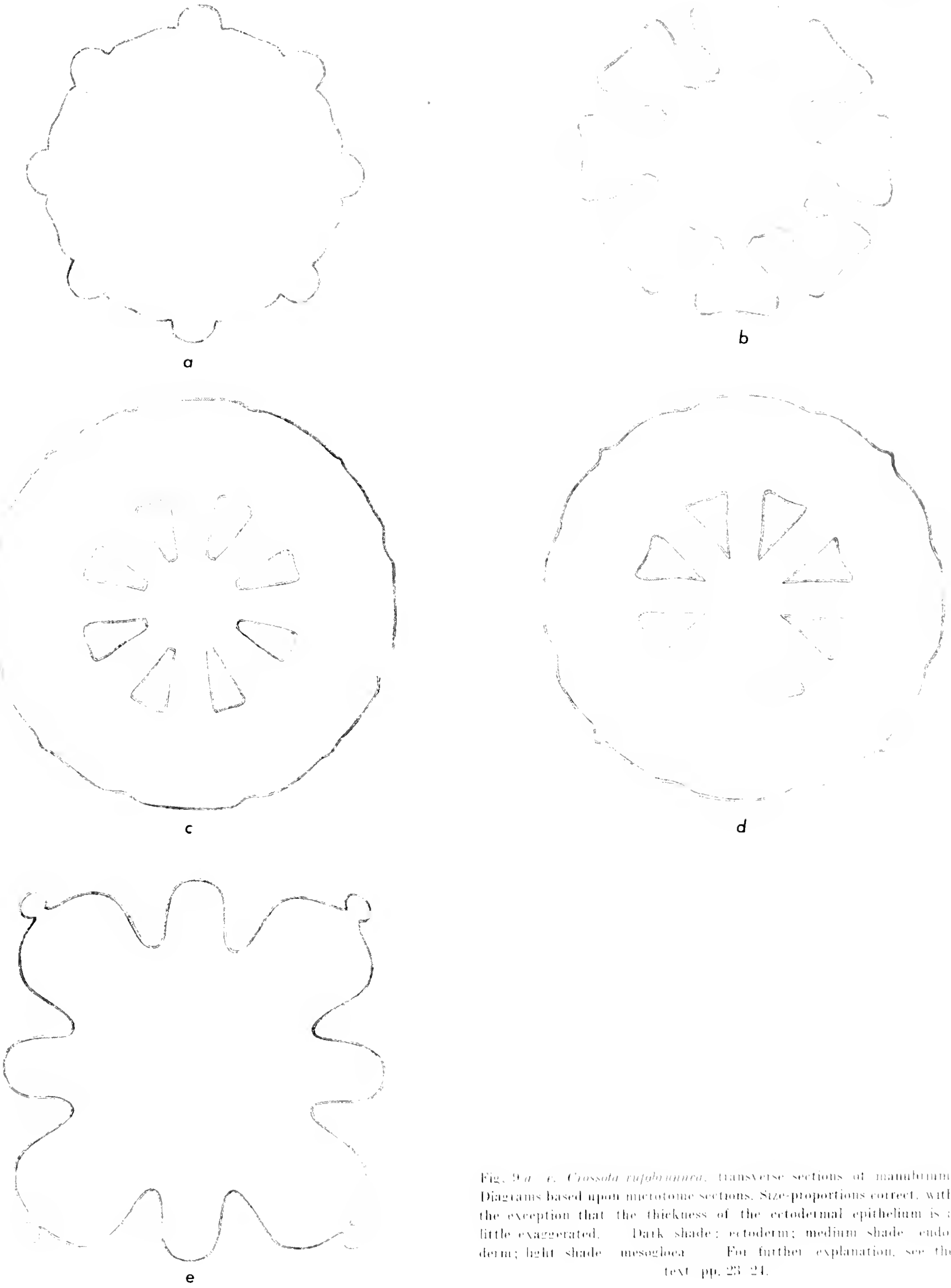


Fig. 9 a–e. *Crossota rufobrunnea*, transverse sections of manubrium. Diagrams based upon microtome sections. Size-proportions correct, with the exception that the thickness of the ectodermal epithelium is a little exaggerated. Dark shade: ectoderm; medium shade: endoderm; light shade: mesogloea. For further explanation, see the text pp. 23–24.

[illegible] epithelium [illegible] from the pe[illegible] the ecto[illegible] the tentacles. [illegible] I [illegible] poor condition [illegible] frequently rubbed off. [illegible] in my original descrip[illegible] (19[illegible] p. 27[illegible]) I stated that "the distal part [illegible] white with four red [illegible] the pigmented epi[illegible] of the four prominent ridges, [illegible] well preserved specimens [illegible] reddish brown."

[illegible] map, textfig. 8): Davis Strait and [illegible] coast of Greenland, in the deep strata [illegible] temperatures between 3.1 and 3.8°, partly [illegible] Fjalr 1909 and "Godthaab" 1928). South [illegible] hauls with 1800–4000 m wire out ("Thor" [illegible] 1932). West of the Rockall Bank, in hauls with [illegible] ("Armauer Hansen" 1913). Also collected [illegible] Norwegian expedition with the "Michael Sars" [illegible] (unpublished) in the channel east of Rockall [illegible] W. of Ireland, St. 94), four localities east of the Newfoundland Bank (St. 80, 81, 82, and 84); these localities are in[illegible] textfig. 8; further in the surroundings of the Azores (St. 87 and 56) and between the Azores and Bermuda (St. 64, 34°44′ N., 47°52′ W.); the specimens collected by the "Michael Sars" were taken in hauls with 1500–3000 m wire out. M[illegible] species has been found in the Bay of Biscay, off [illegible] 46°29′15″ N., 5°12′30″ W., in a vertical haul 2650–0 m [illegible]; it was undoubtedly also this same species [illegible] at some localities near the Bermuda Islands, in [illegible] between 1097–0 and 1829–0 m, and mentioned by B[illegible] 1938 as *C. brunnea*. The distribution of *Crossota* [illegible] the entire deep-sea area of the northern Atlantic [illegible] as far south as about 30° N. It is a well-marked [illegible] and it never crosses the submarine ridges [illegible] Atlantic basin from the Arctic deep-sea basins [illegible] Norwegian Sea and Baffin Bay. In the northern Pacific [illegible] several localities north of about 45° N. (recorded [illegible] *norvegica*, BIGELOW 1913), it was mainly [illegible] from 300 fms. (550 m) to the surface, on [illegible] 2070 fms.

Crossota norvegica Vanhöffen
Pl. IV fig. 5, 6.

[illegible] Vanhöffen 1902 p. 75.
[illegible] Kramp & Damas 1925 p. 317.
[illegible] Broch 1929 p. 507.
[illegible] Thiel 1932a p. 153.
[illegible] norvegica Bigelow 1913 p. 48.
[illegible] Kramp 1920 p. 5.

[illegible] textfig. 8.

[illegible] St. 118, 3 specimens.
[illegible] 126, 2

[illegible] fair condition, the others [illegible] details are well preserved. [illegible] (Pl. IV fig. 5, 6.) Umbrella dome-shaped, [illegible] 20 mm in diameter and 18 mm [illegible] substance fairly thin; [illegible] grooves, about 16–18 [illegible] Velum fairly broad. [illegible] 10 to 11. In two of the specimens, with 10 and 11 radial canals, they all issue separately from the centre of the subumbrella; in two other specimens (textfig. 10*a* and *b*) one or more of the canals are seen branching off from the others at a short distance from their proximal ends. One of these specimens (textfig. 10*a*) has 11 complete radial canals reaching the ring-canal, and also one short blind canal. The terminal points of the radial canals, where they join the ring-canal, are not quite equidistant.

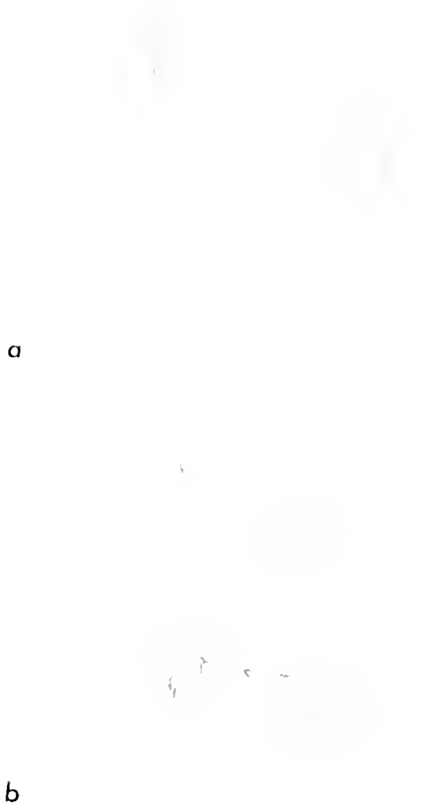


Fig. 10 *a*–*b*. *Crossota norvegica*. Mode of issue of the radial canals in two specimens. — *a* with 11 radial canals and one blind canal ("Ingolf" stat. 118; outline of stomach indicated), *b* with 11 radial canals ("Ingolf" stat. 126).

The manubrium (Pl. IV fig. 6) is bottle-shaped, about one-third to two fifths as long as the height of the bell cavity. The mouth has 5–7 outturned lips (the number of lips being about half the number of radial canals); from each of the lips a prominent ridge proceeds upwards over the mouth tube; in the proximal portion of the stomach proper some of these ridges become more or less irregularly divided. The stomach is provided with similar invaginations as those described above in *C. rufobrunnea* and also seen in *C. brunnea*, but in *C. norvegica* they are variable in number and irregular in position.

The gonads are sausage-shaped, about half as long as the manubrium, attached to the radial canals very near the stomach; the number of gonads is equal to the number of radial canals.

The tentacles could not be counted exactly; in the best preserved specimen there are about 275. The displacement of the point of issue of the older tentacles is not very pronounced. The basal endodermal spur is comparatively long, more elongated than in *C. rufobrunnea*. Statocysts are not observed.

Colour. This medusa has about the same deep reddish-brown colour as that found in *C. rufobrunnea*.

Variation. The seven specimens of this species observed up to now have the following dimensions:

	VANHÖFFEN'S original specimens		"Ingolf" St.				
			118	118	118	120	120
Diameter, mm.	20	20	15	17	19	18	20
Number of radial canals. .	10	12	?	11	10	11	11

Distribution: The two localities, where *C. norvegica* was taken by the "Ingolf" expedition, are north-east of Iceland in the deep basin of the Norwegian Sea; at St. 120, nearest to Iceland, the depth of the bottom was 1666 m, at St. 118 it was 1996 m. The labels do not tell us how far below the surface of the water the specimens were captured, but according to the journal of the expedition they must have been caught in the trawl, either near the bottom of the sea or at some higher level during the hauling in of the trawl. VANHÖFFEN's original specimens were found in the eastern part of the Norwegian Sea, 69°13′ N. 10°40′ E., west of the Lofoten, at a depth of about 1000 m. We may suppose, therefore, that the "Ingolf" specimens were likewise taken in the deep strata where the temperature of the water is very low; at the "Ingolf" St. 118 and 120 the temperature was below 0° from about 500 metres downwards, being ÷ 1°0 at the bottom. *C. norvegica* may thus be designated as an arctic deep-sea medusa.

Genus **Aglantha** Haeckel 1879.

Trachynemidæ with a well-developed, gelatinous stomachal peduncle; with eight radial canals; with numerous tentacles all alike; with free, club-shaped statocysts; with eight pendent, sausage-shaped gonads, equally developed and attached to the subumbrella.

By this diagnosis *Aglantha* is distinguished from *Aglaura* in which the eight gonads are upon the peduncle, and from *Amphogona*, in which the eight gonads are not equally developed; moreover *Aglantha krampi* Ranson, with linear gonads on the peduncle, is removed from the genus *Aglantha* (see above, p. 12).

In two papers (1932 and 1936) RANSON has dealt with the history of the Aglaurinæ and discussed the various genera and species referred to this division of the Trachynemidæ, and in most respects I can agree with him. As far as the species which have been referred to the genus *Aglantha* are concerned, we may safely state as follows: *A. globulifera* (Haeckel) belongs to *Aglaura*; *A. ignea* Vanhöffen should be transferred to the Rhopalonematinæ; *A. camtschatica* (Brandt), *A. rosea* (Forbes), *A. occidentalis* Maas, and *A. conica* Hargitt are forms (races or varieties) of *A. digitale*. *A. elata* (Haeckel) is probably identic with *A. elongata* (Lesson), and RANSON is inclined to identify this form with *A. digitale*; considering its occurrence off the African coasts, far removed from the area of distribution of *A. digitale*, it seems to me that, at least at present, we must retain it as a proper species (the specimens from the Bay of Biscay, identified by MAAS (1904 p. 30) as *Aglisera elata*, certainly belong to *A. digitale* as demonstrated by RANSON, who has re-examined the specimens). *Aglantha digitale* var. *intermedia* Bigelow (1909 a p. 122, Pl. 29 figs. 1–10), taken by the "Albatross" in the eastern tropical Pacific, differs from *A. digitale* in the shape of the manubrium and in the peculiar S like course of the canals upon the peduncle; therefore, and also for geographical reasons, it seems to me that this form should better be regarded as a distinct species. *Melicertum proboscifer* Maas is most probably an *Aglantha*, distinguished by the considerable breadth of the umbrella in proportion to the height (see above, p. 22). As mentioned above (p. 12) *Aglantha krampi* Ranson seems to me to represent a proper genus, *Ransonia* mihi.

Only one species of *Aglantha* occurs in the northern portions of the Atlantic area, viz. *A. digitale* (O. F. Müller); different races may be more or less distinctly recognized, but on the present occasion I shall not enter into this matter because only scattered portions of the material at my disposal are in a condition which make them suitable for this kind of investigations. I shall only give a general survey of the North-Atlantic occurrence of the species as a whole, particularly of the bathymetrical occurrence in the different regions within the area of distribution.

As, from several points of view, *Aglantha digitale* is one of the most important species of medusæ in northern seas, it might be desirable for once to give a list of the references in the literature, as complete as possible. As to the literature previous to 1910 I refer to MAYER, Medusæ of the World (1910 p. 402), with addition of LEVINSEN 1893 p. 146 containing a list of Greenland localities. — In the following list the North-Atlantic records are marked by an *n*.

Aglantha digitale (O. F. Müller).

Aglantha digitale Mayer 1910 p. 402 (list of previous literature).

n – digitalis Le Danois 1913a p. 188, and 1913b p. 27, figs. 11–17 (description of development; localities S.W. of Ireland, near Jan Mayen, and between Jan Mayen and Iceland.

n – digitalis Le Danois 1914 p. 311 (Bay of Biscay, Faroes, Jan Mayen).

n digitalis Linko 1913 (Kara Sea).

digitale Bigelow 1913 p. 43 (N.W. Pacific; discussion of species).

n – digitalis Kramp 1913 a p. 269 (W. Greenland).

n – – 1913b p. 527 (N.W. Europe).

n – 1914 p. 128 (W. and E. Greenland).

n – digitale Bigelow 1914 (New England).

n – digitalis Kramp 1915 (Great Belt and Kattegat).

n digitale Bigelow 1915 (discussion of species; between Nova Scotia and Cape May).

n – digitale Bigelow 1917 pp. 303, 301, 305 (Cape Cod Halifax).

n digitale Bigelow 1918 p. 388 (near Chesapeake Bay).

n digitalis Kramp 1920 p. 5 (N. Atlantic).

n – digitale Bigelow 1920 p. 10 (Alaska) and p. 17 (Labrador).

n Aglaura hemistoma var. "laterna" Sverdrup 1921 p. 26, Pl. 3 fig. 14 (Kristianiafjord).

n Aglantha digitalis Sverdrup 1921 p. 27, Pl. 4 fig. 16 (Kristianiafjord).

n digitale Bigelow 1922 p. 134 (Gulf of Maine).

n – Lebour 1922 p. 664 (food).

n – – Peacock 1923 p. 95 (Northumberland coast).

n – digitalis Jespersen 1923 p. 109 (N. W. Greenland).

n digitale var. rosea Coy 1924 p. 56 (Northumberland coast).

n – digitale var. rosea Peacock 1924 p. 60 (Northumberland coast, remarks on var.).

n digitale Kramp 1924 p. 29, fig. 24 (Bay of Biscay, S.W of Ireland).

n digitale Kramp & Damas 1925 p. 318 (Norway).

n rosea Russell 1925 p. 786 (Plymouth).

digitale Uchida 1925 p. 97 (Japan)

n Bigelow 1926 pp. 38, 40, 48, 50, 352 (Gulf of Maine).

digitale Uchida 1927 p. 225 (Japan).

n Jaschnov 1927 p. 7 (Kara Sea).

n rosea Russell 1927 p. 573 (Plymouth).

n digitale Kramp 1927 (Denmark; races in Danish waters).

digitalis Uchida 1928 p. 79 (Japan).

n digitale Broch 1929 p. 512 figs. 22, 23 (northern seas).

n rosea Sanderson 1930 p. 229 (Northumbrian coast).

n Watson 1930 p. 236 (Northumbrian coast).

digitalis Uchida 1930 p. 335 (Japan).

n rosea Plymouth marine Fauna 1931 p. 83 (Plymouth [illegible] 76 (east coast of [illegible]

[illegible] 1932 [illegible] (Norway).
[illegible] 19[illegible] (Chesapeake Bay).
[illegible] 1932 [illegible] and 1932b (distribution).
[illegible] 193[illegible] 76 (Plymouth).
[illegible] 193[illegible] 132 [illegible] (Kamtchatka).
Kramp 1933 p. 16 (E. Greenland).
Bernstein 1934 pp. 9, 26 (Kara Sea).
[illegible] Russell 1935a pp. 311, 315, 318 (Channel).
1935b p. 27 (biology).
[illegible] Künne 1935 p. 65 (Baltic).
[illegible] Russell 1936 p. 177, Pl. 2 figs. 18–20 (temperate Atlantic; discussion of species and varieties).
[illegible] rosea, Künne 1937a p. 6 (Baltic).
1937b pp. 139, 147, 151, 162 (North Sea).
[illegible] Frost 1937 p. 26 (Newfoundland).
[illegible] Hardy 1936 (N. of Spitzbergen).
Kramp 1937 p. 130, fig. 59 (Denmark).
Uchida 1938a p. 54 and 1938b p. 43 (Japan).
[illegible] Russell 1938 pp. 113, 116, 117, 119, 133, 137 (Plymouth).
[illegible] Bigelow & Sears 1939 p. 362 (Cape Cod – Chesapeake Bay).
[illegible] Kramp 1939 p. 16 (Iceland).
Jaschnov 1939 pp. 112, 114 (Kara Sea, [illegible] Sea).
[illegible] var. rosea Russell 1940 p. 517 (nematocysts).
[illegible] Uchida 1940 p. 292 (Japan).
[illegible] 1942 p. 74 (around Baffin Land).
Kramp 1942 p. 81 (W. Greenland; discussion [illegible] biology).
[illegible] Kramp 1943 p. 7 (E. Greenland).

[illegible] Zoologist O. F. Müller (1776 p. 233) was the [illegible] diagnosis of "*Medusa digitale*", for which, [illegible] was indebted to O. Fabricius. In "Fauna Groenlandica" (1780 p. 366) Fabricius gave the same diagnosis, and [illegible] more detailed description of the specimens which [illegible] Greenland. Though this species is one of the [illegible] distributed and common medusae in the northern [illegible] years elapsed before it was found in other regions. [illegible] was collected by Mertens in the Pacific [illegible] described by Brandt (1838 p. 354, Pl. 1 figs. 1–5). [illegible] record from European seas (the Shetland Islands) [illegible] Forbes 1848 p. 34, Pl. 1 fig. 2, *Circe rosea*). From the [illegible] North America it was recorded for the first time by [illegible] 1865 p. 57, figs. 84–86, *Trachynema digitale*). The [illegible] introduced by Haeckel; his new de- [illegible] based upon the specimens in our museum in [illegible] several localities off the west coast of [illegible] northern Atlantic, mainly from the vessels [illegible] Denmark and Greenland, most of these specimens [illegible] the Greenland localities, and some of [illegible] published by Levinsen (1893 p. 146); [illegible] published in details, are as [illegible] W. [illegible] 1851 [illegible] 59°07' N. 13°32' W. (Mo- [illegible] N. [illegible] W. and [illegible] 58°17' N. 30°56' W. (Olrik [illegible] W. [illegible] 1868.

[illegible] *Aglantha digitale* is com- [illegible] from the Polar Sea to the [illegible] of Maine in the West, [illegible] both sides of the [illegible] to give a complete list [illegible] our collections.

[illegible] pub-

In some previous papers I have dealt with the occurrence in the waters round Denmark, Norway, Iceland, and Greenland, and several other authors have given equally thorough accounts of the occurrence in other coastal areas. It may be worth while, however, to examine the distribution in the large, open oceanic basins, from which the records in the literature are somewhat scattered and from which rather considerable collections are available in our museum. Though *Aglantha digitale* is a holoplanktonic medusa, we cannot beforehand be sure that it is equally abundant everywhere within its extensive area of distribution.

For the following discussion of the occurrence I have divided the area under consideration into six sections, as seen from the map, textfig. 11, and I am going to deal with them separately, leaving out the records from the coastal regions.

I. The Kara Sea: Material: Kara Sea, "Dijmphna" 1882–83. Previous records: Linko 1913, Jaschnov 1927, Bernstein 1934, Jaschnov 1939.

Unfortunately, we have no information of the exact localities at which the specimens were taken by the "Dijmphna" expedition, and no records of depth or date. The expedition comprised the southern portion of the Kara Sea, south of 72° N. and west of 66° E. Linko was the first to mention *Aglantha digitale* from the Kara Sea, but his paper has not been accessible to me. Jaschnov (1927 p. 7) has dealt with its occurrence at some length; according to this author the medusa was never taken east of 66° E., where the salinity of the water is considerably lowered by the influence of the great Siberean rivers; adult specimens were mainly taken in the deeper strata at very low temperatures, whereas very young specimens were found almost exclusively in the surface layers. The largest specimens measured by him were 15 mm in height, thus considerably smaller than those found in other arctic regions. According to Bernstein this species may occur in the Kara Sea in great abundance.

II. The Barents Sea: No new material. Records in the literature: Linko 1904a p. 15 (preliminary list of species) and 1904b p. 219; Kramp 1913b. *Aglantha digitale* may be extremely abundant in this region, but the quantity seems to be variable from one year to another. Linko has given valuable information of the seasonal occurrence, and he concludes that the propagation predominantly takes place during the winter in the neighbourhood of the coasts.

III. The Norwegian Sea and the Polar Sea east of Greenland:

66°23' N.	8°52' W.,	$^{10}_{7}$1896.	"Ingolf" St. 103.	188–0 m.	2 spec.
66°23' N.	7°25' W.,	$^{11}_{7}$1896.	104.	188–0 m.	3
68°27' N.	8°20' W.,	$^{21}_{7}$1896.	118.		1 specimen
62°58' N.	7°09' W.,	$^{11}_{8}$1896.	143.		1
abt. 62$\frac{1}{2}$° N.	1° E.	$^{20}_{6}$1900.	E.-Greenl. Exp.	vert. hauls.	3 + 2 spec.
abt. 63° N.	$\frac{1}{2}$° E.	$^{20}_{6}$1900.			3 + 2 + 1
abt. 63$\frac{1}{2}$° N.	0°	$^{21}_{6}$1900.			1 spec.
abt. 64° N.	$\frac{1}{2}$° W.	$^{21}_{6}$1900.			7
64°05' N.	9°38' W.,	$^{5}_{5}$1904.	"Thor" St. 63.		3 specimens
63°36' N.	6°20' W.,	$^{11}_{5}$1903.	12.	600 m wire.	22 spec.
64°04' N.	1°33' W.,	$^{23}_{5}$1905.	121.		3 specimens
66°49' N.	21°59' W.,	$^{9}_{6}$1927.	"Dana" St. 3221.	800 m wire.	200 sp.
66°22' N.	6°26' W.,	$^{23-24}_{5}$31.	5142.	600 m	800
65°14' N.	6°06' W.,	$^{24}_{5}$1931.	5143.	900 m	2000
			5143.	1100 m	2000
			5143.	1900 m	1800
			5143.	2400 m	2000

Previous records. Le Danois 1913a and b, 1914 records this species from the neighbourhood of Jan Mayen; Kramp 1913b, in which the collections by the International Plankton

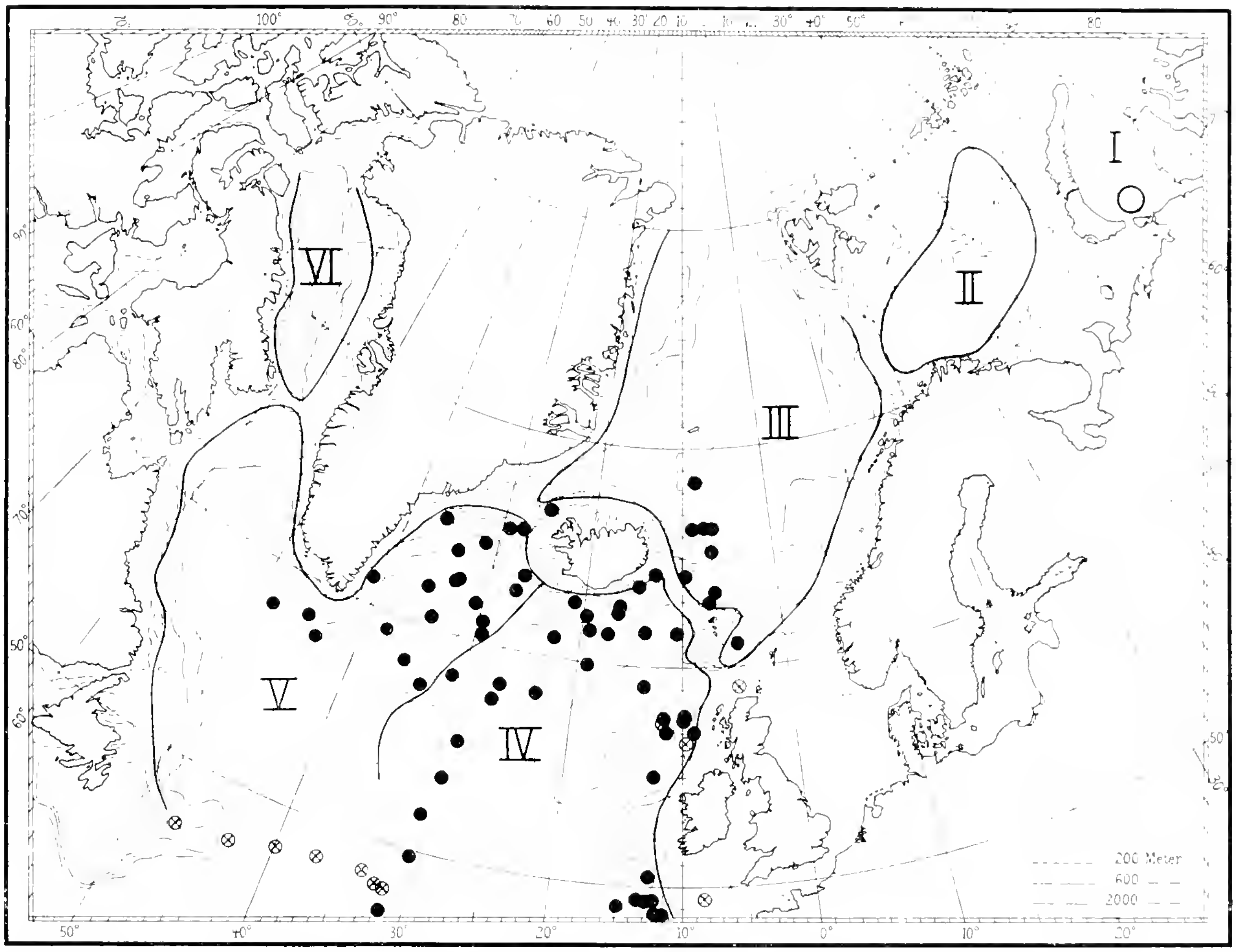


Fig. 11. *Aglantha digitale.* ● new records outside the coastal waters; ⊗, records yet not published; exact localities not stated. The strongly drawn lines indicate the boundaries of the regions mentioned in the text.

Investigations 1902–1908 are summarized and illustrated on a map; *Aglantha digitale* was taken in several localities between Norway and Iceland, usually in small numbers, but in May 1903 it was taken in very great abundance in three localities about 67° N.

The few specimens collected by the "Ingolf" Expedition were taken in hauls through the upper strata with fairly small nets; the specimens from St. 104 were small, 2 mm, the others varied in height between 14 and 18 mm. The specimens taken by the East-Greenland Expedition 1900 in vertical hauls with small nets were all very small, 2–4 mm. The specimens taken by the "Thor" at two stations east of the Wyville Thomson Ridge in May 1903 and 1904 were of considerable size, 19–24 mm high. "Thor" St. 124, 1905, was in the Faroe-Shetland Channel: the three specimens taken there were 10, 17, and 21 mm high. The most interesting material available from the Norwegian Sea is that collected by the "Dana" in May 1931, St. 5112 and 5113, above deep water east of Iceland; the hauls were made with the 2 m ringtrawl with bag of stramin, and at St. 5113 the duration of the hauls was two hours; as seen from the list above great numbers of *Aglantha* were taken at all depths between about 600 and 1600 metres below the surface, especially in the haul with 1900 m wire out (about 1300 m below the surface); there were no remarkable differences in the size of the specimens at these different depths, almost all the specimens were large, up to 20 mm in height, with a slight admixture of small ones. The haul with 600 m wire out at the neighbouring St. 5112 caught about 800 specimens during one hour; the size limits were about the same as in the deeper hauls at St. 5113, 5–19 mm, but very few of them were adult, the vast majority being young ones, about 6 mm in height. There can be no doubt, therefore, that the numerous large specimens brought up by the deep hauls were really caught in the deep strata, where the temperature of the water was below 0°, whereas the vast majority of the young ones occurred at higher levels with positive temperatures.

IV. North-East Atlantic, east of the Mid-Atlantic ridge running southward from south-western Iceland (the Reykjanes Ridge).

Material.

57°13′N. 27°03′W., $^{17}{}_{9}$1868, Bang.	
58°17′N. 30°59′W., Olrik 1859.	
58°27′N. 26°43′W., Moberg 1857	
59°07′N. 13°32′W.,	
59°00′N. 19°02′W., Ryder 1883	
58°17′N. 23°19′W., $^{22}{}_{5}$1898, Ostenfeld	
55°25′N. 29°05′W., $^{18}{}_{5}$1890, Lundbeck	
61°11′N. 10°17′W., $^{11}{}_{8}$1895, "Ingolf" St. 42, 188 0m 18 spec.	
61°10′N. 13°33′W., $^{2}{}_{6}$1903 "Thor" St. 87 5 specimen	
62°10′5N. 19°36′W., $^{12}{}_{7}$1903	161 20 specimens
62°11′N. 20°11′W., $^{9}{}_{7}$1904	179. 50m wire. 1 spec
61°31′N. 19°05′W., $^{10}{}_{7}$1904	180. 100m – 10 –
61°30′N. 17°08′W., $^{11}{}_{7}$1904	183. 12 specimens
57°17′N. 11°33′W., $^{7}{}_{6}$1905	71 3
57°52′N. 9°33′W., $^{8}{}_{6}$1905.	72. 600m wire. 8 spec.
57°16′N. 9°55′W., $^{31}{}_{8}$1905	167. 22 specimens
48°43′N. 12°05′W., $^{21}{}_{5}$1906.	52 300m wire. 78 spec
50°25′N. 12°11′W., $^{5}{}_{6}$1906	62. 1500m 16

[illegible]	[illegible]	120 per
	[illegible]	120
	[illegible]	9
	[illegible]	34
	[illegible]	2
	[illegible]	8
	[illegible] 2000	800
	[illegible]	50
	[illegible] 1800	4
[illegible]	[illegible]	15
	[illegible]	17
[illegible]	12 [illegible]	4
[illegible]	[illegible]	3 sp.
	[illegible] 2000	11
[illegible]	5079 700m	8
[illegible]	5162 600m	6
[illegible]	4201 50m	35
	4201 100m	20
	4201 300m	14
	4201 600m	8
	4201 2000m	115
	4201 3000m	190
	4201 4000m	250
	4201 5000m	220
[illegible]	4203 50m	2500
	4203 100m	330
	4203 300m	460
	4203 600m	160
[illegible]	4205 50m	650
	4205 100m	600
	4205 300m	80
	4205 600m	20
[illegible]	4206 100m	400
	4206 300m	75
	4206 600m	170
[illegible]	4402 50m	5000
	4402 300m	2100
	4402 600m	1800
	4402 1000m	2000
	4402 2000m	1500
	4402 3000m	2000
	4402 4000m	1400
[illegible]	5083 1000m	55
	5083 1500m	45
	5083 2000m	30
[illegible]	5113 1800m	95
	5113 2000m	400

[illegible] M[illegible] 1893 [illegible] 23 [illegible] 79 [illegible] *Aglantha* [illegible] P[illegible] Expedition during the first [illegible] coast of Scotland westwards [illegible] in great abundance in the [illegible] increasing in number [illegible] of about 30° W. [illegible] VAN- [illegible] between the Faroes [illegible] 1903 [illegible] 427 [illegible] collected this [illegible] about 52° N. and [illegible] 1898 [illegible] hauls from [illegible] catches [illegible] between 1000 and [illegible] record from the [illegible] 1915, p. 27 [illegible] 1913 [illegible] 260 [illegible] several [illegible] 17 [illegible] almost all [illegible]

the Rockall Bank, at all depths down to about 600 metres below the surface, sometimes in great abundance.

Young specimens were taken in almost all of the hauls listed above, also in the deepest strata, though as a rule the young ones are more predominant in the upper strata than in the deep sea. The numbers of specimens given in the list do not always represent the entire catch, but in some cases (some of the stations of the "Thor" 1906 and the stations of the "Dana") the whole sample was preserved. From the data available we may state that *Aglantha* is generally distributed and very common throughout the area here dealt with, and in all parts of the area it may sometimes be taken in very great abundance. There is evidently a difference in the maximal size of the adult individuals in the different parts of the area. S. W. of Ireland and between the Rockall Bank and the continental slope west of Ireland and Scotland the majority of the specimens were less than 12 mm high, and only in a few cases a height of 15 or 16 mm was attained. In the interesting series of stations taken in June 1931 approximately along the Long. 30° W. ("Dana" St. 4201–4206) the numerous specimens showed a remarkable increase in size from south towards north; at the two southernmost stations, St. 4201 and 4203, very few specimens were more than 10 mm and none more than 13 mm in height; at St. 4205 the largest specimens were 15 mm, and at St. 4206 still further north several specimens attained a size of 18–19 mm in height. This increase in the maximal size of *Aglantha* apparently coincides with a decrease in the temperature of the water in the intermediate strata, e. g. at a depth of 400 m below the surface the temperatures were as follows: St. 4201 and 4203 about 11°, St. 4205 about 6°, St. 4206 about 5°. Still further north, off the south coast of Iceland, several specimens 20–21 mm high were taken. On the whole, however, *Aglantha* does not seem to grow to such considerable size within this portion of the Atlantic Ocean as in the cold basin of the Norwegian Sea (see above).

V. North-West Atlantic, west of the Reykjanes Ridge.

Material:

57°32′N. 33°31′W., OLRIK 1859.
57°18′N. 43°15′W., OLRIK 1861.
58°29′N. 44°51′W., OLRIK 1861.
58°11′N. 35°31′W., $^{16}/_{7}$1898. OSTENFELD.

61°34′N. 31°12′W., $^{21}/_{5}$1895	"Ingolf" St.	11. 377–0 m.	4 specimens
62°19′N. 26°55′W., $^{16}/_{6}$1895		17. 377–0 m.	2
61°44′N. 30°29′W., $^{17}/_{6}$1895		18. 377–0 m.	6
60°29′N. 34°14′W., $^{18}/_{6}$1895		19. 565–0 m.	6
58°10′N. 48°25′W., $^{22}/_{6}$1895		22. 377–0 m.	5
61°02′N. 29°32′W., $^{13}/_{6}$1896		80.	1
65°21′N. 29°00′W., $^{28}/_{6}$1896		96. 188–0 m.	1
65°28′N. 27°39′W., $^{28}/_{6}$1896		97.	1

abt. 65°N. 36°W., $^{10}/_{6}$1900. E. Greenl. Exped., 2 specimens.

60°20′N. 29°21′W., $^{4}/_{6}$1925	"Dana" St.	2307. 600 m wire.	180 sp.
		2307. 1000 m	85
		2307. 1500 m	150
59°21′N. 37°56′W., $^{12}/_{6}$1925		2308. 600 m	320
		2308. 3000 m	215
		2308. 4000 m	9
64°13′N. 40°57′W., $^{26}/_{7}$1925		2436. 600 m	150
		2436. 1000 m	350
		2436. 1700 m	10
62°35′N. 32°53′W., $^{27}/_{7}$1925		2437. 1000 m	25
63°32′N. 26°23′W., $^{28}/_{7}$1925		2438. 600 m	170
		2438. 1000 m	30
		2438. 1500 m	2
65°19′N. 26°50′W., $^{24}/_{7}$1928.	"Godthaab" St.	1. 50 m wire.	
		1. 150 m	
63°51′N. 33°51′W., $^{19}/_{7}$1931.	"Dana" St.	4235. 600 m wire.	300 sp.
		4235. 1000 m	14

61°52′N. 35°30′W., $^{15}{}_{8}$1933.	"Dana"	St. 1686.	600 m wire	num. sp.	
62°36′N. 32°48′W., $^{16}{}_{8}$1933.	—	St. 1687.	600 m	—	300
—	—	1687.	1000 m		500
—		1687.	2000 m		500

Previous records: The occurrence of *Aglantha digitale* in the coastal waters of the north-western Atlantic has been dealt with by several authors; summaries are given by Bigelow 1926 p. 352 (east coast of North America, with special reference to regional and seasonal occurrence in the Gulf of Maine); Kramp 1911, 1912, and 1913 (the coasts of Greenland); Kramp 1939 (Iceland). Special records from Newfoundland and Labrador are given by Bigelow 1909b p. 312 and 1920 p. 17 and by Frost 1937 p. 26. From the off-shore areas of this section very few records are found in the literature. The Plankton-Expedition in 1889 did not take the typical form west of 30° W., but Maas (1893 p. 24) described a new species or variety, *occidentalis*, from a series of localities across the Newfoundland Bank. The "Tjalfe" expedition, on its voyage to the west coast of Greenland in 1908, collected numerous specimens of *Aglantha* in a series of localities about 58° N. and 34°53′ to 39°24′ W. (Kramp 1913a p. 239). The occurrence in the waters between the southern part of the west coast of Greenland and the eastern coasts of Labrador and Baffin Land is dealt with by Kramp 1913, 1914, and 1912.

Besides the material listed above and the extensive collections from the waters between Greenland and Labrador (Kramp 1912) I have seen numerous specimens collected by the "Michael Sars" expedition in 1910 in a series of localities east of the Newfoundland Bank, and we may state that the species is generally distributed and very abundant in this part of the Atlantic. In the Davis Strait it is particularly numerous above the coastal banks on both sides, off the Greenland coast as well as off the coast of Labrador, but less abundant in the middle parts of this region; in the area east of the southern part of Greenland, however, it may also be taken in great quantities above the greatest depths. At most of the "Dana" stations the greatest number of specimens were taken in hauls with 600 m wire out, but considerable numbers were also sometimes taken in deeper strata. The appliance used by the "Dana" was almost always the 2 m ringtrawl with bag of stramin, and the numbers caught in different depths may therefore be directly compared. Only at St. 2136, 2138, and 4235 the deepest haul was made with a coarser net with more open meshes, which may account for the small number of specimens taken in these hauls. The deepest haul, with 4000 m wire out, at St. 2308 was, however, made with the 2 m ringtrawl and only brought up 9 specimens of *Aglantha*, which may even have been caught at higher levels during the hauling in of the net; undoubtedly, therefore, the species is really rare in the very deep strata. At St. 1687, in the middle of the deep basin east of southern Greenland, the hauls with 1000 and 2000 m wire contained more specimens than the haul with only 600 m wire out.

At all depths and at any time between May and August, from which material is available, small as well as large specimens were taken. The largest specimens, 21–22 mm in height, were found as well in the neighbourhood of the east coast of Greenland as above the Reykjanes Ridge and in the deepest parts of the basin. In the Davis Strait the specimens frequently attain a still larger size, especially in the cold marginal zones off the coasts of Greenland and Labrador, where they grow to a size of about 28 mm in height.

VI. The Baffin Bay. No new material. — A general account of the occurrence of *Aglantha* in this deep and cold basin is given in my paper on the medusæ of the "Godthaab" expedition (Kramp 1942). In certain parts of this cold area the specimens attain a very considerable size, 31 mm or more in height.

The statements above confirm the previous conception of *Aglantha digitale* as a very common medusa throughout the northern part of the Atlantic and adjacent waters, frequently occurring in great numbers. It is rarely taken in the surface water, and as a rule it is likewise rare in the very deep strata, though sometimes it may be met with in considerable numbers as deep down as 3000 metres or more below the surface. We know from the literature that in the southern part of its area of distribution it only occurs in the intermediate and deep strata.

Aglantha digitale has a circumpolar distribution; in the Pacific it penetrates southwards as far as Misaki in Japan (about 34° N.) and Vancouver on the west coast of North America (about 50° N.). In the western Atlantic it is common in the Gulf of Maine and occasionally found as far south as Chesapeake Bay (about 37° N.). In the eastern Atlantic it is frequently mentioned from the Bay of Biscay (Browne 1906, le Danois 1914, Kramp 1924, Ranson 1936); according to Browne it is even the most common of all medusæ in the Bay of Biscay. It is also recorded from a locality west of Cape Finisterre (43° N., Ranson 1936). Re-examination of the specimens taken by the "Thor" in 1909 and 1910 in two localities off the Straits of Gibraltar and formerly (1924) referred by me to *Aglantha digitale*, has proved that they belong to the species which later on (1932) was described by Ranson as *Aglantha krampi*. According to Ranson *Aglantha digitale* is found east and south of the Azores (southernmost locality 36°17′ N., 28°53′ W.) and between the Azores and the Bermudas. In the collections of the "Dana" expedition in 1921–1922 (which I have worked up but not yet published) *Aglantha* was completely lacking, also from the northernmost stations in the Atlantic about 35–36° N. The southern limit of distribution thus seems to be at about 36° N. across the Atlantic Ocean.

Pl. VI fig. 6 presents a typical specimen of the red form of *Aglantha* as found in the cold areas in the waters west of Greenland. The figure was drawn by me on board the "Godthaab" in 1928.

Fam. **Geryonidæ** Eschscholtz 1829.

Trachymedusæ with 4 or 6 radial canals, with blindly ending centripetal canals; with well-developed manubrium mounted upon a peduncle; with leaf-like gonads upon the radial canals.

Gen. **Liriope** Lesson 1843

4-rayed Geryonidæ.

Every author of recent time, who has dealt with this genus, emphasizes the difficulty, or impossibility, of finding reliable characters for distinction and limitation of the species. Ranson (1936 p. 188) still retains at least three Atlantic species, *exigua*, *eurybia*, and *tetraphylla*. Thiel (1936 p. 45) unites all the numerous species into one, *L. tetraphylla* Chamisso & Eysenhardt, and Bigelow (1938 p. 126) is inclined to follow him in this respect. They may be right, but I prefer to leave the question open until I have examined the extensive collections at my disposal.

None of the various forms of *Liriope* are constant inhabitants of the areas here dealt with. Shoals of them are sometimes carried into the western part of the British Channel, where they are usually identified as *L. exigua*, and some few specimens were taken at two of the stations of the "Dana". They agree perfectly with the descriptions of *L. eurybia* as given by Haeckel and subsequent authors.

Liriope eurybia H[illegible]

[illegible] 1864 [illegible] 1862 [illegible] 11 25
[illegible] 1879 [illegible]
[illegible]
[illegible] 1910 [illegible]

[illegible] N	[illegible] W	[illegible]	[illegible]	4204	500m wire	2 spec.
				4204	1000m	1
[illegible] N	[illegible] W	[illegible]		4203	500m	2
				4203	300m	1

These localities are near the northern boundary of the Gulf Stream, where the temperature of the water in the upper strata was about 13–14° C. In the colder water a little further north the species was lacking.

Geographical distribution. *Liriope eurybia* is abundant in the Mediterranean and is also common in the warm parts of the Atlantic; it is recorded by MAAS (1893) from the Northern Equatorial Current and the Florida Current, and by RANSON (1936) from the Bay of Biscay.

II. Narcomedusæ.

Fam. Solmaridæ.

Genus **Pegantha** Haeckel.

Pegantha clara R. P. Bigelow.

Pegantha clara R. P. Bigelow 1909 p. 80, 2 figs.
— Mayer 1910 p. 445, fig. 298 A.
H. B. Bigelow 1918 p. 397.
1938 p. 131.

Material:

17°02'N, 31°15'W., $^{27-28}{}_{6}$31.	"Dana" St. 1201.	50 m wire.	1 spec.
	1201.	100 m	1
	1201.	300 m	1
	1201.	5000 m	1
49°49'N, 30°22'W., $^{30}{}_{6}$1931	1203.	100 m	2
	1203.	300 m	2
	1203.	600 m	1

The original description of this species was based upon one large, well-preserved specimen, taken near the borders of the Gulf Stream, off Woods Hole; MAYER (1910) examined the same specimen and gave new figures of it. H. B. BIGELOW (1918 and 1938) has seen several small specimens, most probably belonging to the same species, taken in the surroundings of the Bermudas and the Bahama Islands. The type specimen was 53 mm in diameter with 14 long tentacles alternating with the same number of smaller size. The specimens examined by H. B. BIGELOW varied in diameter between about 10 and 20 mm, with about 20 to 24 tentacles; BIGELOW does not state, whether the tentacles are of different sizes.

I have no doubt that the present specimens, from the northern boundary area of the Gulf Stream, belong to the same species; they are in rather poor condition, but in some places the otoporpae and the stomach saccules may be traced. They vary in size between 7 and 17 mm; the tentacles, 14–21 in number, are of different sizes, but large and small ones are usually not regularly alternating, as will appear from the adjacent diagrams (textfig. 12).

Geographical distribution: H. B. BIGELOW (1938) is inclined to think that the medusæ identified by VANHÖFFEN (1912a and b) as *Polycolpa forskali* Haeckel, and also *Pegantha smaragdina* Bigelow, belong to *Pegantha clara*; in such case this species has a very wide distribution in the oceans, being found in the tropical Pacific between the Hawaiian and Caroline Islands and off Chile and Peru, in the tropical Atlantic off the Cape Verde Islands, and in the localities mentioned above in the north western Atlantic. *P. smaragdina* (found off Peru) is a large medusa, 50–73 mm wide, with 28–34 tentacles; these are of almost equal size, in contradistinction to the alternately large and small tentacles of the large original specimen of *P. clara* as described by R. P. BIGELOW. Most records are from the upper strata, but, as stated by BIGELOW, the species has also been taken in "open net-hauls from considerable depths." The specimen from "Dana" St. 1201, 5000 m wire, may have been taken in the upper strata during the hauling in of the net.

The distribution of *Pegantha clara* in the North Atlantic seems to be extended still farther north than hitherto supposed, if the parasitic larvae, which shall now be described, really belong to that species.

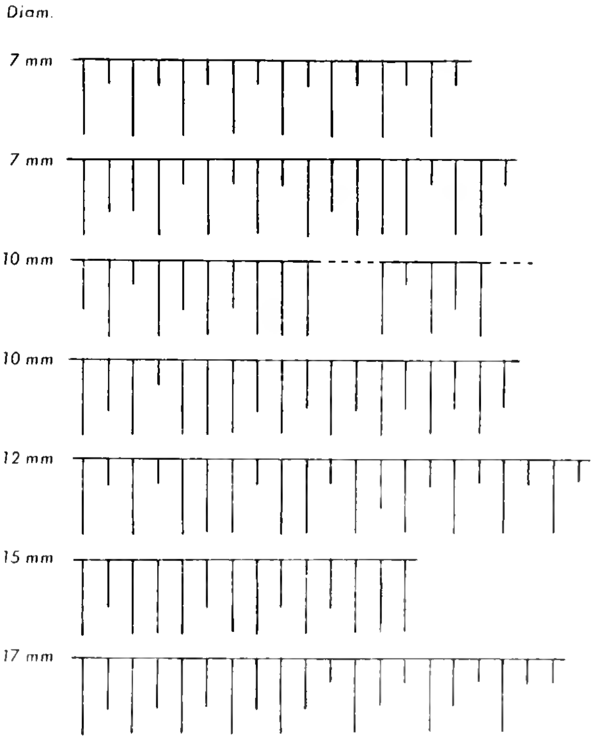


Fig. 12. *Pegantha clara*. Diagram showing relative length of tentacle in seven specimens from "Dana" St. 1201 and 1203.

Larvae of *Pegantha clara* in Periphylla.

Pl. IV fig. 7, Pl. V figs. 1–10.

Several Narcomedusa larvae in different stages of development were found in the stomach cavity of a young *Periphylla periphylla* from "Godthaab" St. 1, south-west of Iceland, 63°12' N, 26°50' W., $^{21}{}_{6}$1928, 1000 m wire out. The larvae were lying free in the gastric cavity of the host, most of them in the stomach proper, but a few young stages were seen in the distal part of one of the marginal lappets. Pl. IV fig. 7 presents the *Periphylla* with the larvae *in situ*. Two of them are medusoids ready for liberation.

[illegible] propagate [illegible] several [illegible] parasitic or [illegible] budding from [illegible] the budding larva [illegible] parent medusa (as in [illegible] *[illegible]scolor* Metschnikoff, and [illegible] cases (as in *Cunoctantha* [illegible] species) the budding [illegible] oral region of other species of [illegible] *Cunina para-*[illegible] -shaped larva (probably of *Cunina* [illegible]) found attached to the mouth region of [illegible] propagates a large number of medusa [illegible]. A special case is described by D. DAMAS [illegible] of Narcomedusa larvae, presumably [illegible] Gegenbaur, were found as para-[illegible] parapodia of the polychaete worm *To-*[illegible] propagate by budding and increase [illegible] causing a complete castration of the host. [illegible] of their parent medusae are also known [illegible] Müller, *Cunina peregrina* Bigelow, and [illegible] Bigelow, but their final development is unknown. [illegible] living free in the gastric cavity of another [illegible] are described here for the first time.

[illegible] stages observed are two complexes of larvae, [illegible] three or four individuals (Pl. V figs. 1 and 2). [illegible] complex differs considerably from the [illegible] consist of a minute body with two very large [illegible] provided with a distal knob of nematocysts. [illegible] I would consider as a primary polyp (no. I in the [illegible] the others are developed by budding. One [illegible] II) is an actinula with a large egg-shaped body and [illegible] placed opposite each other, one of them con-[illegible] the other and both provided with a distal [illegible]. The next bud (III) is still very small, and [illegible] just visible as a small protuberance with a [illegible]. In fig. 2 a still younger knob may be [illegible] to the left of no. III. When a bud has attained a [illegible] detaches itself from the primary polyp and becomes [illegible] with two tentacles. Pl. V fig. 3 shows a chain of [illegible] no. I is an actinula with its two tentacles [illegible] unequal in size, no. II is at the other end of the [illegible] than no. I and its tentacles are both quite [illegible]. Between no. I and II are two swellings evidently repre-[illegible] individuals in their first stages of development [illegible] III [illegible] IV. In this chain there is no individual like the [illegible] the two large tentacles as seen in figs. 1 and [illegible] therefore that an actinula after its liberation [illegible] sometimes able to produce other acti-[illegible].

[illegible] of the actinula is seen in Pl. V figs. [illegible] represented in fig. 4 two more tentacles have [illegible] ones, but they are still much smaller. [illegible]. It will also be seen that the body [illegible] after its liberation. [illegible]

[illegible] actinula into a medusa [illegible] the formation of a circular collar [illegible] opposite the tentacles. [illegible] between the two [illegible] are almost alike. [illegible] tentacles are [illegible] considerable [illegible] radiating grooves [illegible] already provided [illegible] and from each statocyst an otoporpa is seen running some distance towards the central part of the aboral surface, the middle one in each octant being the longest and the others decreasing in length towards both sides. The peronia and otoporpae are also seen in fig. 7, which shows a section of the aboral surface of a larva similar to those figured in figs. 5 and 6. The oral portion of the larva, below the collar, is still egg-shaped, and there is no indication of a mouth opening.

I have seen no further developmental stages between the actinulae just described and the two medusae shown in Pl. V figs. 8–10. The medusae are about 2 mm in diameter. There are still only four tentacles, with a solid core of cylindrical endoderm cells, and with the nematocysts still clustered in the tip of the tentacle. The umbrella is watchglass-shaped, its mesogloea moderately thick. The umbrella margin is turned inwards, and it is slightly notched outside the four peronia. The statocysts are well developed, club-shaped with a basal, cushion-like pad; their number is unaltered, five in each quadrant. The most remarkable feature is the extraordinary length of the otoporpae, the four interradial otoporpae are nearly concurrent at the apex of the exumbrella, and some of the others are only slightly shorter, their length however decreasing towards the tentacular radii. The velum is well developed.

The egg-shaped body of the actinula has now been transformed into the manubrium of the medusa; it has decreased in size, but it is still hanging down like the tongue of a bell; in one of the two specimens the manubrium is even somewhat constricted at its base. In this developmental stage of the medusa the first trace of a mouth is observed as a minute depression in the distal end of the manubrium (Pl. V fig. 10), not yet quite perforating the tissue to connect the stomach cavity with the outside. Until now the nutrition of the larva must evidently have been accomplished by osmosis. Probably the young medusa will leave the host as soon as the opening of the mouth is fulfilled, enabling the medusa to catch and swallow its own food.

The specific affinity of the larvae here described seem to me beyond doubt. Very few species of Narcomedusae are known from the northern Atlantic, and the possession of well-developed otoporpae in the young medusa at once separates it from *Solmaris corona*, *Solmissus incisa*, *Aegina citrea*, *Aeginura grimaldii*, and *Aeginopsis laurentii*. The only remaining species is *Pegantha clara*, which is characterized by the possession of 2–5, usually 3, long, slender, linear otoporpae on each of the marginal lappets. The fully developed medusa may have as many as 28 tentacles and marginal lappets, but as mentioned above the number is increasing with age; in a specimen 7 mm in diameter I counted 8 large tentacles and as many very small ones, and there can hardly be any objection against the supposition that the young medusa begins its free swimming life with only four tentacles as in the specimens found in the stomach of *Periphylla*. It seems to me highly probable, therefore, that the parasitic larvae described above belong to *Pegantha clara* R. P. Bigelow, a species which seems to be widely distributed in the northern Atlantic.

In the closely related species *Pegantha smaragdina* H. B. Bigelow, which occurs in the tropical Pacific, the development of the larvae takes place in the stomach cavity of the parent medusa. MAYER (1910) and also BIGELOW himself (1938) are inclined to think that the two species are identical. This supposition seems, however, to be contradicted by the development of the larvae. In both species the larvae, while in the actinula stage, propagate by aboral budding, and the proceeding of the budding process is very similar in both species. But during the further development the larva of *P. smaragdina* differs from that of *P. clara* in several respects. It has a greater number of tentacles, 6–8 in the older actinula stages, and 10–12 in the young medusa before its liberation. The actinula soon attains a broadly flattened shape, very different from the elongate shape of the actinula of *P. clara*. A mouth opening is pierced in very young actinula stages of

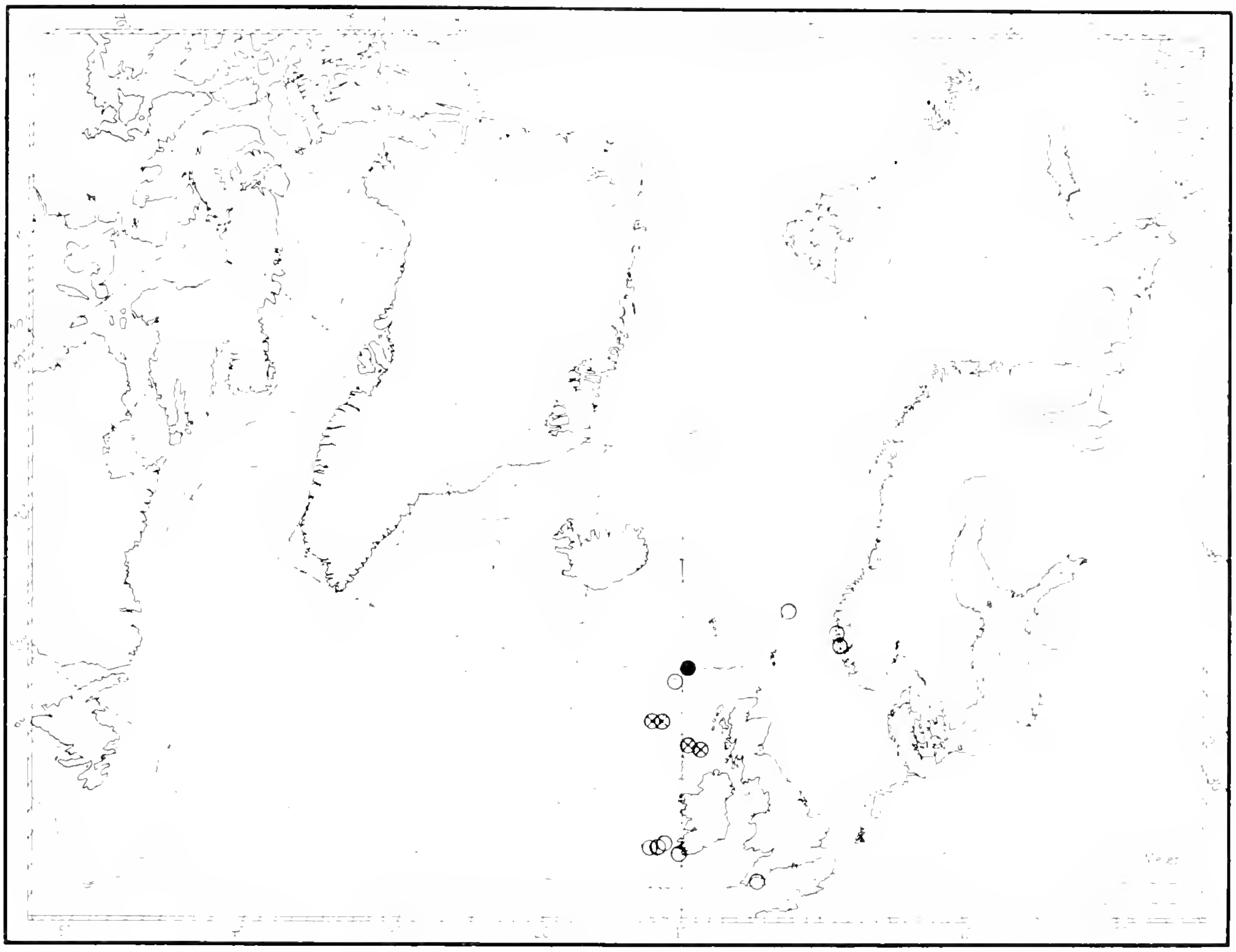


Fig. 13. Distribution in the northern Atlantic of: ● *Solmaris corona*, new record; *Solmaris corona*, previous records; ⊗ *Solmaris corona*, records not yet published; ◎ *Solmaris multilobata*.

P. smaragdina, whereas in *P. clara* the mouth does not appear until immediately before the liberation of the medusa. The statocysts of *P. smaragdina* make their first appearance in much later developmental stages of the larva, and even in the latest state of the medusa before its liberation there are only one or two statocysts between each successive pair of tentacles. Moreover otoporpæ are completely lacking in the larvæ of *P. smaragdina*.

Metagenesis. — A very important difference between the larvæ of the two species is the absence of what I have called "primary polyp" in *P. smaragdina*. Bigelow expressly states (p. 96) that larvæ produced by budding are indistinguishable from those developed directly from eggs. The larvæ being all alike, they probably all develop into medusæ, and consequently the developmental circle of this species is a hypogenesis and not a metagenesis. In *P. clara*, on the other hand, a metagenesis most probably takes place. It is very improbable that the larva described above with its two very large tentacles, much larger than the tentacles in even the most advanced actinula stages, might be transformed into a typical actinula; this would only be possible by a reduction in size of its tentacles, which hardly seems to be possible. This polyp should evidently be regarded as an oozoid, directly derived from an egg; it propagates asexually by budding, producing a number of larvæ which are transformed into medusæ, but it never becomes a medusa itself; it represents an asexual generation, and its offspring, the medusæ, constitute the sexual generation. Thus the cycle of development in *Pegantha clara* is a typical metagenesis, secondarily arisen in connection with the parasitic habit of the larvæ.

How the *Periphylla* becomes infected with the parasitic *Pegantha*-larvæ, can only be guessed; no stages younger than the primary larvæ with two large tentacles were observed. Probably these primary larvæ have entered the stomach cavity of the host while in a ciliated planula stage.

The larvæ of *Cunina lativentris*, parasitic in *Tomopteris* (Damas 1936) apparently enter the body cavity of the host in very early stages, as Damas found morula stages in the parapodia of the polychaete. They increase enormously in number by asexual propagation, first by polyembryonic fission of the morula, in later stages by aboral budding, which is continued after the larvæ have attained the medusoid shape. The budding takes place in almost the same manner as in the species of *Pegantha* and, as in *P. smaragdina* but unlike *P. clara*, the larvæ derived directly from the eggs are similar to those developed by budding, so that probably no metagenesis takes place.

It is possible that a metagenetic development will be discovered in some of the species of Narcomedusæ, in which the cycle of development is not yet fully elucidated; until now, however, the classical example of *Cunina proboscidea* — *rubiginosa* was the only undoubted case of metagenesis known among the Narcomedusæ. In *Pegantha clara* the parasitic habit has brought about a metagenesis of quite another type.

Genus **Solmaris** Haeckel

Solmaris corona (Keferstein & Ehlers)

Ægineta corona Keferstein & Ehlers 1861 p. 94, Pl. 14 figs. 7–9.
Solmaris corona Haeckel 1879 p. 358.
coronantha Haeckel 1879 p. 359, Pl. 20 figs. 7–10.

[illegible] III [illegible] 44
[illegible] 1925 [illegible] 319
[illegible]
[illegible] 1931 [illegible] 83
[illegible] Ma[illegible] 1865 [illegible] 45 Pl. 4 figs. 7 13

[illegible]

N [illegible] W [illegible] 1900 East Greenland Exped. 1 spec.

[illegible] S.W. of the Faroe Bank, moreover [illegible] specimens collected by the "Michael Sars" [illegible] between Scotland and Rockall in [illegible]

[illegible] East Greenland expedition is 9 mm [illegible] with 36 tentacles and marginal [illegible]

[illegible] Mediterranean specimens described by KEFERSTEIN & [illegible] 1861 [illegible] diameter with 27 30 tentacles and [illegible] specimens from the Canary Islands, de[illegible] HAECKEL as *S. conantha*, were 10 15 mm wide with [illegible] Specimens from north-western Europe generally [illegible] larger number of tentacles and lappets, but it [illegible] that they belong to the same species. [illegible] also examined a number of specimens from the [illegible] coast of Ireland, found that very small specimens, [illegible] 12 16 tentacles, but 29 were found in [illegible] wide, and in specimens 12 mm in diameter [illegible] varied between 25 and 35; the greatest [illegible] was 36, in a specimen 10 mm wide. In [illegible] wide, from the Norwegian coast (BROWNE [illegible] KRAMP & DAMAS 1925) 31 42 tentacles have been counted, [illegible] from the "Michael Sars" the number of tentacles [illegible] 44 regardless of the size of the individuals. [illegible] I have no doubt, therefore, that the specimens [illegible] Hebrides examined by VANHÖFFEN (1908), belong to [illegible] were 5 10 mm in diameter with 34 45 [illegible] VANHÖFFEN referred his specimens to *S. multilobata* [illegible] it seems probable that this species [illegible] *S. corona* *S. multilobata*, as described by [illegible] larger number of tentacles and lappets [illegible] than 64 in specimens 12 18 mm in diameter; [illegible] west of the Hebrides, in almost the same [illegible] specimens examined by VANHÖFFEN. Later on [illegible] been taken in great abundance in the [illegible] British Isles and on the Norwegian [illegible] been observed since it was [illegible] no less than 28 specimens of this [illegible] one haul with the plankton net in [illegible] tentacles and lappets makes the only [illegible] and it is certainly very aston[illegible] was abundant in 1889 in [illegible] investigations during several [illegible] form *corona*. The [illegible] particular summer, [illegible] entire population of *Solmaris* [illegible] unusual develop[illegible] number of tentacles [illegible] of the size of the [illegible]

[illegible] very common in [illegible] only belongs to [illegible] to November) it

is more or less regularly carried by the Gulf Stream to the southern part of the west coast of Norway, and also into the Channel, at least as far as Plymouth.

Further distribution: Mediterranean, the Canary Islands.

Fam. Æginidæ.

Ægina citrea Eschscholtz.

Ægina citrea Eschscholtz 1829 p. 113, Pl. 11 fig. 4
rosea Eschscholtz 1829 p. 115, Pl. 10 fig. 3
rhodina Haeckel 1879 p. 338, Pl. 20 figs. 11 15

North-Atlantic record.
Ægina rhodina Kramp 1924 p. 37

Material (see the map, textfig. 14)

57 52 N	9 53 W	$^{8}/_{6}$ 1905	"Thor" St.	72	600 m wire.	1 spec.
49 22 N	12 52 W	$^{4}/_{9}$ 1906		184	1800 m	1
47 02 N	31 45 W	$^{27-28}/_{6}$ 31	"Dana" St.	4201	50 m wire.	1 spec.
				4201	4000 m	3
62 23 N	16 05 W	$^{25}/_{6}$ 1932		4402	2000 m	1
63 38 N	14 13 W	$^{18}/_{5}$ 1934		5113	1800 m	3
				5113	2000 m	3

The specimens are fairly small, 5 15 mm in diameter; they all have four tentacles, and, as far as can be seen from their state of preservation, the eight stomachal lobes have an entire margin with no indication of a secondary notch, the specimens belong, accordingly, to the *rosea* type.

Geographical distribution: The various forms of *Ægina*, all of which probably belong to one species, *Æ. citrea*, are widely distributed in the tropical and subtropical parts of all the oceans, including the Mediterranean. In the Pacific it penetrates northwards into the Bering Sea. In the Atlantic it is quite common east of Florida and near the Bahamas and the Bermuda Islands; in the eastern part of the Atlantic it is recorded from the Azores and off the coast of Portugal (RANSON 1936). As demonstrated by the present collections the area of distribution in the Atlantic extends considerably farther north; on a previous occasion (KRAMP 1924) I have recorded the species from a locality S.W. of Ireland ("Thor" St. 184, 1906). It was also taken by the "Thor" (St. 72, 1905) west of Scotland and by the "Michael Sars" (St. 101, 1910) in the Rockall Channel. The "Dana" has taken it in the northern boundary area of the Gulf Stream about midway between Newfoundland and the British Isles (St. 4201) and also in two localities off the south coast of Iceland, as far north as 62 23' and 63 38' N. (St. 4402 and 5113).

The vertical range is very considerable. THIEL (1936 p. 77) designates this species as a typical deep-sea medusa, but as a matter of fact, it occurs at all depths, being frequently taken in the surface waters. On the "Dana" St. 4201 one specimen was taken near the surface (with 50 m wire out), others in a deep haul, 4000 m wire. The other specimens in the present collections were all taken at rather considerable depths, most of them in hauls with 1800 2000 m wire out.

We may state, accordingly, that *Ægina citrea* is a widely distributed oceanic medusa, its northwards distribution in the Atlantic being limited by the submarine ridges separating the Atlantic proper from the adjacent arctic basins, occurring at all depths in the warmer regions, but restricted to the deep strata in the northern boundary areas.

Æginopsis laurentii Brandt.

North-Atlantic records.
Æginopsis laurentii Wagner 1885 p. 79.

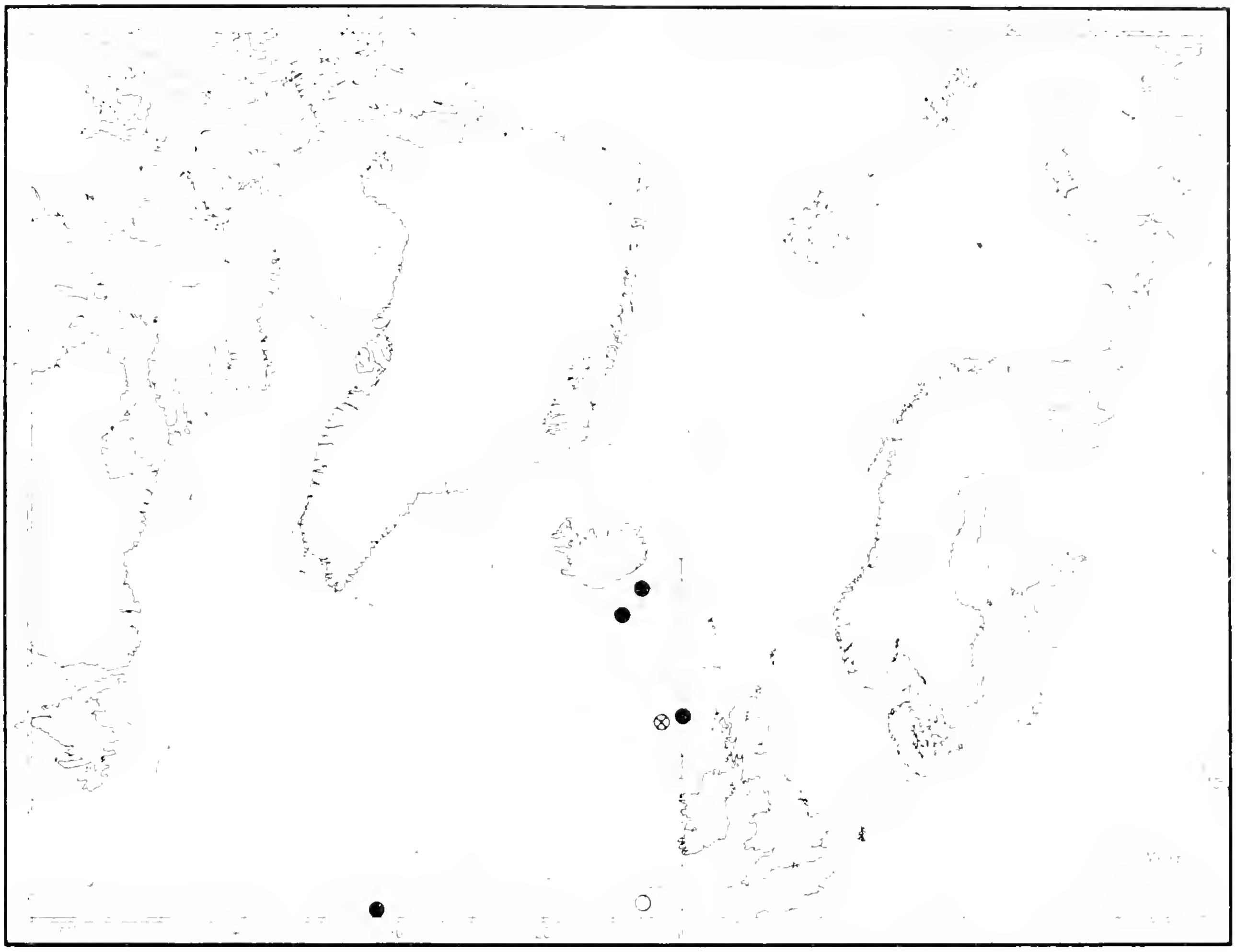


Fig. 14. Distribution in the northern Atlantic of *Ægina citrea*. ● new records; ○ previous records; ⊗ record not yet published.

Solmundus sp. Fewkes 1888.
Æginopsis laurentii Schlater 1891 p. 312.
– Birula 1896 p. 347.
– – Vanhöffen 1897 p. 273.
Solmundus glacialis Grönberg 1898 p. 466, Pl. 27 figs. 7, 8.
– – Aurivillius 1899
Æginopsis laurentii Linko 1904 b p. 219.
– – Maas 1906 a p. 185.
Solmundus glacialis Broch 1905 p. 8.
– – Broch 1907 p. 8.
Æginopsis laurentii Hartlaub 1909 p. 172, Pl. 76 figs. 7, 8.
– Bigelow 1909 b p. 314, Pl. 32 figs. 2–6.
– Kramp 1914 p. 434.
– Kramp & Damas 1925 p. 320.
– Thiel 1932 b.
Kramp 1933 c p. 16.
Bernstein 1934 pp. 9, 26.
Ranson 1936 p. 212.
– Jaschnov 1939 pp. 112, 114.
– – Dunbar 1942 p. 71.
– Kramp 1942 p. 97.
1943 p. 8.

Material: The numerous specimens in our collections are all from the Greenland waters and have been dealt with by me in the papers cited above. The species was well described and figured by Bigelow (1909 b), and I have nothing to add to his description.

Mayer (1910 p. 472) includes *Solmaris tetranema* Hargitt (1902 p. 17 and 1904 p. 58) among the synonyms of *Æginura laurentii*. An identification of these two medusæ seems to me rather questionable. *Solmaris tetranema* was deficiently described from a single specimen, somewhat damaged, so that "accurate determination was not practicable." The bell was flat, discoid, and between the four primary tentacles were "what appeared to be 4 undeveloped or rudimentary tentacles." It was found near the Gulf Stream off Woods Hole, thus quite outside the area of distribution of *Æginopsis laurentii*. For geographical reasons it also seems to me rather objectionable to refer *Æginopsis mertensii* Haeckel to *Æ. laurentii*. This latter has never been observed in the Pacific south of the Bering Strait, whence it was described by Brandt (1838). *Æ. mertensii* was taken in the Sea of Japan, and Haeckel expressly states that the only specimen was "ein sehr unvollkommen erhaltenes Spiritus-Exemplar." It should at present be regarded as an obsolete species, until some medusa be found in Japanese waters which may correspond to Haeckel's description.

Geographical distribution. *Æginopsis laurentii* is an arctic, circumpolar species. Thiel (1932 b p. 166) designates it as arctic-boreal, but its occurrence outside the true arctic regions is evidently restricted to areas, where cold currents prevail. It is common in the waters west of Greenland at least as far north as Smith Sound and is also found on the north coast of Ellesmere Land.[1] It follows the cold Labrador Current southwards along the coast of Labrador to Fogo Island, Newfoundland (Bigelow 1909 b). It also occurs along the entire east coast of Greenland. It has been found in deep water in a locality between Iceland and Norway in the cold bottom water of the Norwegian Sea. From Vardø in

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[1] Recently recorded from several localities around Baffin Land (Dunbar 1942).

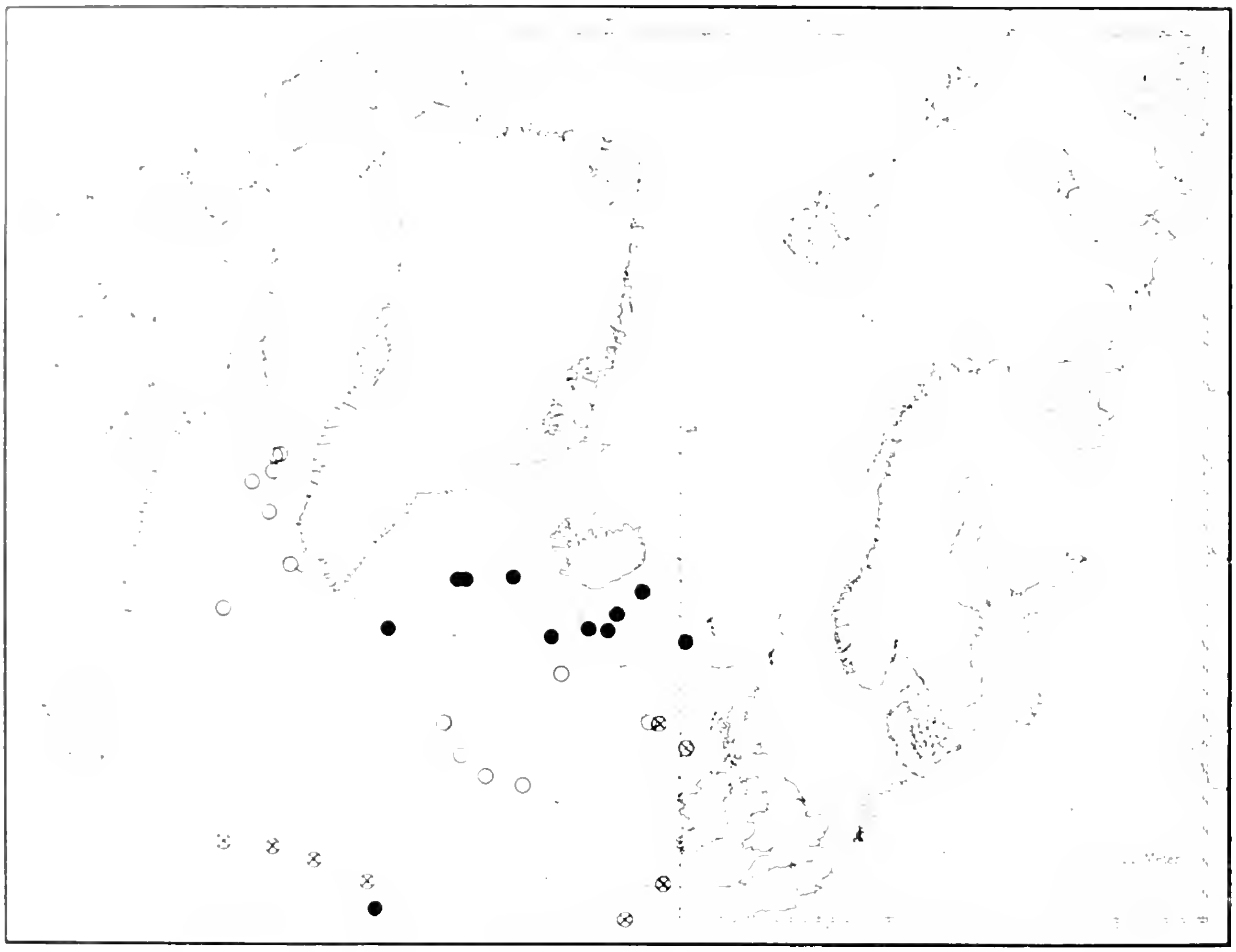

Fig. 15. [illegible] Atlantic of *Æginura grimaldii* ● new records, ○ previous records, ⊗ records not yet published.

[illegible] New[illegible] is distributed northwards to [illegible] along the north coast of Russia and [illegible] 1954 [illegible] the north coast of Alaska (BIGELOW [illegible] from Laurent Bay in Bering Strait. [illegible] to penetrate further southward into the [illegible] vertical occurrence ranges from the surface [illegible] 6000 [illegible]. In the Davis Strait it avoids the com[illegible] Arctic water of the deep-sea area; in the [illegible] the upper strata which are influenced [illegible]

Genus Æginura Haeckel

Æginura grimaldii Maas

[illegible] 1904 [illegible] Pl. [illegible] 19–28
[illegible] 1935 p. 276
[illegible] 1936 p. 86
[illegible]
[illegible] 1912 p. 100

[illegible]

[illegible] 1900 [illegible] 1 spec.
[illegible]
[illegible]
[illegible] 1 spec.
[illegible] 3000 [illegible] 175
[illegible] 2000 [illegible] 160
[illegible] 770
[illegible] 1000 [illegible] 70

62°35′N 32°53′W, 27/5 1925	"Dana" St. 2137	1900 m wire	10 spec.
63°19′N 26°50′W, 23/4 1928	"Godthaab" St. 1.	1000 m	8 –
17°02′N 31°15′W, 27–28/6 31	"Dana" St. 4201	5000 m	12
62°23′N 16°05′W, 25/6 1932	4402	2000 m	500
	4402	3000 m	650
	4402	4000 m	125
62°36′N 32°18′W, 16/5 1933	4687	2000 m	600
63°38′N 14°13′W, 18/4 1934	5113	1800 m	75
	5113	2000 m	130

On the map, textfig. 15, are included eight localities in which this species was taken by the "Michael Sars" in 1910 in hauls with 1000–3000 m wire out.

Æginura grimaldii was well described by MAAS (1904 p. 38, Pl. III figs. 19–28) from a locality outside the Bay of Biscay, 47°45′N 17°40′W, where one single specimen was taken by the Prince of Monaco at a depth of 781 m. The original specimen was only 12 mm in diameter, but the medusa may attain a much larger size, the largest specimens at my disposal are 31 mm wide.

The specific name has been discussed by THIEL (1935 p. 37 and 1936 p. 86), BIGELOW (1938 p. 132), and KRAMP (1912 p. 100).

THIEL has found that in the tropical parts of the Atlantic young specimens may occur in the upper strata; in the northern Atlantic, however, this species is truly bathypelagic. In one locality, south of Iceland ("Dana" St. 2306) a specimen was taken in a haul with only 600 m wire out, at the same time as hauls with 2000 and 3000 m wire out captured a large number of specimens, and in no other North Atlantic localities was this medusa taken in hauls with less than 1000 m wire out, 600 metres or more below the surface.

Very large specimens, more than 25 mm in diameter, were taken only on one occasion ("Dana" St. 2308, 3000 m wire out), otherwise there is no indication of a difference in the bathymetric occurrence of specimens of different sizes; young as well as adult ones, 1–25 mm wide, were taken at all depths.

Geographical distribution: The map, textfig. 15, clearly shows that the horizontal distribution of this species in the North Atlantic is strictly limited by the continental shelves and the submarine ridges connecting Scotland, Iceland, Greenland, and Baffin Land, it is generally distributed and very common throughout the deep-sea area of the northern Atlantic. It is also common in the areas around the Bermudas and the Azores, and is frequently met with in the deep-sea west of southern Europe and north-western Africa, but it seems to be fairly rare in the southern Atlantic. Some young specimens were taken by the "Meteor" in a few localities (THIEL 1936), and it is recorded from the Guinea Current and the Benguela Current off the west coast of Africa, where it was taken by the "Valdivia" (VANHOFFEN 1908); in the vast collections of the "Dana" expedition in 1930, from Cape of Good Hope northwards, this species was altogether lacking south of the Cape Verde Islands. It is unknown in the Mediterranean but it is recorded from several places in the Indian and Pacific Oceans, in the Pacific it occurs as far north as in the Bering Sea. *Aeginura grimaldii* may thus be designated as a bathypelagic medusa with a world wide distribution, comprising all the great oceans, except the Mediterranean and the arctic seas, though apparently it is not equally abundant everywhere.

Narcomedusæ indeterminatæ.

Fragments of medusæ, probably Narcomedusæ, which I am unable to determine, were taken in the following localities.

60°59'N. 22°29'W., ${}^{29}/{}_{5}$ 1925.	"Dana" St.	2306.	2000 m wire
59°21'N. 37°56'W., ${}^{1-2}/{}_{6}$ 1925.		2308.	3000 m
61°13'N. 10°57'W., ${}^{25}/{}_{7}$ 1925.		2436.	1700 m
62°35'N. 32°53'W., ${}^{27}/{}_{7}$ 1925.		2437.	1900 m
47°02'N. 31°45'W., ${}^{27-28}/{}_{6}$ 31.		4201.	5000 and 6000 m wire
62°23'N. 16°05'W., ${}^{29}/{}_{6}$ 1932.		4402.	2000 m wire
62°36'N. 32°18'W., ${}^{16}/{}_{8}$ 1933.		4687.	2000 m
63°38'N. 14°13'W., ${}^{18}/{}_{7}$ 1931.		5113.	1800 and 2000 m wire

III. Scyphomedusæ.

Order Coronatæ.

Fam. Periphyllidæ.

Genus Periphylla Haeckel

[illegible] investigations of extensive collections of [illegible] carried out by Brown, Bigelow, [illegible] doubt that this genus comprises [illegible] necessary, therefore, to discuss the name [illegible] the genus. I am going to do so from [illegible] the law of priority should only be followed [illegible] confusion is avoided. In the present case [illegible] to adopt the oldest specific name, and, [illegible] *periphylla* introduced by Péron & [illegible] be adopted as specific name without [illegible] The determination of the generic name, [illegible] more troublesome considerations. [illegible] between no less than six species [illegible] and *mirabilis* were described [illegible] Haeckel ([illegible] *Carybdea* [illegible] Quoy & Gaimard, *dodecabo-* [illegible] Steenstrup. According to the [illegible] of these species there is no doubt [illegible]

[illegible] *Periphylla hyacinthina* was based [illegible] Iceland in the collections [illegible] almost all these specimens [illegible] applied the name of Steen- [illegible] as well as the specific name, [illegible] Steenstrup 1837 and 1842 [illegible] as a matter [illegible] appears in the printed [illegible] The specific [illegible] 1829 [illegible] medusa from [illegible] specimens [illegible] Provided [illegible] as the [illegible]

[illegible] Faber, it is [illegible] and [illegible] *periphylla* [illegible]

down like a peduncle — sonst keine Faden bemerklich". Also for biological reasons the identification of this medusa with *Periphylla* seems very improbable; Faber saw it twice in Eyjafjord on the north coast of Iceland, it seems most unlikely that an oceanic deep-sea medusa like *Periphylla* should be observed (evidently swimming at the surface) in such a locality; it has occasionally been taken in the coastal area off the south coast of Iceland and once off the north-west coast but never on the north coast (see Kramp 1939 p. 20). Haeckel likewise doubts the identity of Faber's medusa with *Periphylla*.

Faber identified his *Melitea hyacinthina* with some medusæ mentioned in 1772 by Olafsen under the name of "Kiobmandshuner" (merchant-caps), and later on by Mohr (1786) as *Medusa cruciata* or "Bla-Pose" (blue pouch). Some years ago I wrote to Dr. B. Sæmundsson in Reykjavik asking him, whether he had ever heard about "merchant-caps" from the Icelandic fishermen, but he had never heard that name, neither could he tell me, whether the merchants in Iceland had ever used caps which might have any resemblance to *Periphylla* or other medusæ. It also seems unlikely that the fishermen in the eighteenth century should have a proper name for a medusa like *Periphylla*, which is only a stray visitor in the coastal regions of Iceland. It seems, however, that Steenstrup has met with "merchant-caps" during his voyage to Iceland in 1839.

Steenstrup has examined the old specimens of *Periphylla* in the museum, and it would be desirable to know, why he identified them with *Melitea hyacinthina* Faber. With the kind assistance of professor R. Spärck I have therefore searched the old "Acta" in the museum for any notes which might give a clue to the question. The first record of a *Periphylla* is found in a journal from 1851, when a specimen was presented to the museum by captain Hygom; it was collected in the Atlantic, 48° N., 8° W., and was introduced in the journal as *Carybdea* sp. with a later addition in Steenstrup's handwriting "*periphylla* Per. — *hyacinthina* Fab." Another specimen, collected by Hygom in 43° N., 23° W., is entered in the journal for 1857 as "Kjøbmandshue" (*Periphylla* Stp.), and a third specimen, likewise taken by Hygom (39° N., 13° W.), is immediately listed by Steenstrup, in 1863, as *Periphylla hyacinthina*. Of considerable interest is a scrap of paper written by Steenstrup, with the head lines

Periphylla hyacinthina Faber (1829)
Charybdea periphylla Péron
Faber, Islands Fiske p. 197

with a list of the localities, from which the species was known by then, including the Atlantic, Hygom 1851, but not the find by HYGOM 1857; it must, accordingly, have been written between 1851 and 1857. It appears from these notes that STEENSTRUP himself has seen *Periphylla* between the Faeroes and Iceland during his voyage to Iceland in 1839, and also that on his arrival the medusa was named to him as "merchant-cap". The possibility, therefore, exists that FABER's medusa was really a *Periphylla*, and if so FABER becomes the author of the specific name *hyacinthina*.

In 1877 our whole collection of medusæ was sent to HAECKEL in Jena together with a complete hand-written list of the specimens, written by LÜTKEN with provisional identifications of the species; the list was returned in 1880 with the final identifications in HAECKEL's hand-writing. The several specimens of *Periphylla* are by LÜTKEN designated as "*Charybdea hyacinthina* Faber" or "*Periphylla, s: Charybdea hyacinthina*", and to all of them HAECKEL has added the name *Periphylla hyacinthina* Steenstr. — Two of the first numbers in the list are dated 1837 and 1842 (specimens from Greenland), and this is probably what induced HAECKEL to quote the "Acta Musei Hafniensis" 1837 and 1842.

If FABER's medusa from Iceland was really a *Periphylla*, the specific name *hyacinthina* takes precedence over *dubia* Brandt 1838 as well as *bicolor* Quoy & Gaimard 1833. But, as mentioned above, there is no doubt that the same species was formerly described by PÉRON & LESUEUR (1809) under the name of *Carybdea Periphylla*. The description was not very clear, and the atlas, which was intended to follow the text, was never issued as a whole; but the figure of *Carybdea periphylla* was reproduced in 1834 by BLAINVILLE and in 1839 by MILNE-EDWARDS and leaves no doubt of the identity. The correct specific name of the only existing species of this genus thus becomes *periphylla* Péron & Lesueur.

In order to determine the generic name we must look up all the names which have been applied to the medusa since it was first described; they will appear from the following synopsis, in which the four so-called species are placed in four separate columns.

Péron & Lesueur 1809	Carybdea Periphylla			
Faber 1829	Medusa (Melitea) hyacinthina			
Quoy & Gaimard 1833		Carybdea bicolor		
Brandt 1837		Carybdea (Cyclophylla) bicolor	Carybdea (Cyclophylla) periphylla	
Brandt 1838				Chrysaora (Dodecabostrycha ?) dubia
Lesson 1843		Carybdea bicolor	Carybdea periphylla	Cassiopea (Dodecabostrycha) dubia
Mörch 1857	Dodecabostrica Umataursak Groenlandorum			
L. Agassiz 1862		Quoyia bicolor	Charybdea periphylla	Dodecabostrycha dubia
Lütken 1875	Charybdea hyacinthina			
Haeckel 1880	Periphylla hyacinthina	Periphylla bicolor	Periphylla peronii	Periphylla dodecabostrycha

Carybdea Péron & Lesueur 1809 comprised two species, *periphylla* nov. and *marsupialis* Linné; this latter is generally adopted as the genotype of *Carybdea*, and it would cause a most disastrous confusion if that generic name were applied to *periphylla*. AGASSIZ (1862 pp. 172–174), it is true, adopted the division introduced by LESSON, in which *Carybdea* was retained as the generic name of *periphylla*, whereas the name of *Carybdea marsupialis* was changed to *Marsupialis planci*. BRANDT (1837 p. 187), on the other hand, divided the genus *Carybdea* P. & L. into three subgenera, one of which was *Carybdea* genuinae comprising *C. marsupialis* P. & L. and *alata* Reynaud.

FABER (1829 p. 197) referred his *Medusa hyacinthina* to the genus *Melitea* Péron & Lesueur. *Melitea purpurea* P. & L. (1809 p. 343) is however a Rhizostomid.

The name *Dodecabostrycha* is due to BRANDT and has been adopted as generic or sub-generic name by LESSON, MÖRCH, and AGASSIZ, and as specific name by HAECKEL; but all these and several subsequent authors have misunderstood the combinations of names in BRANDT's well-known paper of 1838, because they have paid no regard to his previous paper (BRANDT 1837 pp. 187 and 189)[1], in which the genus *Carybdea* is divided into three sub-genera, one of which is *Cyclophylla* (comprising *C. periphylla* P. & L. and *C. bicolor* Q. & G.), and the genus *Chrysaora* is likewise divided into three sub-genera, one of which is *Dodecabostrycha* with the species *gaudichaudii* Lesson (= *Desmonema gaudichaudi* of the Rhizostomeae). In 1838, when BRANDT described the new species *dubia*, he was in doubt of its affinities and thought it possible, but not certain, that it might belong to the sub-genus *Dodecabostrycha*. His doubt also appears from the various applications of queries. In the text (p. 387) the species is called *? Chrysaora (Dodecabostrycha ?) Dubia*; in the explanation of the plates and also on one of the plates (Tab. 29) is written *? Chrysaora (Dodecabostrycha) dubia*, and on the other plate (Tab. 30) the same without any query. Accordingly *Dodecabostrycha* cannot be applied to any of the forms of *Periphylla*, because it was originally established for a Rhizostomid.

Cyclophylla, on the other hand, was introduced by BRANDT (1837 p. 187) as the name of a new sub-genus comprising the two species *C. periphylla* P. & L. and *bicolor* Q. & G. If we were to decide a change of the generic name *Periphylla*, we must accordingly take into consideration the possibility of replacing it with *Cyclophylla* Brandt.

This name, at any rate, takes precedence over *Quoyia*, introduced by AGASSIZ (1862 p. 173) for *Carybdea bicolor* Quoy & Gaimard; it would certainly be a most inconvenient name, especially if the name of the family, to which the genus belongs, should be derived from it (Quoyiadae[2]).

In the printed literature *Periphylla* is used for the first time as a generic name in HAECKEL's monograph (1880 p. 418). A strict application of the law of priority would lead us to cancel that name in favour of the older name *Cyclophylla* Brandt 1837. It seems to me, however, most deplorable if *Periphylla* should be replaced by a name, which has appeared only once in the literature and never revived, whereas this very common and

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[1] HAECKEL, in his fifth addition (p. 650) regarded almost all the names in that paper as obsolete.

[illegible] employed in P[illegible] and I most entreat- [illegible] name Periphylla be retained [illegible] in mind that this name [illegible] HAECKEL, nor was it invented by [illegible] from which HAECKEL adopted [illegible] the literature in 1809 by PÉRON [illegible] which, in their classification, [illegible] *Carybdea* [illegible] *periphylla* and *marsupialis*, [illegible] very far from each other, in two different [illegible] saw that his medusae from Iceland and Green- [illegible] *Charybdea periphylla* P. & L., and as a new generic [illegible] required, he elevated PÉRON's specific name to the rank [illegible] generic name, a procedure not uncommon in those days. HAECKEL [illegible] the idea and introduced the generic name *Periphylla* into the zoological literature, where it will be wise to [illegible] remain.

We may state that the name of the only species of this genus [illegible] is

Periphylla periphylla (Péron & Lesueur).

Periphylla periphylla (Péron & Lesueur).

North Atlantic records:

Medusa (Melitea) hyacinthina Faber 1829 p. 197.
Dodecabostrica Umataursak Groenlandorum Mörch 1857 p. 95.
Charybdea hyacinthina Lütken 1875 p. 188.
Periphylla hyacinthina HAECKEL 1880 p. 419, Pl. 24 figs. 11–16.
Dodecabostrycha dubia Fewkes 1881 p. 138.
Periphylla hyacinthina Fewkes 1886 p. 930.
[illegible] humilis Fewkes 1886 p. 931.
[illegible] hyacinthina Levinsen 1893 p. 148.
Vanhöffen 1892 p. 6, Pl. I, figs. 1–10, Pl. II figs. 3–8, Pl. III figs. 1–7.
Nordgaard 1900 p. 18.
Browne 1903 p. 30.
Kramp 1913 a p. 277.
Kramp 1914 p. 150.
Bigelow 1914 p. 27.
Broch 1914 p. 4, textfig. 1.
[illegible] regina Broch 1914 p. 8.
[illegible] hyacinthina Kramp 1920 p. 7.
Bigelow 1922 p. 138.
Havnø 1926 p. 286.
Runnström 1932 p. 31.
Kramp 1939 p. 20.
Stiasny 1940 p. 6.
Kramp 1942 p. 106.

M[illegible] (see the map, textfig. 16).

[illegible] N. 16 [illegible] W.	[illegible]1893	E. BAY		2 specimens
[illegible] N. 26 [illegible] W.	[illegible]1895	"Ingolf" St. 17.		2 specimens
[illegible] N. 26 [illegible] W.	[illegible]1896	76.		1
[illegible] N. 27 12 W.	[illegible]1904	"Thor" St. 153.		4
[illegible] W.	[illegible]1904	180.		1
[illegible] N. 17 [illegible] W.	[illegible]1904	183.		1 [1]
[illegible] W.	[illegible]1905	61.		2
[illegible] W.	[illegible]1905	71.		3
[illegible] W.	[illegible]1905	72.		1
[illegible] W.	[illegible]1905	165.		5
[illegible]	[illegible]1905	167.		2
[illegible]	[illegible]	"Dana" St. 2306.	2000m wire,	75 spec.
		2307.	600m	14
		2307.	1000m	32
		2308.	2000m	31
59°21'N. 37°56'W.,	$^{15}/_{6}$1925	"Dana" St. 2308.	1000m wire,	8 spec.
61°13'N. 10°57'W.,	$^{25}/_{7}$1925	2436.	600m	17
		2436.	1000m	11
		2436.	1700m	21
62°35'N. 32°53.2'W.,	$^{27}/_{7}$1925	2437.	600m	28
		2437.	1000m	26
		2437.	1900m	32
63°32'N. 26°23'W.,	$^{28}/_{7}$1925	2438.	600m	1
		2438.	1500m	8
51°48'N. 30°30'W.,	$^{1}/_{7}$1931	4205.	300m	1
		4205.	600m	1
53°38'N. 29°11'W.,	$^{1}/_{7}$1931	4206.	100m	2
		4206.	300m	2
		4206.	600m	38
		4206.	1000m	1
63°51'N. 33°51'W.,	$^{19}/_{7}$1931	4235.	600m	2
62°23'N. 16°05'W.,	$^{25}/_{6}$1932	4402.	2000m	22
		4402.	3000m	6
		4402.	4000m	6
61°52'N. 35°30'W.,	$^{15}/_{8}$1933	4686.	600m	2
62°36'N. 32°18'W.,	$^{16}/_{8}$1933	4687.	600m	7
		4687.	1000m	9
		4687.	1500m	140
		4687.	2000m	100
63°38'N. 11°13'W.,	$^{18}/_{5}$1934	5113.	1800m	12
		5113.	2000m	19

In our collections are numerous specimens from other localities in the North-Atlantic area, which have previously been recorded in the literature; they are indicated on the map, textfig. 16, by a special signature.

Periphylla periphylla is very abundant in the Atlantic Ocean south of the submarine ridges between Scotland, the Faroes, Iceland, Greenland, and Baffin Land. It has its main occurrence in the deep and intermediate strata, but it may sometimes ascend towards the surface and may then cross the ridges and be carried considerably farther northwards, but it evidently avoids areas where cold currents prevail. I have previously dealt with its occurrence in the waters west of Greenland (KRAMP 1942), where stray specimens are sometimes seen in the coastal area even as far north as Godhavn, about 70° N. From the deep-sea south of Iceland it may penetrate as far as the north-west point of the island, but we have no evidence of its occurrence off the north coast, unless the "*Melitea hyacinthina*" Faber, recorded from Eyjafjord, be really a *Periphylla*. By the Gulf Stream it is frequently carried to the west coast of Norway; it is recorded from the Sognefjord in May and the fjords in the neighbourhood of Bergen in January, March, and July, and according to HAVNØ (1926) it is a regular visitor to the Lofoten region, about 68° N. In Sognefjord it was taken in great numbers, partly small individuals, which might indicate that the medusa is indigenous in this deep fjord; it is also possible, however, that the fjord, being provided with a submarine barrier at the mouth, acts as a trap to the medusae which happen to be carried in across the barrier (BROCH 1914 p. 8). *Periphylla* is also said to occur at Spitzbergen (MAYER 1910 p. 546), but I have been unable to find any precise records from this region in the literature.

As far as the horizontal distribution is concerned the present material only adds a number of localities within the same area, from which the species was previously known; but the numerous representative samples from different depths taken by the "Dana" provide us with valuable information of the vertical distribution of the various developmental stages of the medusa. In my paper on the West Greenland medusae (KRAMP 1942 p. 108) I have mentioned the disagreement between the bathymetrical occurrence, especially of the young individuals, in the Greenland waters as observed by me, and the corresponding observations from other

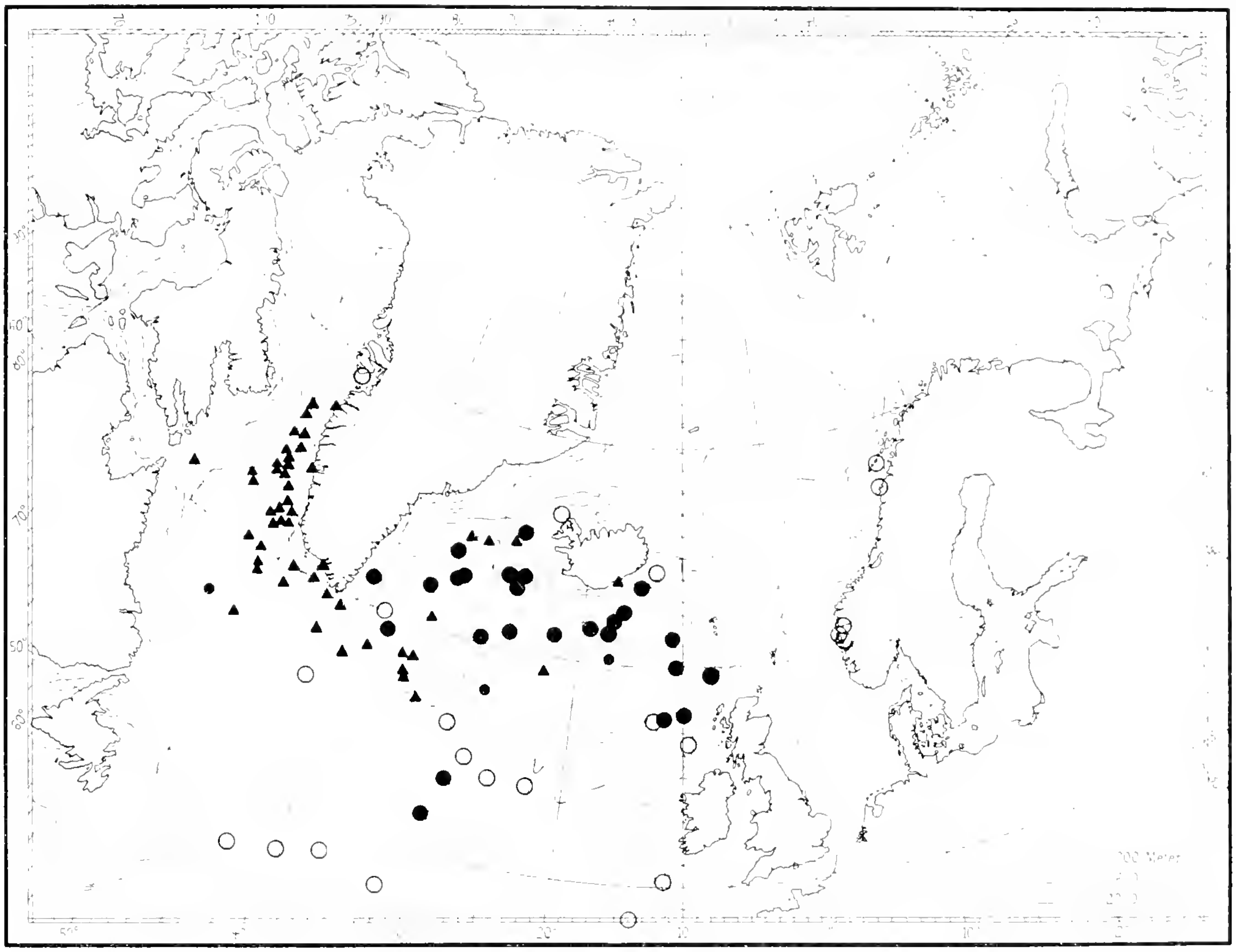


Fig. 16. Distribution in the northern Atlantic of *Periphylla periphylla*. ● new records; ▲ previous records, specimens in Zoological Museum, Copenhagen; ○ other previous records.

regions. In a previous paper (1913a) I pointed out that in Davis Strait the young specimens are particularly abundant in the deep strata, whereas STIASNY (1931 p. 363) is of the opinion that the small individuals mainly occur at higher levels than the large ones, and this opinion was based partly upon his own examination of the "Discovery" collections, partly on the statements by BROCH in the "Michael Sars" report (1914).

I have measured the diameter of all the specimens taken by the "Dana"; in the collections from the older expeditions the specimens were picked out and preserved more or less at random, and these collections are therefore not representative and are not considered in the following calculations. The results of the measurements are given in Tables V–VII, and for comparison I have summarized the results from other geographical areas as obtained by STIASNY, BROCH, and myself in Tables I–IV. The results are not directly comparable, because the diameter of the medusæ has been measured in different ways by the various authors. The diameter of the "Dana" specimens is measured to the base of the marginal lappets; BROCH preferred to measure the diameter of the central disk above the annular furrow. None of these methods are quite reliable, because the shape of the medusa is very variable according to the state of contraction, and this applies not merely to the bell margin, but to the gelatinous central disk as well. Nevertheless, in spite of the unavoidable incorrectness of the measurements, they give an impression of the bathymetrical distribution of small, middle-sized, and large specimens in the various regions, sufficient for the purpose.

In the southern part of the Atlantic (Table I, STIASNY 1934, "Discovery" collections) the largest specimens (forma *regina*) evidently have their principal occurrence between about 1250 and 2000 m below the surface, whereas middle-sized (forma *hyacinthina*) and small specimens (forma *dodecabostrycha*) are mainly caught between about 750 and 1000 m below the surface, and several specimens were even taken at depths of less than 250 m, whereas these stages were almost entirely lacking in the deepest strata, from about 1250 m downwards.

In the Mediterranean (Table II, KRAMP 1924, "Thor" collections) this species never seems to attain any considerable size, the largest specimens observed being only 35 mm wide. In the collections by the "Thor" specimens more than 25 mm in diameter were restricted to the deepest strata, about 1100–1700 m below the surface (1600–2600 m wire out; in my paper of 1924 I have calculated the depth as about one half the length of wire out, whereas two thirds probably comes nearer to the truth), whereas middle-sized and small specimens occur at all depths, "the young individuals seem normally to ascend into the intermediate, occasionally even into the upper strata, but sink to the deep water once more before breeding."

Table III is a contraction of the table, fig. 3, given by BROCH (1914, "Michael Sars" collections). In this portion of the North Atlantic, predominantly between 25° and 50° N., small and middle-sized specimens likewise occur at all depths, the majority being found rather high up in the water, about 500–600 m below the surface, occasionally even quite near to the surface, whereas the large individuals evidently prefer the deep strata.

Table IV illustrates the facts as observed in the Davis Strait by the "Tjalfe" expedition (KRAMP 1913); in the corresponding table in that paper are included some observations from the

Table I. V[illegible] of P[illegible] in the South At- [illegible] Stiasny 1931

[illegible]	Diameter of specimens, mm		
	[illegible]	[illegible]–80	80–200
[illegible]	[illegible]	3	
[illegible]	2	1	1
[illegible]	[illegible]		4
[illegible]	25	10	
[illegible]	8	1	
[illegible]	1		14
[illegible]			5
[illegible]			4

Table II. Vertical distribution of *Periphylla* in the Mediterranean, from Kramp 1924.

[illegible]	Diameter of specimens, mm		
	5–15	15–25	25–35
[illegible]	2	2	
[illegible]	26	18	
[illegible]	4		
[illegible]	15	5	
[illegible]	1	2	2
[illegible]	17	34	11
[illegible]	3	2	2

Table III. Vertical distribution of *Periphylla* in the North Atlantic between about 25° N. and 50° N., from Broch 1914.

[illegible]	Diameter of specimens, mm			
	[illegible] 15	15–25	25–40	40
	6			
[illegible]	8	1		
[illegible]	5	3		
[illegible]	30	4	2	
[illegible]	13	4	2	
[illegible]	10	5	2	1
	5	2		
	4	6	2	

Table IV. V[illegible] of *Periphylla* in the Davis Strait, from Kramp 1913.

[illegible]	[illegible]	Medium sized	Large
		1	
	[illegible]		
		[illegible]	3
			1
			4
			1
		1	
			4
			1

Irminger Sea; they are left out here. In this region specimens of all sizes may be met with at all depths; all of them predominate in the deep strata, and young specimens are very rarely taken in the upper layers, where, on the other hand, large specimens have repeatedly been observed, not merely by the "Tjalfe" expedition, but also on other occasions.

The material collected by the "Dana" in the North Atlantic between about 52° and 61° N. gives the following results (Tables V–VII). Table V presents the actual number of individuals taken in hauls of two hours' duration with the 2 m ringtrawl (S 200), the numbers obtained by hauls of only one hour's duration being multiplied by 2. This table is directly comparable with the tables presented above from other geographical regions, and it shows that the vast majority of the smallest individuals, 1–10 mm in diameter, are densely crowded in the deeper strata, only very few being taken in the upper layers, whereas the middle-sized and large specimens seem to be somewhat more dispersed. The number of hauls made at each depth must, however, be taken into consideration, and this is done in Table VI, giving the number of specimens per one haul of two hour's duration with the S 200, (only positive hauls are included in the table). It confirms the impression of a dense accumulation of small specimens, 1–15 mm wide, at depths between about 1000 and 1350 m, the number decreasing gradually downwards and very suddenly upwards; specimens 15–25 mm in diameter are far less numerous than the small ones, and they are about equally common from 100 to about 1350 m below the surface; the same apparently applies to the larger specimens, 25–40 mm wide. Specimens more than 40 mm in diameter were altogether scarce, but were taken at all depths, even in the uppermost strata, and it may be noted that the specimen taken nearest to the surface (with only 50 m wire out, "Dana" St. 2306, south of Iceland) was the largest of the specimens brought home, being about 250 mm in diameter. Table VII, giving the percentage number of specimens of each size-class at the various depths, shows that at depths between about 100 and 650 m below the surface the stock of *Periphylla* mainly consists of middle-sized individuals, whereas in the deeper strata, from 1000 m downwards, the vast majority are quite young ones.

In this portion of the North Atlantic, accordingly, the vertical distribution of the various developmental stages of *Periphylla periphylla* is very nearly the same as in the Davis Strait, which was also to be expected, as the southern, deep part of Davis Strait is a direct continuation of the deep basin of the Atlantic Ocean. In both areas the majority of the specimens were taken in strata which had a temperature of about 3–4°.

Stiasny (1931 p. 361) is inclined to think that "the small stages of *Periphylla* have their origin on the continental slope or near the coast . . . and that they are driven into the open sea and sink slowly to greater depths," and also (p. 363) that the occasional occurrence of young stages in the superficial layers in the tropical regions "is perhaps to be explained by cold vertical currents which carry deep-sea animals to the surface." – To this may be remarked: In the North Atlantic there is no indication of small specimens of *Periphylla* being particularly plentiful in the neighbourhood of the continental slopes; the proportionate number of small and larger individuals seems to be independent of the position of the localities, and we may conclude, therefore, that breeding takes place everywhere in the deep sea areas. The development of *Periphylla* is unknown, but it is generally supposed that, like other Scyphomedusæ, the specimens pass through a fixed, benthonic polyp stage. The remarkable fact, pointed out above, that the majority of the young specimens are accumulated in certain intermediate strata (different in different regions) and almost lacking deeper down, regardless of the distance to the bottom, makes it probable that the development is independent of the sea bottom, so that no fixed bottom stage comes into the cycle of development.

Moreover it should be remarked that the horizontal currents

Tables V-VII. Vertical distribution of *Periphylla* collected by the "Dana" in the North Atlantic between about 52° N. and 64° N.

Table V. Actual number of specimens taken in hauls of two hours' duration with the 2 m ringtrawl.

Length of wire out, m	Approximate depth, m	Diameter of specimens mm 4–10	10–15	15–20	20–25	25–30	30–40	40	Total number of specimens	Number of hauls made	Number of hauls containing Periphylla
50	25	..	..	..	..	..	..	1	1	9	1
100	60	2	..	..	..	..	2	..	4	10	2
300	200	2	..	..	..	..	..	1	3	10	2
600	400	20	31	49	26	10	4	2	142	12	10
1000	650	2	13	19	17	1	2	3	57	7	4
1500	1000	302	28	42	6	.	..	1	349	3	3
1800-2000	1350	175	143	33	19	5	2	1	378	5	5
3000	2000	15	16	6	..	..	2	..	39	2	2
4000	2700	4	2	2	3	2	..	..	13	2	2

Table VI. Number of specimens per one haul with the 2 m ringtrawl in two hours.

Approximate depth m	Diameter of specimens, mm 4–15	15–25	25–40	>40	Total number per one haul
25	..	..	..	0.1	0.1
60	0.2		0.2	..	0.4
200	0.2		..	0.1	0.3
400	4.2	6.2	1.2	0.2	11.8
650	2.1	5.1	0.4	0.4	8.1
1000	110.0	9.0	..	0.3	119.3
1350	63.5	10.4	1.4	0.2	75.5
2000	15.5	3.0	1.0	..	19.5
2700	3.0	2.5	1.0	..	6.5

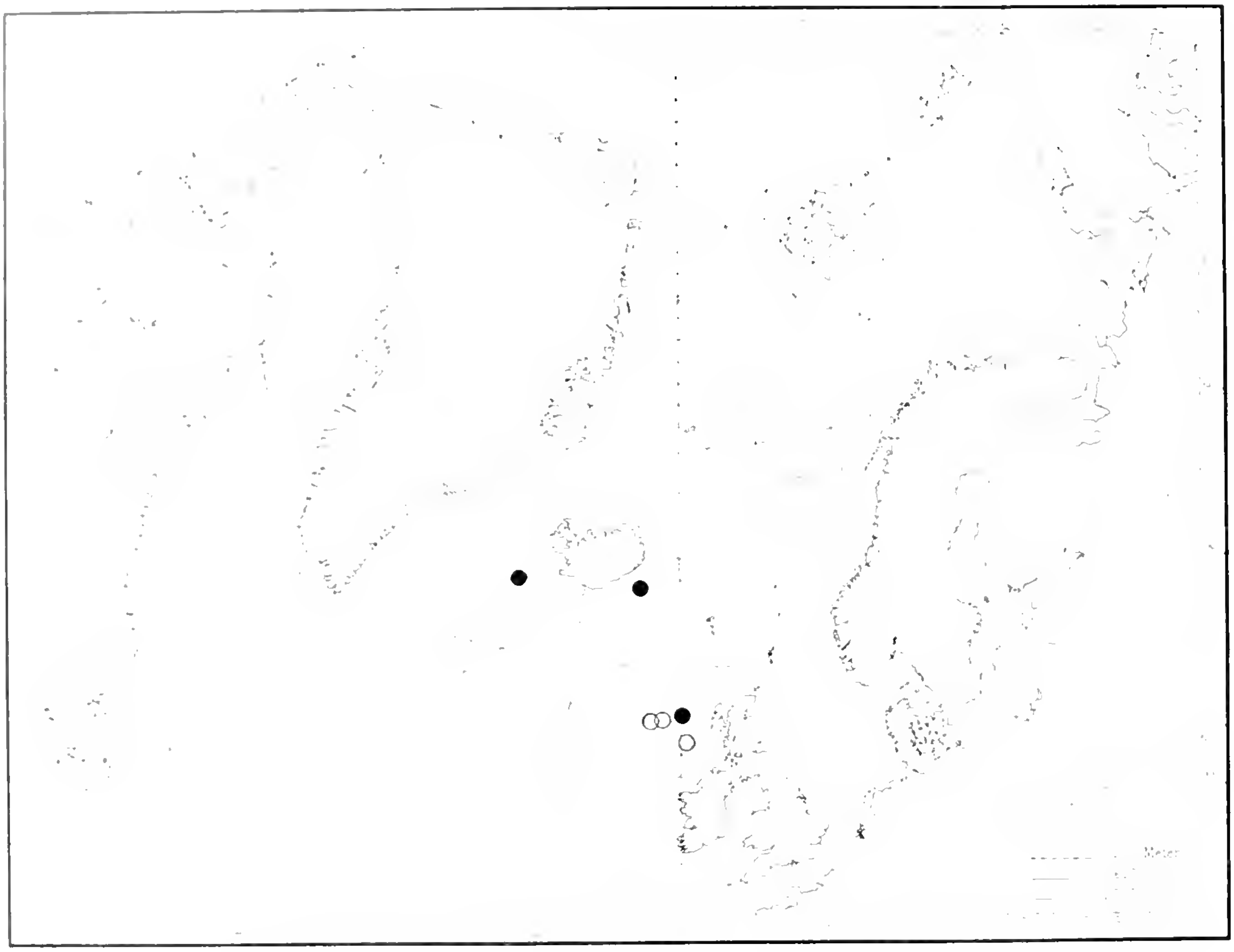
Table VII. Percentage number of specimens of each size-class in the various depths.

Approximate depth, m	Diameter of specimens, mm 4–15	15–25	25–40	40
25	0	0	0	100
60	50	0	0	50
200	67	0	0	33
400	36	53	10	1
650	26	63	5	5
1000	95	5	0	0.3
1350	86	11	2	0.3
2000	79.5	15.5	5	0
2700	46	39	15	0

in the intermediate strata of the Atlantic Ocean are slow, their velocity being somewhat more or less than 1 cm/sec., which means that it takes the water with its contents of plankton organisms about a year to pass through a distance of 300 kilometres; floating animals, bred on the continental slopes, must therefore have attained a rather advanced age before they can reach the central parts of the oceanic basins. E. g. at the "Dana" St. 4206, 53°38′N. 29°41′ W., several small specimens of *Periphylla*, 5–10 mm in diameter, were taken in a haul with 600 m wire out, nearly 900 kilometres from the nearest continental shelf (the Rockall Bank); it should have taken them about three years to cover that distance providing they followed a straight line, and still more by a curved route. It is highly improbable, therefore, that these specimens have arisen from benthonic polyps growing somewhere on the continental slopes surrounding the northern basin of the Atlantic Ocean.

The difference in the vertical distribution of the various stages of development in different geographical areas must be due to differences in the hydrographical conditions. I quite agree with Bigelow (1938 p. 158) that "it seems likely that the upper boundary for *Periphylla* is set by light combined with temperature." As pointed out by the same author in a previous paper (Bigelow 1928 p. 496), "*Periphylla* never normally swims upward to the zone of strong illumination in Tropic seas, contrasting with its not exceptional occurrence right at the surface in arctic and subarctic latitudes." In the various geographical regions the majority of the specimens are accumulated in strata with very different temperatures, about 13–15° in the Mediterranean, about 7–12° in the subtropical belt of the North Atlantic, about 2–5° in the southern Atlantic, about 3–4° in the northern part of the Atlantic north of 50° N. and in the Davis Strait. 15° C. probably marks the upper limit of temperature endurable to the species. The young medusæ are most probably bred in the intermediate strata above the great depths; the fact that in some areas the young individuals are inclined to ascend towards the surface, while in other areas, as in the northernmost portions of the Atlantic, the young specimens are almost entirely restricted to the deeper strata and only large specimens occasionally occur in the surface layers, is most probably due to differences in the vertical circulation of the water masses, and it seems likely that the large specimens are more capable of resistance against the movements of the water. Upwelling currents will carry young specimens towards the surface, but in the subarctic portions of the Atlantic the vertical movement of the water is predominantly downwards, and this will keep the small medusæ in the deeper layers, while the large ones have the capability to force their way upwards towards the surface.

In the above discussion of the vertical distribution of *Periphylla* I have only dealt with the specimens collected by the "Dana" in the 2 m ringtrawl with bag of stramin (the so called



[illegible] in the northern Atlantic of *Nausithoë globifera*. ● new records; previous records.

[illegible] with 2 and 3 m ring- [illegible] between the knots (E 200 and [illegible] specimens must be supposed [illegible] Arctic stations, where *Pe*[illegible] [illegible] with the S 200, altogether [illegible] four hauls with [illegible] two hauls), one haul with [illegible] 1700, one with 1900, and one with [illegible] in all of these deep hauls, [illegible] the catches predominantly [illegible] must have been [illegible]

Pe[illegible] is a [illegible] parts of all [illegible] almost [illegible] it occurs as [illegible] In the [illegible]

Nausithoidæ.

Nausithoë K[illegible]

Nausithoë globifera B[illegible]

[illegible]

Material (see the map, textfig. 17):

57°52'N., 9°53'W., 8/6 1905. "Thor" St. 72, 1 specimen
63°19'N., 26°50'W., 21/5 1928. "Godthaab" St. 1, 1000 m wire, 2 spec
63°38'N., 11°13'W., 18/5 1931. "Dana" St. 5113, 1800 m wire, 2 spec.
5113, 2000 m 3

Remarks on the specimens. The specimens are all in a rather poor condition, but all of them show some of the features characteristic of *Nausithoë globifera* as described by Broch. The rhopalia are provided with a diffuse accumulation of dark pigment, but no lense is present. The pedalia are very indistinct, but the annular furrow is deep and strongly marked, and in the best preserved specimens the central disk has retained its solid mesogloea and its globular shape. The gastric cirri are very numerous and arranged in a single row, not in clusters. The gonads are very large in all the specimens, and in most of them the eight gonads are all in contact with each other, but in two of the specimens ("Dana" St. 5113, 2000 m wire, diam. 9 mm, and "Godthaab" St. 1, diam. 17 mm) they are arranged in pairs, separated by four narrow, perradial spaces. The dark and vivid colours, which according to Broch attracts attention in this species, have almost completely disappeared; only in the specimens from "Dana" St. 5113 the remnants of the stomach exhibit a vivid orange colour.

Diameter of the specimens: "Thor" St. 72, 17 mm; "Godthaab" St. 1, 8–16 mm; "Dana" St. 5113, 1800 m wire, 10–13 mm; 2000 m wire, 9–11 mm.

Bigelow (1928) is inclined to think that the two Atlantic deep-sea species, *N. atlantica* and *globifera*, described by Broch in his account of the "Michael Sars" Scyphomedusæ (1914), both are identical with *N. rubra* Vanhöffen, and he may be right as far as *atlantica* is concerned. It seems to me, on the other hand, that *N. globifera* differs so much from the two other species that it is unsafe to unite them, unless further studies of a larger number of well preserved specimens perhaps might lead to the conclusion that the differences were only due to individual variation. The specimens of *N. rubra* from the eastern tropical Pacific, examined by BIGELOW himself (1909a p. 36), agree very well with the original description by VANHÖFFEN (1902a p. 29), in which it is expressly stated that the pedalia are prominent, the tentacular spaces between the marginal lappets larger than the rhopalar, and the marginal lappets narrow and pointed; in all the specimens examined by me (in so far as they are sufficiently well preserved to show the outline of the margin) the lappets are equidistant and broad and rounded, exactly as in BROCH's original specimens. Moreover the gonads of *N. rubra* are separated from each other by large and equal spaces, which is in striking contrast to the characteristic position of the gonads in *N. globifera* as observed by BROCH as well as by me.

Geographical distribution: *Nausithoe globifera* occurs in the deep and intermediate strata of the north-eastern Atlantic; two of the new localities recorded in the present paper are considerably farther north than the localities from which the species was previously known; the distribution is evidently limited by the continental slopes of Iceland and the British Isles.

Fam. **Atollidæ.**

Genus **Atolla** Haeckel.

Atolla wyvillei Haeckel.

North-Atlantic records:

Atolla bairdii Fewkes 1886 p. 936, Pl. 1–3.
— verrillii Fewkes 1886 p. 939, Pl. 4–5.
bairdii + verrillii Fewkes 1889 p. 530.
— wyvillei Roule 1896 p. 302.
— bairdii Browne 1906 p. 179.
— — Vanhöffen 1906 p. 44, textfigs. 4, 5.
— tenella Hartlaub 1909 p. 477, Pl. 77 figs. 1, 2.
bairdii Kramp 1913a p. 279.
— — Kramp 1914 p. 453.
— wyvillei + bairdi Broch 1914 p. 14.
— bairdi Kramp 1920 p. 7.
— wyvillei Bigelow 1928 p. 508.
— Stiasny 1940 p. 14.
— Kramp 1942 p. 109.

Material (see the map, textfig. 18):

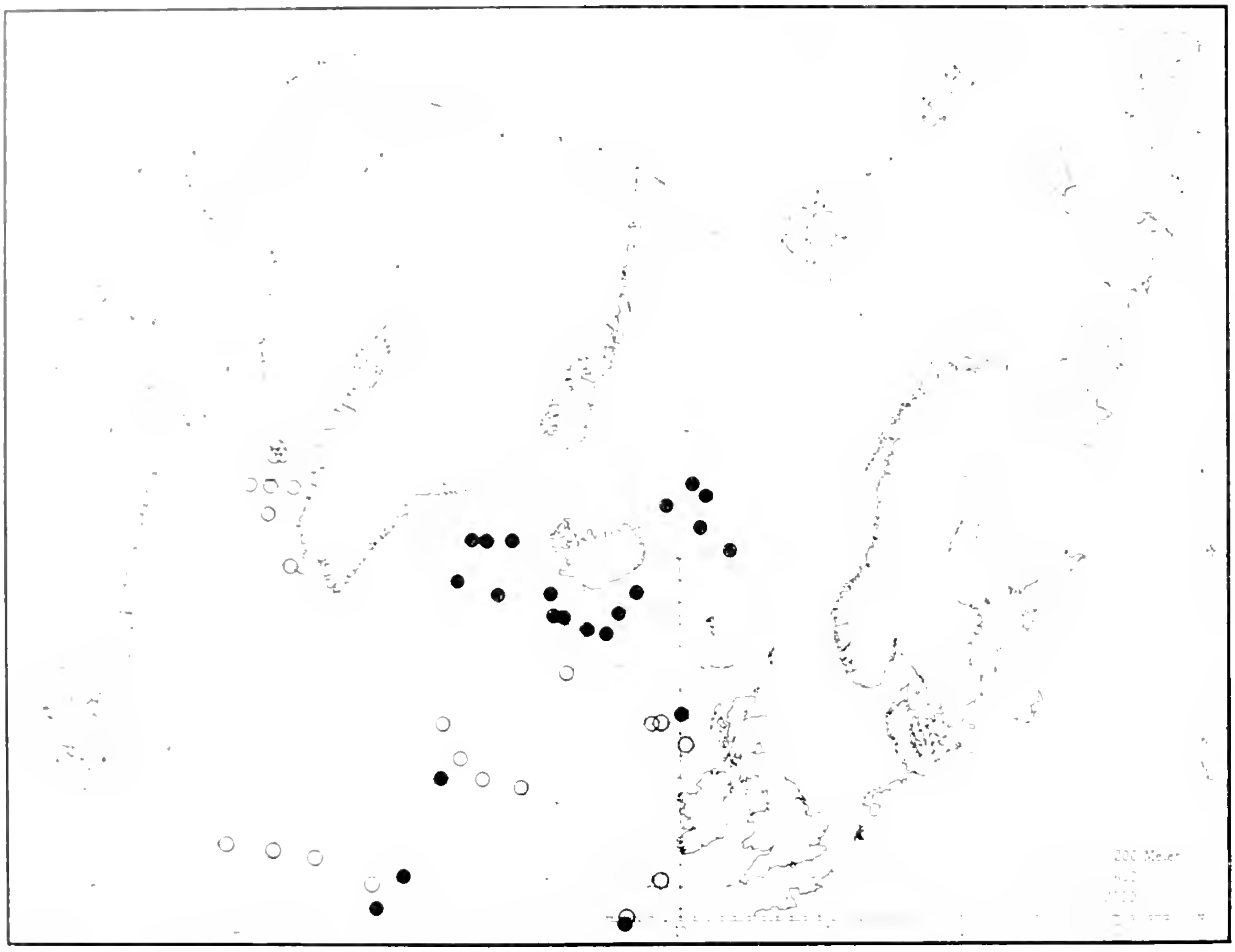
64°38'N. 32°37'W., $^{22}/_{5}$1895. "Ingolf" St. 12. 1958 m. 1 specimen
62°00'N. 21°36'W., $^{9}/_{8}$1895. 40. 1591 m. 1 —
62°58'N. 23°28'W., $^{8}/_{6}$1896. 73. 914 m. 1 —
62°25'N. 28°30'W., $^{14}/_{6}$1896. 83. 1717 m. 1 —
64°14'N. 31°00'W., $^{25}/_{6}$1896. 91. 2328 m. fragments
66°23'N. 7°25'W., $^{11}/_{7}$1896. 101. 1802 m. 1 specimen
67°57'N. 6°44'W., $^{20}/_{7}$1896. 112. 2386 m. 3
68°27'N. 8°20'W., $^{24}/_{7}$1896. 118. 1996 m. 1
67°29'N. 11°32'W., $^{25}/_{7}$1896. 120. 1666 m. 1
65°00'N. 28°10'W., $^{19}/_{6}$1901. "Thor" St. 152. 800 or 1000 m wire. 2 specimens
61°31'N. 19°05'W., $^{10}/_{7}$1901. "Thor" St. 180. prob. 1800 m wire. 1 sp.
61°30'N. 17°08'W., $^{11}/_{7}$1901. 183. 1800 m 1
57°52'N. 9°53'W., $^{8}/_{6}$1905. 72. 1500 m 1
48°19'N. 13°53'W., $^{3}/_{9}$1906. 180. 1800 m wire. 3 spec.
60°59'N. 22°29'W., $^{29}/_{5}$1925. "Dana" St. 2306. 2000 m wire. 1 spec.
17°02'N. 31°15'W., $^{27-28}/_{6}$31. "Dana" St. 4201. 3000 m wire 1 spec.
4201. 4000 m fragm.
4201. 5000 m 7 spec.
4201. 6000 m 13
19°19'N. 30°22'W., $^{30}/_{6}$1931. 4203. 4000 m 2
53°38'N. 29°11'W., $^{4}/_{7}$1931. 4206. 600 m 1
4206. 1000 m fragm.
62°23'N. 16°05'W., $^{25}/_{6}$1932. 4402. 2000 m 7 spec.
62°36'N. 32°18'W., $^{16}/_{8}$1933. 4687. 2000 m 7
63°38'N. 11°13'W., $^{18}/_{5}$1931. 5113. 1800 m 1
65°14'N. 6°06'W., $^{24}/_{5}$1931. 5113. 2100 m 1

FEWKES described this species (under the names of *Atolla bairdii* and *verrillii*) from the Gulf-Stream area off the east coast of North America between about 35 and 43° N. ROULE (1896) and BROWNE (1906) recorded it from the Bay of Biscay. According to VANHÖFFEN (1906, Nordisches Plankton) it has been taken near the Faroes, "ferner von der Ingolf-Expedition unter 64° N. Br., endlich vom "Michael Sars" in einem Fange aus 1900 m Tiefe noch höher im Norden ....," but no precise localities are given by this author. It was taken at several stations by the "Michael Sars" North Atlantic Deep-Sea Expedition in 1910 (BROCH 1914) and by the Norwegian vessel "Armauer Hansen" in the north-eastern basin of the Atlantic in 1913 (KRAMP 1920). Also found in several localities in the deep parts of Davis Strait (KRAMP 1913a, 1914, and 1942). BIGELOW records it from the area off the east coast of North America as far north as off New York, about 40° N.

Atolla has about the same world-wide distribution as *Periphylla* in the deep portions of the oceans, but it seems to be more strictly confined to the deep strata, especially in northern waters. In the North-Atlantic area it is not, like *Periphylla*, known to ascend into the upper strata and to be carried across the submarine ridges by the currents along the west coasts of Greenland and Norway. It is rather astonishing, therefore, that it was taken by the "Ingolf" expedition at four stations (St. 101, 112, 118, and 120) and also by the "Dana" (St. 5113) in the deep, cold basin of the Norwegian Sea. *Atolla* was never taken by the "Ingolf" by implements for pelagic fishery, but always in the trawl. If this had happened once or twice, one might suppose that the medusa was captured on higher levels during the hauling in of the trawl, but the fact that all the specimens, more than ten, in all the nine localities, were taken in benthonic hauls, leads us to the conclusion that they really lived near the bottom. (The specimens recorded by ROULE from the Bay of Biscay were likewise taken in the trawl). In the five localities south of the ridges the depth varied between 914 and 2328 m, and the bottom temperature between 0°3 and 5°5; at the four stations in the Norwegian Sea the bottom temperature was very low, −1°1 — −1°0 at depths between 1802 and 2386 m; by the "Dana" a specimen was taken in a haul with 2100 m wire out, i. e. about 1600 m below the surface, at a similar low temperature, about −0°8. We may conclude, therefore, that *Atolla* is indigenous in the deep strata of the Norwegian Sea, and this confirms the supposition that the two small medusæ described by HARTLAUB (1909) as *Atolla tenella* were young specimens of *Atolla wyvillei*; they were collected by the "Belgica" in a locality between N. E. Greenland and Spitzbergen, 79°34' N., 2°37' W., at depths between 1200 and 1800 m. The area of distribution of this species accordingly comprises the high arctic regions.

The material available is too small to serve as base for a discussion of the vertical distribution of the various stages of development; some of the specimens are quite small, 10–20 mm in diameter.

Geographical distribution: *Atolla wyvillei* is a true cosmopolitan deep-sea medusa, occurring in all the oceans from the



[illegible] 8. Distribution in the northern Atlantic of *Atolla wyvillei*. ● new records; previous records.

[illegible] in the Pacific it is found as far north as [illegible] Atlantic area it penetrates into high-arctic

Order Semæostomæ.

[illegible] N. Atlantic species belonging to this order are [illegible] only occasionally are taken [illegible] be briefly mentioned in this

Pelagia noctiluca (Forskål).

[illegible]

[illegible]

[illegible] E. B[illegible]

[illegible]

[illegible] 71 [illegible]

[illegible] D[illegible] St. 1291 [illegible] 1 spec.

[illegible] 1291 [illegible] 50 m [illegible] 3 [illegible]

[illegible] Ocean 1891, in [illegible] about 60° N. [illegible] independent of [illegible] in the [illegible] part of the [illegible] D[illegible] St. 1291 in a haul [illegible] the Faroes the [illegible] Pelagia this medusa was found in several localities across the Atlantic between the edge of the Newfoundland Bank and the mouth of the Channel, a little south of Lat. 50° N., and the two stations, where it was taken by the "Dana", are within the same range. It is very abundant in the Bay of Biscay, whence it is frequently carried into the mouth of the Channel and northwards along the western coasts of Ireland and Scotland, sometimes even right to the Norwegian coast. According to VANHÖFFEN (1906 p. 15) a big shoal has been observed west of the Rockall Bank, about 57–58° N., 22–28° W. The specimen mentioned above, taken by E. BAST, shows that it may even occur still farther north, at 62° N., not very far from the south coast of Iceland.

Aurelia aurita (L.).

Syn. *Aurelia flavidula* L. Agassiz 1862, non Péron & Lesueur 1809.

Material:

62°30' N. – 8°21' W. (N.W. of the Faroes), $^{11}/_{5}$1895, "Ingolf" St. 1. 10 specimens.

Thorshavn on the Faroes, $^{26}/_{5}$1901, "Dana". 2 specimens.

Lerwick on the Shetland Islands, $^{22}/_{6}$1905, "Thor". 1 specimen.

Espevikpollen, Hardangerfjord, Norway, $^{2}/_{6}$1927, R. SPÄRCK. 5 specimens.

Moreover our collections contain numerous specimens from Iceland and West Greenland, previously mentioned by me (KRAMP 1939 and 1942).

In my paper on the West-Greenland medusæ (1942 p. 126) I expressed the opinion that *Aurelia aurita* had probably invaded the Greenland seas in recent time, because all the specimens collected previously proved to belong to *A. limbata*. Among the old drawings of Greenland medusæ made by H. P. C. MÖLLER I have however found one, undoubtedly representing *A. aurita*; the locality is not stated, but the drawing was probably made somewhere in West-Greenland.

The localities mentioned above add nothing to the known area of distribution of this almost cosmopolitan species. It occurs along the entire west coast of Norway, round Iceland, and on the west coast of Greenland as far north as about 70° N., but has never been found on the East-Greenland coast.

Cyanea capillata (L.).

Syn. *Cyanea arctica* Péron & Lesueur.

Material:
58°21'N. 0°20'W., $^{12}/_{6}$1891. HARTZ. (West of the Hebrides).
48°09'N. 8°30'W., $^{20}/_{6}$1905. "Thor" St. 88. (Off the mouth of the Channel).
57°36'N. 7°05'W., $^{27}/_{5}$1908. "Thor" St. 8. (At the Hebrides).
64°15'N. 12°10'W., $^{10}/_{7}$1927. "Dana" St. 3079. 700 m wire. (S. E. of Iceland).
Tyrolerfjord, $^{23}/_{6}$1929, and Nordfjord, Strindberg's peninsula, $^{30}/_{8}$1929. The Danish East-Greenland Expedition 1929. (E. Greenland).

The occurrence round Iceland and on the coasts of Greenland is dealt with in some of my previous papers (1939, 1912, 1943). The specimens from the two East-Greenland localities mentioned above were not available to me, when I wrote my paper on the medusæ in "The Zoology of East Greenland" (1943); these localities are in the Franz Joseph Fjord area, about 71° N.

Cyanea capillata is widely distributed in the coastal areas of temperate and arctic seas. In the waters west of Greenland it occurs at least as far north as in Jones Sound between Ellesmere Land and North Devon, about 76° N.; it is very common along the west coast of Greenland from Cape Farewell to Upernavik. On the east coast it has been found in several scattered localities as far north as Danmarks Havn, about 76½° N. It also occurs round Iceland, Jan Mayen, and Spitzbergen, and along the European coasts from France to northern Russia.

Order **Stauromedusæ.**

Besides the specimens from Greenland and Iceland of *Halimocyathus lagena*, *Haliclystus octoradiatus*, *Lucernaria quadricornis*, and *Lucernaria haeckeli* our collections in Copenhagen contain some Lucernarians from a few other localities in the North-Atlantic area, mainly from the Faroes. The collections from Greenland and Iceland are dealt with in some of my previous papers (KRAMP 1939, 1912, and 1943), the others will be briefly mentioned here.

Haliclystus octoradiatus (Lamarck).

Syn. *Haliclystus auricula* Clark.

Material:
The Faroes (without further statement). 2 specimens collected by STEENSTRUP.
Bordovig, the Faroes, $^{22}/_{5}$1899. TH. MORTENSEN. Numerous young specimens.

This species occurs on the east coast of North America north of Cape Cod; the west coast of Greenland as far north as Thule, about 76½° N.; the south coast of Iceland; the European coasts from France to northern Norway; Spitzbergen. Moreover known from Alaska and Japan.

Lucernaria quadricornis O. F. Müller.

Material:
The Faroes. MÜLLER. 3 specimens (identified by STEENSTRUP).
Bergen in Norway. KOREN. 1 specimen.
69°31'N. 7°06'W., $^{21}/_{7}$1896, depth 2465 m. "Ingolf" St. 113. 1 spec.
Svino, the Faroes, $^{1}/_{9}$1897. H. JONSSON. 1 specimen.
Kvannesund, the Faroes, 1898. H. JONSSON. 1 specimen.
Bordovig, the Faroes, $^{10}/_{5}$1902. 13–28 m. "Diana". A. DITLEVSEN. 1 specimen.

One of these localities, "Ingolf" St. 113, is of particular interest being situated in the Norwegian Sea, north-east of Iceland, at the considerable depth of 2465 m, which is unusual for *Lucernaria quadricornis*. It was originally referred to that species by G. M. R. LEVINSEN, and a careful re-examination has convinced me of the correctness of the identification. The total height of the specimen is 22 mm, the pedicel is 9 mm in length and distinctly marked off from the calyx; the perradial notches between the arms are not much broader than the interradial. Thus it is quite different from *Lucernaria bathyphila* Haeckel, which was described from deep water in the southern part of the Norwegian Sea, between the Faroes and the Shetland Islands. The specimen is mentioned in the journal of the Ingolf Expedition, so that the possibility of a confusion of labels is excluded. The capture of a large specimen in Inglefield Bay, N. W. Greenland, at a depth of 930 m, shows that also in other arctic regions this species may occasionally occur in the abyssal region.

Lucernaria quadricornis occurs on the east coast of North America north of Cape Cod and along the west coast of Greenland as far north as Inglefield Bay, 77°17' N.; also taken in some localities on the east coast of Greenland between about 65° and 71° N. Also recorded from Spitzbergen, but never seen at the coasts of Iceland. Common along the European coasts from southern England to the White Sea.

Additions and Corrections to Parts I and II.

[illegible] the Lepetolina in "The Danish Ingolf [illegible] Leptomedusæ 1919, Anthomedusæ 1926) I have [illegible] several samples of medusæ from various [illegible] N. Atlantic area. I have treated most of these [illegible] following papers:

[illegible] Méduses de la Norvège, by Kramp & Damas. (The [illegible] distribution of the Hydromedusæ along the west [illegible] Norway.)

[illegible] Notes on Coelenterata. I. (On *Cuboiconema* [illegible] the Skagerrak).

[illegible] Hydromedusæ of the Danish Waters. (Distribution, [illegible] ecology etc. of all species of Hydromedusæ [illegible] Danish waters.

[illegible] collected in the south-western part of [illegible] part of the Channel in 1903–1911.

[illegible] Notes on Coelenterata. II. (Identity of the [illegible] *M.* [illegible] *campanula* A. Ag. with *M. octo-* [illegible] *M.* [illegible] (van Bened.) found in [illegible]

[illegible] Plankton. (General survey of [illegible] Leptomedusæ *Cyclocanna welshi* [illegible] Mycoscora [illegible]

[illegible] Ctenophora and Chætognatha. The [illegible] East Greenland Expedition [illegible] the east coast of Greenland).

[illegible] of the Genus *Eirene* Eschscholtz [illegible] Revision of the distribution of *Eirene* [illegible] *Helgicirrha schulzei* Hartlaub).

[illegible] Danmarks Fauna (All the medusæ [illegible]

[illegible] The Zoology of Iceland. (Distribution of [illegible]

[illegible] Expedition 1928. (All the [illegible] of Greenland).

[illegible] Ctenophora. The Zoology [illegible] from the east coast [illegible]

[illegible] up to now:

[illegible] 1 specimen.

[illegible] 1 specimen [illegible] coast of [illegible] found [illegible]

[illegible] Kattegat 7/9 1937 [illegible] dredged [illegible]

Steenstrupia nutans (M. Sars):
63°26'N, 22°28'W., $^{1}/_{8}$ 1927. "Dana" St. 3162, 600 m wire.

Bougainvillia britannica Forbes:
Helgoland, $^{26}/_{5}$ 1931, S. Tuxen. Numerous specimens.

Bougainvillia principis (Steenstr.):

60°35'N., 3°15'W., $^{11}/_{8}$ 1926.	"Dana" St. 2998,	600 m wire.
57°55'N., 8°17'W., $^{13}/_{6}$ 1927.	3001,	65 m
63°26'N., 22°28'W., $^{1}/_{8}$ 1927.	3162,	600 m

Podocoryne borealis (Mayer):
Mangerfjord near Bergen, Norway, July 1932, Th. Mortensen. One specimen, taken near the bottom, about 300 m. — Russell (1910 p. 525) and Rees (1941 p. 307) have shown that the medusa *Podocoryne hartlaubi* Neppi & Stiasny (previously known only from the Gulf of Trieste) occurs in British waters together with the so-called *P. areolata* (Alder) and has probably sometimes been confounded with the latter. According to Russell the hydroid known as *Podocoryne areolata* (Alder) can be the hydroid of either of the two species of medusæ, and Rees is of the opinion that no connection exists between this hydroid and the medusa which up to now has carried the same name; he changes the name of the medusa to *P. borealis* (Mayer). I have re-examined our specimens from Norway and Denmark; they all belong to *P. borealis* (formerly *areolata*).

Leuckartiara octona (Fleming):

57°21'N., 3°20'E., $^{14}/_{6}$ 1927.	"Dana" St. 3006.	
57°30'N., 1°58'W., $^{18}/_{6}$ 1927.	3009,	65 m wire.

Leuckartiara nobilis Hartlaub:

47°02'N., 31°45'W., $^{27}/_{6}$ 1931.	"Dana" St. 4201,	100 m wire.
49°49'N., 30°22'W., $^{30}/_{6}$ 1931	4203,	50 m

These two localities are about midway between Newfoundland and the mouth of the British Channel; it is rather surprising to find this medusa so far out in the open sea. It was previously known from a number of localities off the western coasts of the British Isles and south of Iceland, and it has recently been recorded from Newfoundland (Frost 1937 p. 26).

Neoturris pileata (Forskål):

64°15'N., 12°40'W., $^{19}/_{7}$ 1927.	"Dana" St. 3079,	700 m wire.
63°26'N., 22°28'W., $^{1}/_{8}$ 1927	3162,	600 m
49°49'N., 30°22'W., $^{30}/_{6}$ 1931	4203,	1000 m
62°23'N., 16°05'W., $^{25}/_{6}$ 1932	4402,	50 m

St. 4203 is in the middle of the ocean, between Newfoundland and southern England; as the species has never been recorded from the western parts of the Atlantic, it is unexpected to find it in this distant locality, which marks the northern boundary of the Gulf Stream.

Tiaranna rotunda (Q. & G.):

59°21'N., 37°56'W., $^{12}/_{6}$ 1925.	"Dana" St. 2308,	1000 m wire.
62°35'N., 32°53'W., $^{27}/_{7}$ 1925.	2437,	1900 m

This bathypelagic Anthomedusa was previously known from the straits of Gibraltar and from the North Sea and the west coast of Norway, and recently (Kramp 1942 p. 36) I have also recorded

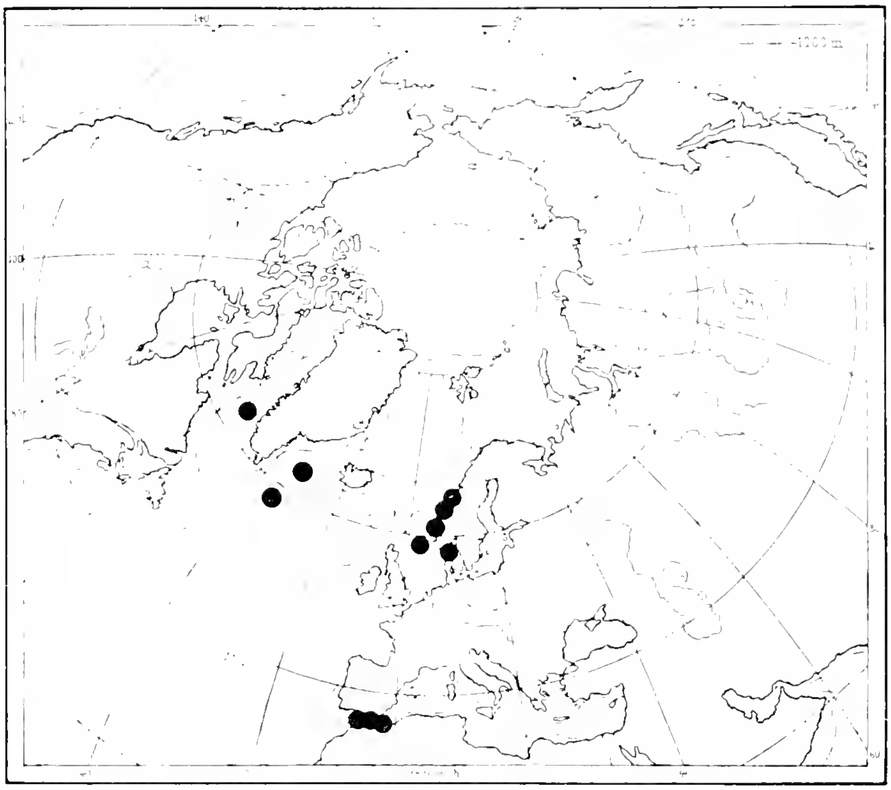


Fig. 19. Distribution of *Tiaranna rotunda*.

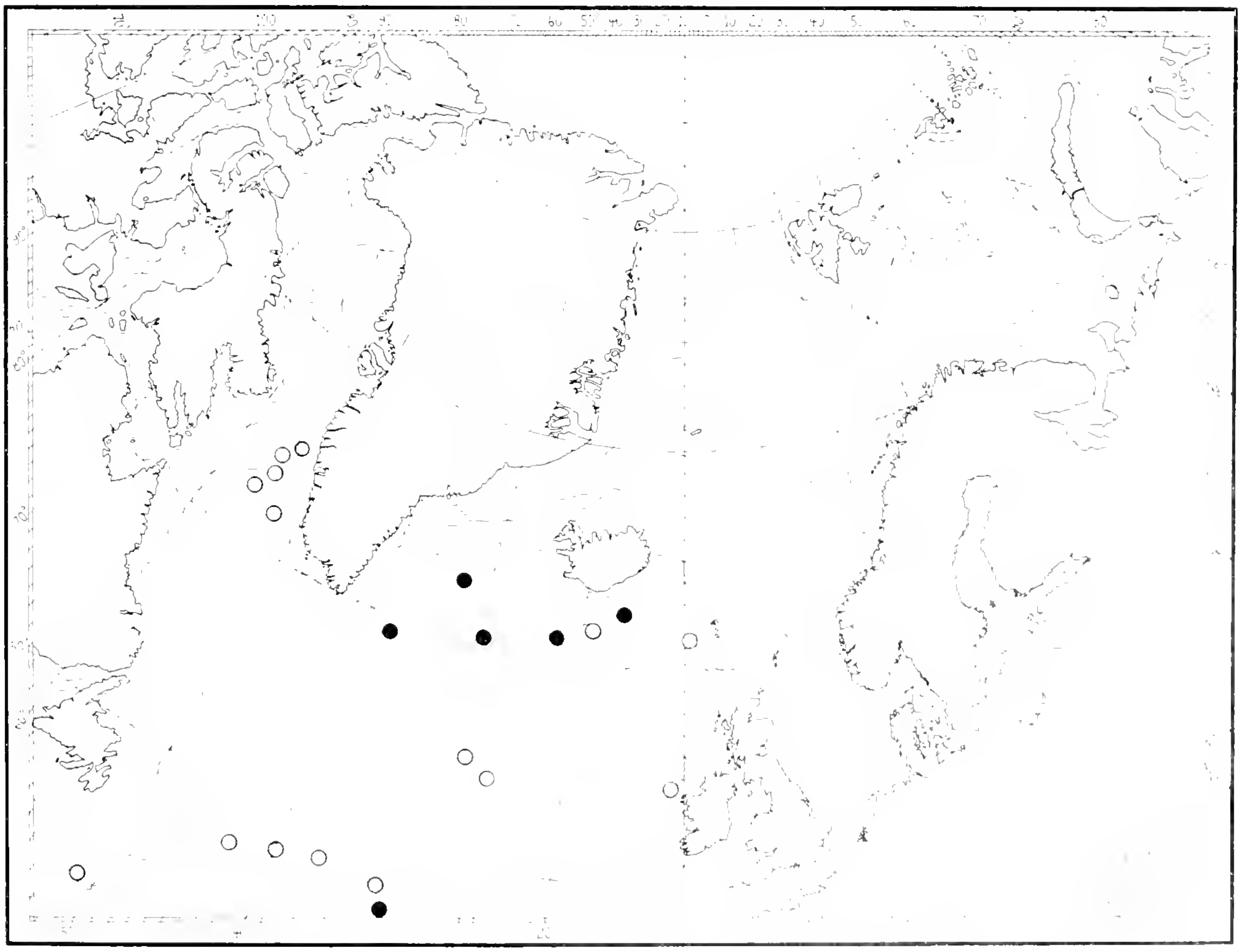


Fig. 20. Distribution in the northern Atlantic of *Chromatonema rubrum*. ● new records; previous records

[illegible] The two localities here [illegible] touching the eastern [illegible]

[illegible]

[illegible] N.	[illegible] W.	[illegible]	"Dana" St. 2306	2000m wire.
[illegible] N.	[illegible] W.	[illegible]	2307	1500m
[illegible] N.	[illegible] W.	[illegible]	2308	3000m
[illegible] N.	[illegible] W.	[illegible]	4201	3000, 4000, and 6000m wire.
[illegible] N.	[illegible] W.	[illegible]	4402	2000m wire.
[illegible] N.	[illegible] 18 W.	[illegible]	4687	2000m

[illegible] the conception of this species as a bathy-[illegible] generally distributed in the deep basins of the [illegible] Atlantic [illegible] the southern slopes of the submarine [illegible] Scotland, Iceland, Greenland, and Baffin Land.

[illegible] position of *Chromatonema* has been much [illegible] on the medusae of West Greenland (KRAMP 1942 [illegible]) I [illegible] my original view (of 1919) that it belongs [illegible] referred to the Laodiceidae among the Lepto-[illegible] this family with the Pandeidae among the Anthomedusae. Since I have become acquainted with RUSSELL's [illegible] Hydromedusae, III" (RUSSELL 1940 [illegible]) during the war this paper was inaccessible to me, [illegible] Swedish library in 1945. I agree with him [illegible] be referred to the Anthomedusae and placed with [illegible] a special family, the Tiaranniidae.

[illegible] *Chromatonema rubrum*: As previously mentioned ([illegible] 1942) the colour of living specimens, as I saw them [illegible] differs rather considerably from the [illegible] in preserved specimens. Pl. VI fig. 7 [illegible] a coloured sketch made by me on board [illegible]

Laodicea undulata (Forb. & Goods.):

63 26 N. 22 28 W., $^{1}/_{8}$1927. "Dana" St. 3162. 600m wire.

62 23 N. 16 05 W., $^{25}/_{6}$1932 4402. 600, 1000, and 3000m wire.

Ptychogena crocea Kramp & Damas:

Mangerfjord near Bergen, Norway, July 1932. TH. MORTENSEN. 11 specimens, taken near the bottom, about 300m.

Staurophora mertensi Brandt:

65 27 N. 18 17 W., $^{21}/_{7}$1921. "Dana" St. 2193. 700m wire.

Mitrocomella polydiademata (Romanes):

57 21 N. 3 20 E., $^{14}/_{6}$1927. "Dana" St. 3006.

Cyclocanna welshi Bigelow:

Mangerfjord near Bergen, Norway, July 1932. TH. MORTENSEN. 15 specimens, taken near the bottom, about 300m.

Phialella quadrata (Forbes):

57 30 N. 4 58 W., $^{18}/_{6}$1927. "Dana" St. 3009. 65m wire.

KÜNNE (1937a p. 6) records "*Eucopium quadratum*" from the Baltic, *teste* MÖBIUS, but this is erroneous.

Phialidium hemisphaericum (L.):

60 35 N. 3 45 W., $^{11}/_{8}$1926. "Dana" St. 2998, 600m wire.

61 15 N. 12 40 W., $^{10}/_{7}$1927. 3079, 700m

63 26 N. 22 28 W., $^{1}/_{8}$1927 3162, 600m

Phialidium islandicum Kramp:

64 15 N. 12 40 W., $^{10}/_{7}$1927. "Dana" St. 3079. 700m wire.

Octocanna funeraria (Q. & G.):

57 46 N. 9 55 W., $^{1}/_{9}$1905. "Thor" St. 167. 1500m wire, 1 spec. Outside the Mediterranean this species was hitherto only known from some of the deep fjords on the west coast of Norway; the locality mentioned above is in the Atlantic between the west coast of Scotland and the Rockall Bank.

Zoogeographical Remarks

on the Medusæ of the northern Atlantic and adjacent Waters.

In Table VIII is given a general survey of the distribution of the North-Atlantic free-swimming medusæ, and on the following pages the composition of the fauna in each of the different geographical areas will be briefly discussed. In the Table I have included the coastal area on the east coast of North America between Cape Cod and the south-east point of Newfoundland (about 42–47° N.), because its pelagic fauna bears a considerable likeness to that in higher latitudes in north-western Europe.

The first three columns in the table comprise the three deep-sea areas: the Atlantic basin (including the deep, southern part of Davis Strait), the Baffin Bay, and the Norwegian Sea. The occurrence of the bathypelagic species is mainly restricted to these areas, but some of them may also be found in the neighbourhood of the coasts, either as stray visitors, or as constant inhabitants of deep fjords, e. g. on the west coast of Norway. On the other hand, neritic species with a somewhat prolonged pelagic life-time may sometimes be carried far out into the open sea, where they may be found in the upper strata above deep water; they are marked with an S in the table. The medusæ of the genus *Obelia* cannot be specifically separated; in the table the distribution of the corresponding hydroids is given, marked H. In some other species the hydroid has been found in areas from which the free medusa has not yet been recorded; in such cases the occurrence of the species is likewise indicated by an H.

The number of species of medusæ which at present are known from the areas here dealt with (north of about 50° N.) amounts to 142; but in Table VIII are also included 14 species taken off the American coast between Cape Cod and Newfoundland, but never recorded further north.

Among the 142 species 61 are Anthomedusæ, 38 Leptomedusæ, 1 Limnomedusæ, 16 Trachymedusæ, 6 Narcomedusæ, and 14 Scyphomedusæ (see Table IX). The majority of the species are meroplanktonic and neritic. It is true that the developmental cycle is unknown in several species, but probably all of the Leptolina (Antho-, Lepto- and Limnomedusæ) have a fixed polyp stage, and all of the Trachylina (Trachy- and Narcomedusæ) are presumably holoplanktonic. Among the Scyphomedusæ 8 species are known or supposed to be meroplanktonic, and these are also neritic; but we know that *Pelagia noctiluca* is holoplanktonic, and the vertical distribution of the oceanic species *Periphylla periphylla*, *Nausithoe globifera*, *Atolla wyvillei*, and *Poralia rufescens* gives reason to believe that they are likewise destitute of a fixed bottom stage. Among the species with doubtful development is also reckoned the high-arctic *Nausithoe limpida*, which is only known from the north east coast of Greenland.

Almost all the species of Trachylina are true oceanic forms, independent of the sea-bottom; the only exception among the northern species is *Ptychogastria polaris*, which seems to spend part of its time attached to the bottom of the sea, whence it occasionally swims towards the surface. The vast majority of the Leptolina are neritic forms, derived from polyp-stages attached to the bottom in the coastal areas, but some few of them occur in deep water. Most of these medusæ are however only taken at rather short distances outside the continental shelves or in deep fjords, which indicates that their fixed polyps live on the continental slopes and not in true oceanic basins. *Paragotoea bathybia* is only known from the southern, deep part of Davis Strait; *Annatiara affinis* and *Pandea rubra* occur in the eastern parts of the Atlantic Ocean; *Bythotiara murrayi* is likewise found in the eastern Atlantic and also in the Norwegian Channel and in some of the Norwegian fjords; *Calycopsis simplex* is only known from one of the fjords on the west coast of Norway; *Tiaranna rotunda* occurs at Gibraltar, in Norwegian fjords, and in the Skagerrak, but it is also known from the Irminger Sea and Davis Strait. *Ptychogena hyperborea* is only known from Smith Sound between Greenland and Ellesmere Land and is presumably an arctic deep-sea medusa; *Ptychogena crocea* and *Cyclocanna welshi* have been taken in some of the Norwegian fjords, the latter species also in the Skagerrak and off the east coast of North America; *Octocanna funeraria* is common in the Mediterranean and in some of the fjords on the west coast of Norway, and in the present paper it is recorded from the channel between Scotland and the Rockall Bank. In contradistinction to all these species *Chromatonema rubrum* should be designated as a true oceanic species, being generally distributed over the entire North-Atlantic deep-sea area, apparently quite independent of the continental slopes (see above, the map textfig. 20).

As far as the Trachylina are concerned, it is difficult to distinguish between bathypelagic species and species belonging to the upper strata. Most of the Trachymedusæ are well marked bathypelagic forms, but *Aglaura hemistoma* and *Liriope exigua*, which are stray visitors to the European coasts, belong to the upper strata, and *Aglantha digitale* occurs almost everywhere, though as a rule it is rare at great depths as well as near the surface; in most places it has its principal occurrence some hundreds of metres below the surface; in Table IX it is listed among the species of the upper strata. The Narcomedusæ are poorly represented in the northern seas. *Solmaris corona*, *Pegantha clara*, and *Ægina citrea* have their main occurrence in the upper strata in warmer seas, but in these northern latitudes they show a marked tendency to seek deeper water. *Æginura grimaldii* is a well marked deep-sea species with a cosmopolitan distribution; *Æginopsis laurentii*, on the other hand, is an arctic species, which decidedly prefers cold water; it is therefore mainly taken in the upper strata in the waters round Greenland and in the deeper strata in the Norwegian Sea.

Table VIII.

[illegible]	Deep-sea areas			Coastal areas														
	Atlantic Ocean	Baffin Bay	Norwegian Sea	Cape Cod–Newfoundland	Newfoundland–Ellesmere Land	West Greenland	East Greenland	S. and W. Iceland	N. and E. Iceland	Faroes	British Isles, West	Channel	North Sea and Skagerrak	Kattegat and Baltic	Norway S. of Lofoten	Norway N. of Lofoten	Spitzbergen	Barents Sea and Kara Sea
[illegible]																		
[illegible]								[illegible]										[illegible]
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[illegible]									[illegible]					[illegible]		[illegible]		
[illegible]															[illegible]			
[illegible]								H										
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Table VIII (continued).

	Deep-sea areas			Coastal areas														
	Atlantic Ocean	Baffin Bay	Norwegian Sea	Cape Cod – Newfoundland	Newfoundland – Ellesmere Land	West Greenland	East Greenland	S. and W. Iceland	N. and E. Iceland	Faroes	British Isles, West	Channel	North Sea and Skagerrak	Kattegat and Baltic	Norway S. of Lofoten	Norway N. of Lofoten	Spitzbergen	Barents Sea and Kara Sea
Amphinema rugosum (Mayer)																		
Stomotoca pterophylla Hckl.																		
Halitholus pauper Hartl.																		
— cirratus Hartl.																		
Annatiara affinis (Hartl.)																		
Leuckartiara octona (Fleming)																		
abyssi (G. O. Sars)						H	H						H	H			H	
breviconis (Murb. & Sh.)																		
nobilis Hartl.	S																	
Neoturris pileata (Forskål)	S																	
Catablema vesicarium (A. Agass.)																		
— multicirrata Kishin.																		
Pandea rubra Bigelow																		
Bythotiara murrayi Günther																		
Calycopsis simplex Kramp & Damas																		
Tiaranna rotunda (Q. & G.)																		
Chromatonema rubrum Fewkes																		
LEPTOMEDUSÆ																		
Laodicea undulata (Forb. & Goods.)	S																	
Ptychogena crocea Kramp & Damas																		
— hyperborea Kramp																		
— lactea A. Agass.																		
Staurophora mertensi Brandt																		
Toxorchis kellneri Mayer																		
Dipleurosoma typicum Boeck																		
Melicertum octocostatum (M. Sars)																		
Mitrocomella brownei Kramp																		
fulva Browne																		
polydiademata (Romanes)																		
Halopsis ocellata A. Agass.	S																	
Cosmetira pilosella Forbes																		
megalotis (Maas)																		
Cyclocanna welshi Bigelow																		
Tiaropsis multicirrata (M. Sars)																		
Obelia geniculata (L.)				H	H	H		H	H	H	H	H	H	H	H	H		
dichotoma (L.)				H				H		H	H	H	H	H	H	H		
longissima (Pallas)				H	H	H	H	H	H	H	H	H	H	[illegible]	H	H	[illegible]	H
Agastra mira Hartl.																		
Phialella quadrata (Forbes)										H								
Phialidium hemisphaericum (L.)				H														
languidum (A. Agass.)																		
bicophorum (L. Agass.)																		
islandicum Kramp																		
Octocanna funeraria (Q. & G.)																		
Eucheilota maculata Hartl.																		
hartlaubi Russell																		
ventricularis McCrady																		
Phialopsis diegensis Torrey	S																	
Eutonina indicans (Romanes)																		
Saphenia gracilis (Forbes)																		

Table VIII (continued)

	Deep-sea areas			Coastal areas														
	Atlantic Ocean	Baffin Bay	Norwegian Sea	Cape Cod – Newfoundland	Newfoundland – Ellesmere Land	West Greenland	East Greenland	S. and W. Iceland	N. and E. Iceland	Faroe	British Isles West	Channel	North Sea and Skagerrak	Kattegat and Baltic	Norway S. of Lofoten	Norway N. of Lofoten	Spitzbergen	Barents Sea and Kara Sea

Table VIII (continued).

	Deep-sea areas			Coastal areas														
	Atlantic Ocean	Baffin Bay	Norwegian Sea	Cape Cod—Newfoundland	Newfoundland—Ellesmere Land	West Greenland	East Greenland	S. and W. Iceland	N. and E. Iceland	Faroes	British Isles West	Channel	North Sea and Skagerrak	Kattegat and Baltic	Norway S. of Lofoten	Norway N. of Lofoten	Spitzbergen	Barents Sea and Kara Sea
Nausithoë globifera Broch																		
Atolla wyvillei Haeckel																		
Pelagia noctiluca (Forskål)																		
Chrysaora hysoscella (L.)																		
Cyanea capillata (L.)																		
lamarcki Pér. & Les.																		
Discomedusa lobata																		
Phacellophora ornata (Verrill)																		
Poralia rufescens Vanh.																		
Aurelia aurita (L.)																		
limbata (Brandt)																		
Rhizostoma pulmo (L.)																		
Number of species	32	6	6	39	19	32	11	29	19	24	68	68	73	39	59	24	14	26

Table IX. Systematic and biological survey of the pelagic Medusae in the Atlantic Ocean and adjacent waters north of about 50° N.

	ANTHOMEDUSÆ	LEPTOMEDUSÆ	LIMNOMEDUSÆ	TRACHYMEDUSÆ	NARCOMEDUSÆ	SCYPHOMEDUSÆ	Total number
Meroplanktonic species	64	38	4			8	114
Holoplanktonic species				16	6	1	23
Development doubtful						5	5
Neritic species	57	34	4	1		9	105
Oceanic species	7	4		15	6	5	37
Mainly in upper strata	57	34	4	4	5	11	115
Mainly in deep strata	7	4		12	1	3	27
Total number of species	64	38	4	16	6	14	142

The Fauna in the Different Geographical Areas.

I. Coastal Areas.

1. The coastal waters between Cape Cod and Newfoundland. The [illegible] plankton fauna, and especially the medusae, of this [illegible] thoroughly dealt with in several papers by H. B. B[illegible] the most important being the large volume: Plankton [illegible] the Waters of the Gulf of Maine, 1926. The area comprises the Gulf of Maine, the Bay of Fundy, the southern coasts of Nova Scotia and Newfoundland, and the Gulf of St. Lawrence. Among the 30 species recorded from the area at least 20 are [illegible] neritic species indigenous in the coastal waters; [illegible] 5 species are possibly also indigenous, but as they [illegible] met with on very rare occasions, we cannot [illegible]: *Pennaria tiarella*, *Bougainvillia britannica*, *L*[illegible], *Dipleurosoma typicum*, and *Phacellophora* [illegible] these were found in the Gulf of Maine, *Dipleurosoma* [illegible] off Newfoundland. The holoplanktonic [illegible] likewise indigenous in the coastal area, but [illegible] in the gulfs is mainly due to influx from [illegible] N[illegible] E[illegible]. The warm water of the Gulf Stream carries [illegible] species of southern origin: *Stomotoca pterophylla*, [illegible] *Tima formosa*, *Æquorea albida*, *Æquorea* [illegible] *atlanticum*, *Aglaura hemistoma*, *Liriope tetraphylla*, *L*[illegible]. The Gulf Stream water is a surface [illegible] salt water, generally lying close outside [illegible] but when some of the 9 species mentioned [illegible] the gulfs, they serve as indicators of an influx [illegible] off shore banks of this warm water of [illegible]. [illegible] continuation of the ice-cold Labrador Current [illegible] the southern coasts of Newfoundland and Nova Scotia [illegible] occasionally enters the gulfs, carrying with it [illegible]. When the following four species of medusae [illegible] coastal area here concerned, they must be [illegible]: *Sarsia princeps* (found as far south as [illegible] Newfoundland), *Catablema vesicarium* [illegible] Halifax), *Ptychogastria polaris* (off Halifax), *P*[illegible] occasionally carried further south [illegible]. [illegible] the indigenous species also occur [illegible] western Europe; the only exceptions [illegible] *P*[illegible] and *Phialidium* [illegible] known only from the American [illegible] with the only exception of the oceanic [illegible] mentioned above [illegible] *L*[illegible] occurring in the [illegible]

2. [illegible] Newfoundland, Labrador, D[illegible] Ellesmere Land. [illegible] of this region is the ice-[illegible] the coasts from Smith [illegible] South, carrying with [illegible] inhospitable coast is imperfectly known; up to now it comprises 19 species of medusae. the hydroid of *Obelia geniculata* occurs on the east coast of Larador, the other species are recorded from scattered localities between Hudson Strait and Smith Sound (for details, see Dunbar 1942[1] and Kramp 1942); eight of them are decidedly arctic species, *Aglantha digitale* and *Cyanea capillata* are widely distributed in arctic as well as in boreal regions.

3. The west coast of Greenland. The fauna of medusae in the waters west of Greenland was thoroughly dealt with by me in a recent paper (Kramp 1942) to which I refer. In the table above (Table VIII) 32 species are listed as occurring in the West-Greenland coastal area; three of them are however only represented by their hydroids (*Leuckartiara abyssi*, *Obelia geniculata*, and *Obelia longissima*). The species are all indigenous in the area, except *Periphylla periphylla* which belongs to the deep-sea outside the southern part of the coast; it sometimes ascends to the surface layers and may then be carried by the currents into the coastal area. The great majority of the species (28) are meroplanktonic and neritic. The fauna is of a mixed character corresponding to the mixed composition of the waters; among the 28 meroplanktonic species 7 are predominantly arctic, 6 arctic-boreal, 9 northern-boreal, 2 boreal, 1 southern-boreal, and 3 cosmopolitan. The 3 holoplanktonic species are *Aglantha digitale* and the two arctic forms *Æginopsis laurentii* and *Ptychogastria polaris*. Almost all the West-Greenland medusae are also known from the coasts of northern Europe; the only exceptions are: *Halitholus pauper*, which occurs at Iceland but not on the coasts of the European continent (also recorded from the northern Pacific); *Catablema multicirrata* and *Aurelia limbata* which are arctic-boreal forms in the Pacific; *Eucheilota ventricularis* which is an American medusa distributed from Florida to Vineyard Sound and once taken in the southern part of the Greenland coast. The distribution of the various species along the west coast of Greenland depends on the hydrographical conditions in the various sections and is discussed by me in the paper quoted above.

4. The east coast of Greenland. The ice-cold water of the East Greenland Polar Current moves southwards all along the east coast of Greenland, decreasing in thickness towards the south; below it is a stratum of Atlantic water with temperatures above 0°; in the southernmost section this comparatively warm layer partly consists of water from the Irminger Current which turns westwards from Iceland, and it is possible that medusae are sometimes carried into the coastal area of East Greenland by this current. Up to now, however, we know only 9 species of medusae from East Greenland besides two species which are only represented

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[1] Owing to the war Dunbar's paper has only quite recently been accessible to me; four species, not previously known from this area, are recorded by him from the coasts of Baffin Land, and three others were taken farther north than known before.

by their hydroids (*Leuckartiara abyssi* and *Obelia longissima*). There are the usual three arctic holoplanktonic forms, and 8 meroplanktonic, neritic species, all of which must be considered indigenous in the area. *Nausithoe limpida* was taken off North East Greenland, and its further distribution is unknown. *Cyanea capillata* is generally distributed along the coast being fairly common; the other neritic species are found in some few scattered localities. All of the East-Greenland species also occur in West Greenland and in North-European seas.

5. Iceland. — 33 species of pelagic medusæ are known to occur in the coastal waters round Iceland, including *Podocoryne carnea*, *Bougainvillia ramosa*, and the three species of *Obelia*, the presence of which is only stated by the occurrence of their hydroid polyps. The medusæ of Iceland have previously been dealt with by me in a special paper (Kramp 1939); in the table above (Table VIII) are included two species (*Paratiara digitalis* and *Ptychogastria polaris*), which had been left out in the paper quoted, because they were only taken at some distance from the coast; they are, however, considered as belonging to the fauna of the Icelandic coastal waters.

Only two of the Icelandic species of medusæ are holoplanktonic: *Aglantha digitale*, which is common everywhere, and *Ptychogastria polaris*, which has been taken in two localities north and east of the island at depths of somewhat more than 500 m. The bathypelagic *Periphylla periphylla* is rather frequently carried towards the south and west coast from the Atlantic deep-sea area. The remaining 30 species are meroplanktonic and neritic, and most of them are indigenous in the Icelandic coastal areas, but rather few are generally distributed around the island.

The northern branch of the Gulf Stream moves towards the south coast of Iceland turning westwards (the Irminger Current) and continues in a clockwise direction along the west and north coast, but it is considerably diminished in extent after turning round the north-west point of the island under the cooling influence of the Polar Current coming from the North; the main body of the Polar Current, however, follows the east coast, which therefore is the coldest part of the Icelandic coasts. Off the south-east coast there is usually a fairly sharp limit between the cold water of the Polar Current and the warm water derived from the Gulf Stream. The combined effect of the currents is, accordingly, a marked decrease of the temperature of the water from the south-east round the whole island in a clockwise direction. Species belonging to southern and boreal regions, therefore, are mainly found on the south and west coasts, occasionally carried round the corner to the north coast, whereas arctic species are only taken on the north and east coasts. The species which have a wide distribution round the island are mainly those belonging to arctic-boreal and northern-boreal tracts (for details, see Kramp 1939, especially Table III, p. 31). In the table above (Table VIII) the medusæ occurring on the south and west coast (29 species) and those taken on the north and east coast (19 species) are separated in two columns.

Specimens of meroplanktonic medusæ, especially of the larger forms with a fairly long pelagic period, may undoubtedly sometimes be carried to the southern coasts of Iceland from distant areas to mix with the indigenous population, and some decidedly southern forms, such as *Bougainvillia ramosa* (the hydroid with medusa buds taken once on the south coast), *Lizzia blondina* (taken once near Cape Horn), *Leuckartiara octona* (on the south coast, twice), and *Cyanea lamarcki* are probably not constant inhabitants of the Icelandic coastal waters, but may occasionally settle there for some time.

The Icelandic fauna of medusæ has a predominantly boreal character, and the majority of the species occur in the western as well as in the eastern parts of the North-Atlantic area. Only one species has a decidedly western distribution: the arctic medusa *Halitholus pauper*, known from the northern Pacific and from both sides of Greenland; in Iceland it has only been taken off the north-western part of the coast. On the other hand, the following seven species have never been recorded from the western Atlantic: *Lizzia blondina*, *Podocoryne areolata*, *Paratiara digitalis*, *Neoturris pileata*, *Phialidium islandicum*, *Eutonina indicans*, and *Cyanea lamarcki*. They are all inhabitants of the coastal waters in north-western Europe (*Neoturris* and *Eutonina* also known from the Pacific), and they have a predominantly boreal or southern distribution. *Phialidium islandicum* occurs all round Iceland, the others have only been taken on the southern and western coasts.

6. The Faroes. — The fauna of medusæ at the Faroes is imperfectly known and has never been the subject of special treatment. The number of species recorded up to now and listed in Table VIII amounts to 20, but a closer examination of the neritic fauna around and between these small islands would certainly add several species to the list, especially such which are common to Iceland and the British Isles.

With the exception of *Aglantha digitale* the medusæ known from the immediate neighbourhood of the Faroes are all meroplanktonic and neritic, and most probably all of them are indigenous in the area, though in this respect *Bougainvillia superciliaris* and *B. principis* may perhaps be a little doubtful. Besides the three species of *Obelia*, *Phialella quadrata* is included in the list, because the corresponding hydroid has been taken at the islands, whereas the free medusa has not yet been observed.

The Faroes are washed by the Gulf Stream, and in accordance herewith their marine fauna is mainly of a boreal character. Under normal conditions a number of species with a predominantly southern distribution might also be able to occur round the islands; the cold water of the East-Iceland Polar Current, which is moving southwards along the north-eastern edge of the Wyville Thomson Ridge below the Gulf Stream, may however occasionally rise towards the shallow-water area of the Faroe plateau, and the temperature of the water around the islands is therefore subject to considerable variations, which may prevent a constant settling down of the southern species. Only two of the medusæ hitherto recorded from the Faroes (*Mitrocomella polydiademata* and *Phialella quadrata*) do not occur in the Icelandic waters, whereas all of the Faroese species are known from the British coasts and (with the exception of *Phialella quadrata*) from the southern part of the west coast of Norway.

7. Atlantic coasts of the British Isles. — The medusæ occurring off the coasts of the British Isles have invoked the interest of several British zoologists, particularly E. Forbes, E. T. Browne, and in recent years F. S. Russell. As most of their investigations have been carried out from the various marine laboratories, the different portions of the coasts have not been equally well examined. We may however suppose that almost all the species actually occurring there have really been observed. In Table VIII the British medusæ are enumerated under three different columns, because the conditions on the Atlantic coasts, in the Channel, and in the North Sea present rather considerable dissimilarities.

68 species of pelagic medusæ are recorded from the coastal areas west of the British Isles; the two bathypelagic species *Bythotiara murrayi* and *Octocanna funeraria* were however only taken in a few localities on the continental edge; they are included here, because, as mentioned above (p. 53), they are supposed to pass their fixed bottom stage on the continental slopes and not in the true oceanic basins. *Aglantha digitale* is very common, and it is mainly the comparatively small, southern form, forma *rosea*, which occurs on the British coasts. *Solmaris corona* is indigenous in the waters west of Scotland and Ireland and is mainly taken in the upper strata. The third holoplanktonic medusa is *Pelagia noctiluca*; it is probably not indigenous in British waters, but is frequently carried by the currents from more southerly

[illegible] Scotland [illegible] neritic and prob-[illegible] 22). These species are distributed [illegible]

[illegible] Our knowledge of the fauna [illegible] due to the extensive investiga-[illegible] Plymouth Marine Laboratory. A complete list of [illegible] known up to 1951 is given in [illegible] Marine Fauna (1951), and some additions are [illegible] The Plymouth offshore Medusa [illegible] the seasonal distribution and the varying [illegible] species are dealt with. Some species, [illegible] RUSSELL's list, are recorded from other parts [illegible]

[illegible] RUSSELL there are three different water types [illegible] each carrying their own faunistic associations of [illegible] "Channel" water, 2) the "swirl" water, derived [illegible] swirl south of Ireland, 3) the "oceanic" water, [illegible] from the ocean. The latter two types of water [illegible] of the Channel in much varying quantities.

At present 68 species of pelagic medusae are known from the [illegible] among which 4 species are holoplanktonic: *Aglantha* [illegible] is indigenous in the Channel, but shoals are [illegible] by the "swirl" water. The three others belong to [illegible] of the "oceanic" water: *Liriope exigua* is an irregu-[illegible] particularly abundant in the autumn, *Solmaris corona* [illegible] appear on very rare occasions. The majo-[illegible] 64 meroplanktonic medusae are undoubtedly indige-[illegible] 48 meroplanktonic species listed from the Ply-[illegible] area 13 are, however, designated as "visitors" [illegible] RUSSELL 1953 p. 110, mainly belonging to the "swirl" water. The Scyphomedusa *Discomedusa lobata* is a rare oceanic guest; [illegible] belongs to the "Channel" water and is [illegible] indigenous at least in the deeper parts of the Channel [illegible] the south western part of the North Sea. *Gonionemus* [illegible] been taken at Roscoff on the coast of France.

[illegible] The North Sea and the Skagerrak. The North Sea [illegible] supply of water partly from the English Channel [illegible] Dover Strait, partly from the north through the [illegible] Scotland and the Shetland Isles and in a less [illegible] still further north.

[illegible] knowledge of the medusa fauna off the east coast of Great Britain [illegible] due to investigations carried out from the [illegible] at St Andrews in Scotland and Cullercoats [illegible] England, the English coast south of Northumberland [illegible] examined. The Hydromedusae in the south-[illegible] the North Sea is dealt with by me in a paper [illegible] special attention is paid to the influx [illegible] The fauna in the surroundings of Helgoland [illegible] part of the North Sea has been carefully [illegible] The occurrence of the Hydromedusae [illegible] Jutland and in the Skagerrak (as also in the [illegible] was thoroughly dealt with by me in [illegible] regard to the biology of the species, their [illegible] dependence on hydrographical conditions, [illegible] currents.

[illegible] are listed in Table VIII as occur-[illegible] the Skagerrak. Besides *Pelagia noctiluca*, [illegible] carried across the northernmost part [illegible] the west coast of Norway by the Gulf [illegible] the only holoplanktonic medusa [illegible] Sea, even in the deep strata of the Nor-[illegible] represented by the large forma *typica*, whereas forma *rosea* is generally distributed throughout the entire area.

The majority of the meroplanktonic medusae found in the North Sea area are indigenous there, but the native population of several species is also renewed by influx from outside, and in some cases it is difficult to decide, whether a species is indigenous or not.

The currents in the North Sea are rather complicated and frequently varying in extension, but the main features are as follows. One branch of the Gulf Stream moves slowly across the northern part of the North Sea into the Skagerrak constituting the deep strata of "Atlantic" water in the Norwegian Channel. Another branch of the Gulf Stream, the "North" water, goes as a surface-water current north of the Orkney Islands southwards along the east coast of Scotland and northern England about as far as Flamborough Head, whence it turns to the east. The "Channel" water enters through the Dover Strait moving northwards until it meets the "North" water in the surroundings of Dogger Bank. These two volumes of water become more or less mixed with each other and proceed together eastwards towards the west coast of Jutland as the "Jutland Current"; both currents have also been mixed up with English and Flemish coastal water. A whirl is usually formed south of the Horns Reef, forcing some of the combined bodies of water into the Helgoland Bight, but the main body of the Jutland Current moves northwards along the west coast of Jutland into the Skagerrak, mainly along the Danish coast, and further as an undercurrent into the Kattegat. The Jutland Current is particularly extensive in summer and autumn, and when entering the Danish seas it is called "southern bank water"; in winter and spring it is partly replaced by the cold "northern bank water", coming directly from the northern parts of the North Sea.

The following species of medusae are supposed to occur in the North Sea only as visitors from the English Channel: *Phialella quadrata*, *Mitrocomella brownei*, *Equorea forskalea*, *Æquorea vitrina*, and *Gossea corynetes*. *Slabberia halterata* and *Zanclea implexa* likewise belong to the "Channel" water, but as they have also been taken off the east coast of Scotland and Northumberland they are presumably also imported with the "North" water. *Turritopsis nutricula* is also imported from the Channel, sometimes in considerable number, but it seems to be able to breed in the south-western part of the North Sea. It is doubtful whether the shoals of *Rhizostoma pulmo*, frequently seen off the Jutland coast in the autumn, originate from the southern part of the North Sea or from the English Channel. *Chrysaora hysoscella* and *Cyanea lamarcki* are certainly indigenous in the southern part of the North Sea, whence they are carried northwards by the Jutland Current, but shoals of them are undoubtedly also brought into the North Sea from the Channel. Some of the "Channel" water medusae never, or rarely, penetrate far into the North Sea, others, particularly the larger forms, proceed more or less regularly to the eastern parts and sometimes further north into the Skagerak.

Most of the medusae carried in from the Atlantic by the "North" water belong to species which are indigenous in some parts of the North Sea, but some few of them are probably mere visitors. *Phialidium islandicum* has only been taken in the northernmost part of the North Sea, probably coming from the Norwegian Sea and not from the Atlantic. Another species with a predominantly northern distribution is *Staurophora mertensi*; as a rule it does not occur in the North Sea, but in certain years it may be met with even as far south as Helgoland; in the spring of 1923 it was taken in numerous localities off the west coast of Jutland and even in the northern Kattegat, evidently a population derived from polyps which had passed the previous winter on the Jutland coastal banks, certainly an exceptional case.

Among the numerous species which undoubtedly are indigenous in parts of the North Sea or the Skagerrak the following deserve some special remarks.

[illegible] additional information, [illegible] paper was in press.

Bythotiara murrayi, *Tiaranna rotunda*, and *Cyclocanna welshi* are bathypelagic forms only found in the deep strata of the Skagerrak.

Tima bairdi probably is indigenous only on the slopes of the Norwegian Channel; during the period of its pelagic life, which lasts about a year, it spreads far around in the surrounding waters, into the Kattegat as well as towards the south and west in the North Sea, though never into the southernmost portions.

The following species are only known from a few localities, where they however seem to be indigenous: *Margelopsis haeckeli* (Belgium and Heligoland), *Eleutheria dichotoma* (Gullmarfjord on the Swedish coast of the Skagerrak), *Cladonema radiatum* (Belgium, the Limfjord in Jutland, Gullmarfjord), *Bougainvillia nordgaardi* (once observed in Oslofjord, else known only from the surroundings of Bergen), *Bougainvillia macloviana* (in the Heligoland Bight, probably transported by ships from the Antarctic), *Nemopsis bachei* (Zuider Sea), *Agastra mira* (Dover and Heligoland), *Eutima elephas* (Heligoland), *Willia stellata* (east coast of Scotland), *Pochella polynema* (one locality south of the Shetland Islands), *Gonionemus murbachi* (Oslofjord and Gullmarfjord).

A comparatively large number of the medusæ (13 species) occurring in the North Sea and Skagerrak have never been recorded from the south and west coast of the British Isles: The two deep-sea species *Tiaranna rotunda* and *Cyclocanna welshi*; the decidedly northern species *Bougainvillia superciliaris*, *Staurophora mertensi*, and *Phialidium islandicum*; *Leuckartiara abyssi* and *Tima bairdi* which have their proper home in the Norwegian Channel; *Eutonina indicans*, common in the North Sea except in the southern part; and the following species with a narrow distribution (see above): *Margelopsis haeckeli*, *Bougainvillia nordgaardi*, *B. macloviana*, *Nemopsis bachei*, and *Eutima elephas*.

10. The Kattegat and the Baltic. — The fauna of Hydromedusæ in the Danish waters inside the Skaw was thoroughly dealt with by me in the paper quoted above (Kramp 1927) and also in the series "Danmarks Fauna" (1937) comprising also the Scyphomedusæ (as well as the Siphonophora and the Ctenophora). To the lists given in these papers should only be added *Stauridium productum* and *Leuckartiara abyssi*, the hydroids of which have been found in the Kattegat.

The Kattegat is an interesting sea, being a transition area between the North Sea and the Baltic; the salt water of the North Sea (the Jutland Current) penetrates into the deep channels of the Kattegat as an undercurrent, still traced through the Belts into the western part of the Baltic; it is overlayered by the brackish water of the Baltic running northwards to the Skagerrak, where it is forced towards the coasts of Sweden and Norway and finally reaching the North Sea off the Norwegian coast.

39 species of pelagic medusæ occur in the Kattegat, 26 of which are indigenous there. The following 13 species are more or less regular visitors from the Skagerrak, most of them derived from the North Sea: *Bougainvillia britannica* (sometimes penetrating into the Great Belt which constitutes the principal connection between the Kattegat and the Baltic), *Leuckartiara nobilis* (found only once, in the Great Belt in 1923), *Laodicea undulata*, *Staurophora mertensi* (only under exceptional conditions), *Melicertum octocostatum*, *Mitrocomella polydiademata*, *Cosmetira pilosella*, *Eucheilota maculata*, *Saphenia gracilis*, *Eutima insignis*, *Chrysaora isosceles*, *Cyanea lamarcki*, and *Rhizostoma pulmo*. Under exceptional conditions (as in 1936) *Cyanea lamarcki* may be carried as far south as into the Belt Sea. *Chrysaora* and *Rhizostoma* are very rarely seen in the Kattegat, but in 1933 *Chrysaora* appeared in the northern part of the Kattegat, and in the same year *Rhizostoma* even occurred at the northern entrance of the Great Belt.[1]

In the Baltic 16 species have been taken, 9 of which are indigenous in the western part, whereas only 4 species (*Sarsia tubulosa*, *Halitholus cirratus*, *Cyanea capillata*, and *Aurelia aurita*) are indigenous in the Baltic proper east of the Gedser-Darsserort threshold. Of special interest are the two arctic medusæ *Euphysa tentaculata* and *Halitholus cirratus*. The former occurs in the southern Kattegat, the Belts, and the western Baltic, and besides it is only known from the Barents Sea and West Greenland; *Halitholus cirratus* is very abundant in the deep, cold basins of the Baltic proper, less common in the Belt Sea and the Kattegat, and its further distribution is purely arctic (see Table VIII); it must be designated as an arctic survivor in the Baltic.

The only holoplanktonic medusa in this area is a particularly small form of *Aglantha digitale*, indigenous in the deeper parts of the Kattegat, occasionally carried into the Baltic.

11. The west coast of Norway. — A special treatment of the Hydromedusæ occurring along the west coast of Norway is given by Kramp and Damas (1925); some few species are added to the list by Runnström (1932), Kramp (1933b), and Rees (1938 and 1941).

A branch of the Gulf Stream approaches the Norwegian coast, mainly through the Faroe-Shetland Channel; it is particularly powerful in late summer and autumn. As a rule it is separated from the coast by a belt of coastal water of lower salinity, partly derived from the Baltic Current. The Gulf Stream follows the Norwegian coast northwards and is still traced in the Barents Sea, but north of the Lofoten it is considerably cooled by the influence of the polar water, which accounts for the great difference in number of species found in the two portions of the Norwegian coastal region (59 in the southern section against 23 in the northern section). The majority of the species are meroplanktonic forms indigenous in the coastal areas. The few holoplanktonic forms are: *Ptychogastria polaris* (taken in several localities in the northern section, rarely seen in the southern), *Homoeonema platygonon* (in some of the fjords in the surroundings of Bergen), *Aglantha digitale* (generally distributed), *Solmaris corona* (rather frequently carried to the Norwegian coast by the Gulf Stream), and *Pelagia noctiluca* (a rare visitor from the Atlantic). *Periphylla periphylla*, which possibly also is holoplanktonic, is frequently carried to the Norwegian coast, and the possibility cannot be excluded that it is also indigenous in some of the deep fjords.

The following meroplanktonic species are constant inhabitants of the deep strata in some of the fjords of the southern section: *Bythotiara murrayi*, *Calycopsis simplex*, *Tiaranna rotunda*, *Ptychogena crocea*, *Cyclocanna welshi*, and *Octocanna funeraria*.

Besides the above-mentioned holoplanktonic species *Cosmetira pilosella* and *Phialidium islandicum* are probably visitors brought to the southern part of the Norwegian coast by the Gulf Stream.

When the following species occasionally are met with in the coastal water of southern Norway, they are most probably derived from the Jutland Current, which sometimes crosses the mouth of the Skagerrak: *Eutima elephas*, *Æquorea vitrina*, *Chrysaora hysoscella*, *Cyanea lamarcki*, and *Rhizostoma pulmo*.

Apparently very few of the numerous species which are indigenous in the southern section only are able to pass the boundary at Lofoten; *Laodicea undulata* and *Melicertum octocostatum* may probably be regarded as visitors from the southern section, when they occur north of the Lofoten; all the other species found in the northern section are probably indigenous there.

12. Spitzbergen. — The medusa fauna of Spitzbergen is imperfectly known. As the Gulf Stream is still traced at least on the western coasts, one might expect to find occasional visitors from southern regions, but the 13 species hitherto observed are commonly occurring also in other arctic regions. Three of the species are holoplanktonic, *Aglantha digitale* and the two decidedly arctic forms *Ptychogastria polaris* and *Æginopsis laurentii*.

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[1] In October and Novembr 1946 *Rhizostoma* was observed in the southern Kattegat and in the Sound, even as far south as in Køge Bay south of Copenhagen.

[illegible] W[illegible] S[illegible] K[illegible] Se[illegible]. The [illegible] by LINKO [illegible] JASCHNOV 26 species of [illegible] three of them have [illegible] *[illegible]*, *S[illegible]*, and [illegible] holoplanktonic (see Table VIII) [illegible] *H[illegible]*) are known [illegible]. The fauna is however not purely [illegible] Gulf Stream is still remarkable [illegible] accordance herewith the fauna [illegible] boreal and northern boreal species. [illegible] by BERNSTEIN (1934), is the [illegible] Kara Sea of the northern boreal species *Mitro-*[illegible] [illegible] the small Trachymedusa *Homoeo-*[illegible] [illegible] above p. 17), both of which demonstrate [illegible] from the Barents Sea.

II. The Deep-Sea Areas.

A. [illegible] north of about 50° N.

1. Meroplanktonic neritic medusae. The great majority of meroplanktonic medusae are neritic, and the duration of their pelagic life is usually too short to enable them to be drifted far away from the coastal areas, from which they are derived. Some few of the larger species may, however, sometimes be met with at considerable distances from their place of origin. The Anthomedusae *Leuckartiara nobilis* and *Neoturris pileata*, and the Leptomedusae *Laodicea undulata* and *Halopsis ocellata*, all of which [illegible] coastal areas of the north-eastern Atlantic, [illegible] taken above deep water west of the British Isles [illegible] Iceland, following the circulations of the Gulf-Stream system. The Leptomedusa *Phialopsis diegensis*, which [illegible] eastern tropical Atlantic, has also occasionally been [illegible] south west of Ireland and in the Irminger Sea. The [illegible] *Nausithoe punctata*, indigenous in the warm [illegible] is recorded by VANHÖFFEN (1902, p. 29) [illegible] north west of Scotland.

Very peculiar is the occurrence of three East Atlantic neritic [illegible] in the central portion of the North Atlantic between 30 [illegible] 40° W. *Phialopsis diegensis* was taken in July 1910 by the "Michael Sars" east of the Newfoundland Bank (St. 81), 48° 02′ N [illegible] W [illegible] with 200 m wire out. Some specimens of *Leuckartiara nobilis* were taken in June 1931 by the "Dana" [illegible] 47° 02′ N 31° 47′ W (St. 4201) and 49° 49′ N [illegible] 22′ W (St. 4203) in hauls with 100 and 50 m wire out; at St. 42[illegible] [illegible] of *Neoturris pileata* were also found (in [illegible] wire out, possibly caught on a higher level [illegible]). Apart from one record of *L. nobilis* at [illegible] Frost 1937, p. 26) these three species were only [illegible] the eastern parts of the Atlantic [illegible] south west of Iceland. We know [illegible] surface water currents in the northern [illegible] influence on the habitual [illegible] one might conclude that the [illegible] species in these western tracts [illegible] of surface water from the [illegible] south west. In all three localities [illegible] pure Gulf Stream water [illegible] 14–15° C) together with such [illegible] *Pelagia noctiluca*, *Rhopalonema* [illegible] The only possible explanation seems [illegible] *Leuckartiara nobilis*, and *Neo-*[illegible] American coastal waters, [illegible] record of *L. nobilis* at [illegible] not observed there.

[illegible] the upper strata [illegible] indigenous in the upper strata above the northern part of the Atlantic deep-sea basin, is *Aglantha digitale*. The distribution of this species is dealt with above (pp. 27 ff); it occurs throughout the area, being particularly common some hundreds of metres below the surface, less frequent in immediate neighbourhood of the surface as well as in the very deep strata. *Aglaura hemistoma* and *Solmissus incisa* are rare visitors from the south. The Narcomedusa *Solmaris corona* has only been found within the coastal areas of the British Isles.

Pegantha clara and *Eqinia citrea* belong to the upper strata of warmer seas; they are occasionally met with in the northern waters, where they seem to prefer the deeper strata. *Pegantha clara* is a predominantly West Atlantic form, and the free medusa has not been met with east of 30° W. in the northern section, whereas parasitic larvae, probably belonging to this species, were taken south-west of Iceland (see p. 35). *Eqinia citrea* occurs in the entire tropical and subtropical belt of the Atlantic Ocean and penetrates far towards the north in the north-eastern Atlantic, being recorded from deep water in localities not far from the south coast of Iceland (see p. 36).

Four species of *Liriope* enter the northern seas as visitors from the warm portions of the Atlantic, but three of them have only been taken in the coastal areas: *L. tetraphylla* and *scutigera* along the American coast into the Gulf of Maine, *L. exigua* along the European coasts reaching as far as the English Channel as an occasional visitor. Only one species of this genus, *L. eurybia*, has been found above deep water in the northern Atlantic; it is distributed right across the tropical Atlantic, and some few specimens were taken by the "Dana" (St. 4201 and 4203) in the Gulf-Stream water about midway between Newfoundland and Ireland (see p. 32). *Pelagia noctiluca*, which is widely distributed in the warm portions of the Atlantic, is frequently met with along the northern border of the Gulf Stream between the edge of the Newfoundland Bank and the British Isles, and in the north-eastern Atlantic it may even on rare occasions be carried as far north as 62°, not far from the south coast of Iceland, following the northernmost branch of the Gulf Stream (see p. 48).

Rhopalonema velatum has a similar distribution in the North Atlantic as *Pelagia noctiluca*, following the Gulf Stream towards the northern parts of the British Isles, but in the central portion of the North-Atlantic basin it is not restricted to the surface water, several specimens being taken even in the deepest hauls (with 4000–5000 m wire out) at "Dana" St. 4201 (see p. 43).

3. Bathypelagic medusae. The following two species should be excluded from the discussion, because their distribution is imperfectly known: The Anthomedusa *Paragotoea bathybia* was taken in deep water in the southern part of Davis Strait by the "Godthaab" expedition (KRAMP 1942)[1]. The Scyphomedusa *Poralia rufescens* is known from deep water in a few scattered localities in the Pacific, Indian, and Atlantic Oceans, and one specimen was taken in 1910 by the "Michael Sars" about midway between Newfoundland and the British Channel.

The meroplanktonic medusae *Annatiara affinis*, *Pandea rubra*, *Bythotiara murrayi*, *Tiaranna rotunda*, and *Octocanna funeraria* only seem to occur in the neighbourhood of the continental shelves, and probably their fixed hydroid stages live on the continental slopes, whence the free medusae are not likely to be carried much farther out into the deep-sea basins, the currents being slow in the deep and intermediate strata, where these species occur.

Most of the other deep-sea medusae of the northern Atlantic are known or supposed to be holoplanktonic (see p. 53), and the majority of them are generally distributed in the North-Atlantic deep-sea basin until the submarine ridges Scotland–Iceland–Greenland–Baffin Land, a few of them penetrating more or less north of the ridges.

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[1] I have found a very similar medusa, apparently the same species, in a sample of medusae taken by the "Dana" expedition 1930 near Cape of Good Hope in South Africa.

Two species have only been taken in the eastern portion of the area: the Scyphomedusa *Nausithoe globifera* occurs in the deep-sea basin east of the Mid-Atlantic ridge from about 45° N. until the channels west of Scotland, and in the present paper it is also recorded from deep water south of Iceland. The Trachymedusa *Rhopalonema funerarium* is widely distributed in the Tropics, and in the eastern Atlantic it occurs as far north as off the south-west coast of Ireland, where it has been taken in deep water; in the western part of the North Atlantic it was met with in a locality outside the Gulf of Maine, where it occurred in the Gulf-Stream water less than 300 m from the surface, but it has never been observed in the North-West Atlantic deep-sea.

Among the bathypelagic medusae, which are distributed throughout the deep-sea basins of the North Atlantic, the following species have a world-wide distribution in the great oceans: the Trachymedusae *Halicreas minimum*, *Botrynema brucei*, *Colobonema sericeum*, and *Pantachogon haeckeli*; the Narcomedusa *Æginura grimaldii* (which however is rare in the South Atlantic), and the Scyphomedusæ *Periphylla periphylla* and *Atolla wyvillei*. All these are found in the entire deep-sea basins in the northern Atlantic, with the exception of *Colobonema sericeum*, which has not been observed in the Labrador Sea and Davis Strait.

Three of these species may also be met with north of the submarine ridges. *Periphylla periphylla* rather frequently ascends towards the upper strata in colder seas and may therefore be carried across the ridges by the currents; but it avoids the very cold bodies of water and has never been taken in the deep, cold strata of the Baffin Bay and the Norwegian Sea; its distribution north of the ridges follows the Gulf Stream and its off-shoots to the west coast of Norway and the southern and western coasts of Iceland, and it is likewise carried northwards along the west coast of Greenland, but not very far, mainly following the comparatively warm water moving northwards outside the edges of the off-shore banks. *Pantachogon haeckeli* is more strictly confined to the deep and intermediate bodies of true Atlantic water, but occasionally it ascends into higher levels; the record of a specimen from Spitzbergen (Maas 1901) is doubtful. West of Greenland some few specimens were taken by the "Godthaab" in deep water, about 800 and 1750 m, in Baffin Bay, about 70° N., at temperatures between 0°3 and ÷ 0°4, probably carried directly across the ridge (which in its central part rises to about 700 m below the surface), afterwards sinking into the deep strata of Baffin Bay (Kramp 1942 pp. 78 and 140). – *Atolla wyvillei* is a well marked bathypelagic species, at any rate in the northern seas. It has been found in five localities in the Norwegian Sea, preferably near the bottom at depths between 1600 and 2100 m and at temperatures about ÷ 1°, and some young specimens, probably belonging to the same species, are recorded from deep water between north-east Greenland and Spitzbergen. The occurrence of this species in the deep-water of the Norwegian Sea can hardly be due to transportation by the currents across the Wyville Thomson Ridge; it must be indigenous in the Norwegian Sea. It has never been observed in Baffin Bay.

Whereas all these species have an almost cosmopolitan distribution in the deep parts of the great oceans, there are three bathypelagic species which are confined to the northern parts of the Atlantic Ocean (partly found also in the Pacific). All of them are generally distributed in the deep-sea on both sides of the Mid-Atlantic ridge, their southern limit of distribution being at 30 or 40° N. Towards the north they all reach the continental slope south of Iceland and the submarine ridges between Scotland, Iceland, and East Greenland. *Haliscera bigelowi* has been found east of the Newfoundland Bank, but not in the Labrador Sea and Davis Strait; *Chromatonema rubrum* and *Crossota rufobrunnea* also occur in the deep part of Davis Strait south of the ridge between West Greenland and Baffin Land. The occurrence of these North-Atlantic species in the northern basins of the Atlantic is thus quite similar to that of the cosmopolitan species mentioned above. They are equally adapted to the conditions in these northern waters, and the reasons why the three last-mentioned species do not penetrate into the southern seas should be considered in connection with the question of the evolution of species within the various genera. Some genera, as e. g. *Atolla*, *Periphylla*, *Æginura*, *Colobonema*, and *Halicreas*, comprise only one species each, all of which are cosmopolitan; others, like *Pantachogon* and *Botrynema*, contain one cosmopolitan species and one or more species of restricted distribution; *Haliscera*, *Crossota*, and *Chromatonema* are split up in a number of species, each with its particular area of distribution; *Haliscera bigelowi* and *Crossota rufobrunnea*, which are common in the northern Atlantic, also occur in the Pacific.

B. The arctic basins.

Very few medusae are indigenous in the deep basins of Baffin Bay and the Norwegian Sea. Some of the neritic species may occasionally drift out above the deep-sea areas; they will not be considered here. The Narcomedusa *Æginopsis laurentii* is a well-marked arctic species which prefers the coldest water; in Baffin Bay it is mainly found in the upper strata in the neighbourhood of the coasts, but in the Norwegian Sea it avoids the comparatively warm surface water and sinks into the cold, deep strata. *Aglantha digitale*, which occurs over the entire areas, is rare in the deep strata in Baffin Bay, whereas in the Norwegian Sea it may be taken in great abundance at least as far down as 1600 m below the surface (see p. 29). The Leptomedusa *Ptychogena hyperborea* has only been taken in Smith Sound; it is probably a bathypelagic species. *Sminthea arctica* is a doubtful species, taken in deep water west of Spitzbergen (Hartlaub 1909). *Pantachogon haeckeli* is a stray Atlantic visitor in Baffin Bay (see above). The cosmopolitan deep-sea medusa *Atolla wyvillei* is indigenous in the deep, cold strata of the Norwegian Sea, but has not been found in Baffin Bay (see above).

There are, however, two decidedly arctic deep-sea medusae; one of them, *Botrynema ellinorae*, is very abundant in Baffin Bay about 1000–1800 m below the surface at temperatures between 0° and ÷ 0°1 and has also been taken in deep water between Spitzbergen and Greenland and north of Norway. Among the medusae this is the only species which confirms the supposed resemblance between the deep-sea faunas of Baffin Bay and the Norwegian Sea. In the deep, cold strata of the Norwegian Sea, 1000–2000 m below the surface, we also find *Crossota norvegica*, which has not been observed anywhere else.

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PLATES

Plate I.

Figs. 1–4. *Ptychogastria polaris* Allman.

Figs. 1–3. Tentacles with adhesive disk. — Figs. 1–2 × 45, fig. 3 × 120.

Fig. 4. Optical section of filiform tentacle. — × 70.

Figs. 5–8. *Haliscera bigelowi* n. sp.

Fig. 5. Male individual. × 6.

Fig. 6. Stomach, showing the circular mouth opening; one of the radial canals with female gonad.

Fig. 7. Part of umbrella margin. *c. v.* circular vessel, *n. r.* nerve ring, *r. c.* radial canal, *v.* velum. × 19.

Fig. 8. Distal end of a juvenile tentacle. — × 300.

Fig. 9. *Botrynema brucei* Browne.

Fig. 9. Young tentacle: *a* near base, *b* middle portion, *c* distal part. — × 135.

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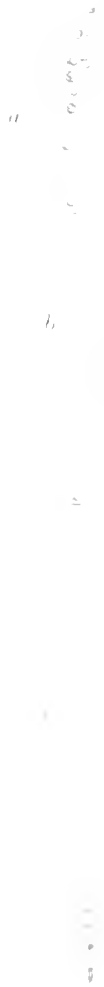

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Plate II.

Figs. 1–2. Statocysts of *Haliscera bigelowi* n. sp. 180.

Fig. 3. Statocyst of *Botrynema brucei* Browne. 180.

Figs. 4–5. *Rhopalonema funerarium* Vanhöffen.

Fig. 4. Manubrium. Specimen from "Thor" stat. 181(06).
Fig. 5. Interradial cirrus. 225.

Fig. 6. *Homoeonema platygonon* Browne, stomach and male gonads, seen from the exumbrella. 70.

Figs. 7–8. Statocysts of *Pantachogon haeckeli* Maas. 675.

Figs. 9–10. *Crossota rufobrunnea* Kramp.

Fig. 9. Transverse section of radial canal. *ex*, exumbrella, *end. l*, endoderm lamella, *m*, circular muscle fibres, *sub*, subumbrella. 70.
Fig. 10. Part of radial canal with its surroundings. On the right hand side part of the ectodermal muscular epithelium is removed, disclosing the cells of the endoderm lamella; through an opening in the subumbrella wall of the radial canal the pigmented cells of its exumbrella wall are seen. For further explanation, see the text p. 24. 135.

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Plate III.

Cassida ratobrunnea Kramp

Fig. 1 Manubrium, external view.

Fig. 2 Manubrium, internal view, showing the two whorls of invaginated pouches and one of the longitudinal grooves; *g.* gonad.

Fig. 3 Transverse section of one corner of the mouth tube, showing the string of large, vacuolated endoderm cells.

Fig. 4 Transverse section of proximal part of the stomach, through the upper whorl of invaginated pouches (cfr text fig. 9, p. 251.

Figs. 5–6 Longitudinal sections of stomach; for further explanation, see p. 24

Fig. 7 Longitudinal section of radial canal; *ex.* exumbrella, *m.* circular muscle fibres, *p.* pigmented endodermal epithelium, *n. p.* non-pigmented endodermal epithelium of radial canal, *sub.* subumbrella.

Fig. 8 Meridional section of umbrella; *end. l.* endoderm lamella, *m.* layer of circular muscle fibres, *sub.* subumbrella

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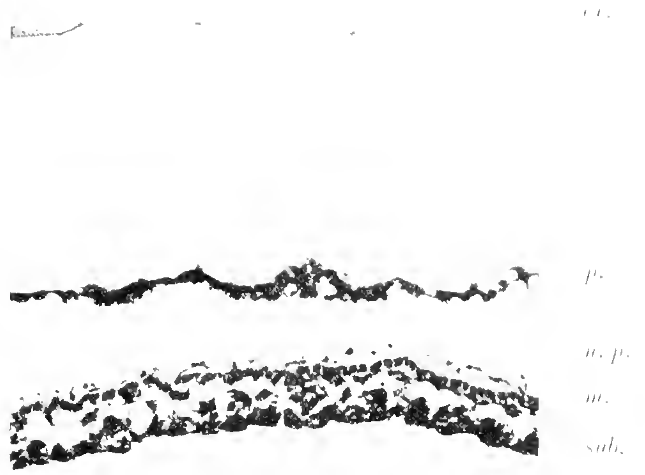

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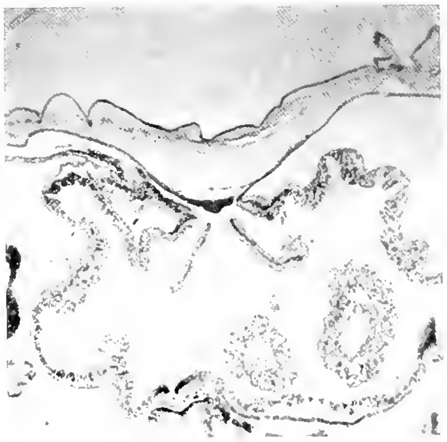

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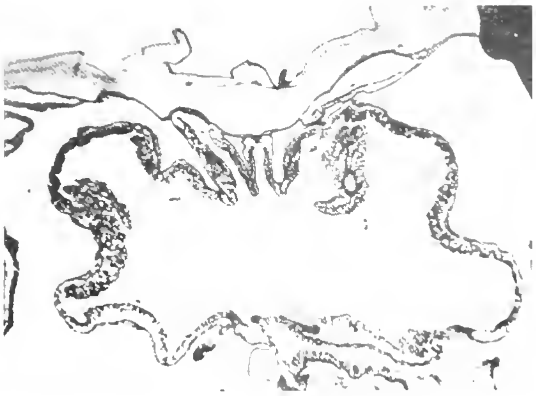

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Plate IV.

Figs. 1–4. *Crossota rufobrunnea* Kramp.

Fig. 1. Umbrella margin, abaxial aspect.
Fig. 2. Umbrella margin, adaxial aspect (velum removed): *c. v.* circular vessel, *n. r.* nerve ring, *sub.* subumbrella.
Figs. 3–4. Statocysts, longitudinal sections. × 500.

Figs. 5–6. *Crossota norvegica* Vanhöffen.

Fig. 5. Specimen from "Ingolf" stat. 120. — × 4.
Fig. 6. Manubrium of a specimen with 11 radial canals. "Ingolf" stat. 120.

Fig. 7. *Pegantha clara* R. P. Bigelow.

Fig. 7. Larva in the gastric cavity of *Periphylla periphylla.* "Godthaab" stat. 1. × 4.

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Plate V.

Larvae of *Pegantha clara* R. P. Bigelow

Figs. 1, 2. Primary polyps (I) with actinula buds in successive stages of development (II and III).

Fig. 3. Chain of actinula buds in successive stages (I–IV).

Fig. 4. Young actinula with two well-developed and two small tentacles; without statocysts, and without aboral collar.

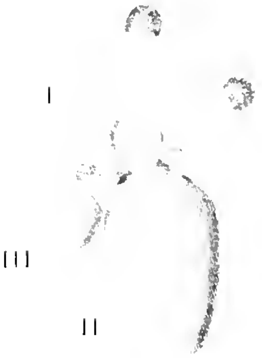
Figs. 5, 6. Two actinulae, each with four tentacles almost equally developed, and with 20 statocysts on the rim of the aboral collar.

Fig. 7. Part of aboral surface of actinula, showing otoporpae and peronia (tentacles cut off at their bases).

Figs. 8, 9. Aboral view of medusae, showing the four tentacles and the long otoporpae.

Fig. 10. Oral view of medusa, showing four peronia, twenty statocysts, and the first trace of mouth opening.

All figures × 40.



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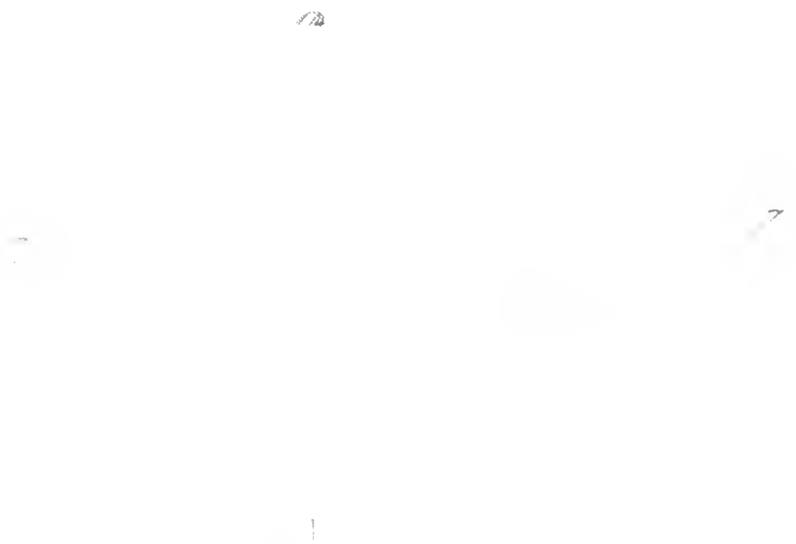

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Plate VI.

Fig. 1–2. *Ptychogastria polaris* Allman. Coloured sketches made on board the "Ingolf" stat. 126, by C. F. Wandel.
Fig. 3. *Halicreas minimum* Fewkes.
Fig. 4. *Botrynema brucei* Browne.
Fig. 5. *Crossota rufobrunnea* Kramp.
Fig. 6. *Aglantha digitale* (O. F. Muller).
Fig. 7. *Chromatonema rubrum* Fewkes.

Figs. 3–7 are reproductions of coloured sketches drawn from life by the author on board the "Godthaab" in Davis Strait 1928.

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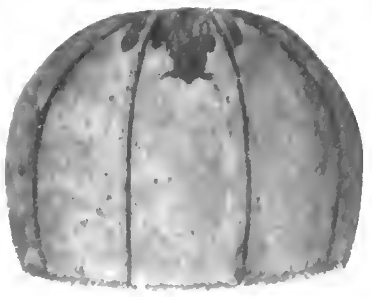

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THE INGOLF-EXPEDITION

1895—1896

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.	Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.	Station Nr.	Date	Lat. N.	Long W.	Depth in m	Bottom-temp.
	1895												1896				
1	11 - V	62° 30'	8° 21'	249	7·2	24	25 - VI	63° 06'	56° 00'	2258	2·4	45	11 - V	61° 32'	9° 43'	1211	4·17
2	12 -	63 04'	9 22'	493	5·3	25	26 -	63 30	54 25'	1096	3·3	46	- -	61 32'	11 36'	1356	2·40
3	- -	63 35'	10 24'	512	0·5			63 51'	53 03'	256		47	12 -	61 32'	13 40'	1789	3·23
4	13 -	64 07'	11 12'	446	2·5	26	- -	63 57'	52 41'	64	0·6	48	- -	61 32'	15 11	2165	3·17
5	- -	64 40'	12 09'	292				64 37'	54 24'	205		49	13 -	62 07'	15 07'	2109	2·91
6	16 -	63 43'	14 34'	170	7·0	27	1 - VII	64 54'	55 10'	740	3·8	50	- -	62 43'	15 07	1921	3·13
7	17 -	63° 13'	15 41'	1130	4·5	28	- -	65 14	55 42'	791	3·5	51	15 -	64 15	14 22'	128	7·32
8	19 -	63 56'	24 40'	256	6·0	29	5 -	65 34'	54 31'	128	0·2	52	- -	63 57'	13 32'	791	7·87
9	20 -	64 18'	27 00'	555	5·8	30	10 -	66 50'	54 28	44	1·05	53	16 -	63 15	15 07'	1497	3·08
10	- -	64 24'	28 50'	1484	3·5	31	11 -	66 35'	55 54'	166	1·6	54	18 -	63 08	15° 40	1301	3·9
11	21 -	64 34'	31 12'	2448	1·6	32	11 -	66 35'	56 38'	599	3·9	55	19 -	63 33'	15° 02'	595	5·9
12	22 -	64 38'	32 37'	1958	0·3	33	12 -	67 57	55 30'	66	0·8	56	- -	64 00'	15 09'	128	7·57
13	- -	64 47'	34 33'	1171	3·0	34	18 -	65 17	54 17'	104		57	20 -	63 37	13 02	659	3·4
14	- -	64 45'	35 05'	331	4·4	35	- -	65 16	55 05'	682	3·6	58	- -	64 25	12 09	397	0·8
15	4-VI	66 18'	25 59'	621	0·75	36	28 -	61 50	56 21'	2702	1·5	59	- -	65 00'	11 16'	584	0·1
16	5 -	65 43'	26 58'	471	6·1	37	29 -	60 17	54 05	3229	1·4	60	21 -	65 09	12 27'	334	0·9
17	16 -	62° 49'	26 55'	1403	3·4	38	30 -	59 12	51 05'	3521	1·3	61	- -	65 03	13 06	104	0·4
18	17 -	61° 44'	30 29'	2137	3·0	39	9-VIII	62° 00'	22 38'	1629	2·9	62	31 -	63 18	19 12	136	7·92
19	18 -	60 29'	34 14'	2949	2·4	40	- -	62 00	21 36	1591	3·3	63	1 - VI	62 40	19 05	1506	4·0
20	20 -	58 20'	40 48'	3192	1·5	41	12 -	61 39'	17 10'	2345	2·0	64	- -	62 06	19 00	1960	3·1
21	21 -	58° 01'	44° 45'	2505	2·4	42	14 -	61 41'	10 17	1177	0·4	65	2	61 33	19 00	1564	3·0
22	22 -	58 10'	48 25'	3474	1·4	43	- -	61 42	10 11	1215	0·05	66		61 [illegible]	20 43	[illegible]	3·3
23	24 -	60 43'	56° 00'	[illegible]		44	- -	61 42	9 36	1026	1·8	67	3	61 [illegible]	[illegible]	[illegible]	3·0

					Bot-tom-temp	Sta-tion Nr.	Date	Lat. N	Long W	Depth in m	Bot-tom-temp	Sta-tion Nr.	Date	Lat. N	Long W.	Depth in m	Bot-tom-temp.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	92	25 - VI	64 44	32 52	1838	1.4	118	24 - VII	68 27'	8 20'	1996	1.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.9	93	26 -	64 24	35 14	1444	1.46	119	25 -	67 53'	10 19'	1902	1.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.0	94	- -	64 56'	36 19'	384	1.1	120	- -	67 29'	11 32'	1666	1.0
[illegible]	[illegible]	[illegible]	[illegible]	87				65 31'	30 45'	401		121	- -	66 59'	13 11'	996	0.7
[illegible]	[illegible]	[illegible]	[illegible]	571	6.7	95	27 -	65 14'	30 39'	1416	2.1	122	26 -	66 42'	14 44'	217	1.8
[illegible]	[illegible]	[illegible]	[illegible]	915	5.5	96	28 -	65 24'	29 00'	1384	1.2	123	28 -	66 52'	15 40'	273	2.0
[illegible]	[illegible]	[illegible] 17	24 [illegible]	1309	4.2	97	- -	65 28'	27 39	847	5.5	124	- -	67 40'	15 40'	932	0.6
		[illegible] 55	25 [illegible]	1433		98	- -	65 38'	26 27'	260	5.9	125	29 -	68 08'	16 02'	1373	0.8
		61 28	25 06'	1561		99	7 - VII	66 13'	25 53'	352	6.1	126	- -	67 19'	15 52'	552	0.5
[illegible]	[illegible]	61 28	26 25	1469	4.3	100	9 -	66 23'	14 02'	111	0.4	127	2-VIII	66 33'	20 05'	83	5.6
[illegible]	[illegible]	60 50	26 50'	1518	4.1	101	10 -	66 23'	12 05'	1011	0.7	128	- -	66 50'	20 02'	365	0.6
57		60 10	26 59	1791	3.6	102	- -	66 23'	10 26'	1412	0.9	129	3 -	66 35'	23 47'	220	6.5
58	[illegible]	[illegible] 57	27 52'	1505	4.5	103	- -	66 23'	8 52'	1090	0.6	130	8 -	63 00'	20 40'	636	6.55
59	[illegible]	60 52	28 58	1230	4.4	104	11 -	66 23'	7 25'	1802	1.1	131	- -	63 00'	19 09'	1314	4.7
[illegible]	[illegible]	61 02	29 32'	1761	4.0	105	- -	65 34'	7 31'	1435	0.8	132	- -	63 00'	17 01'	1407	4.6
81	13	61 44	27 00'	913	6.1	106	12 -	65 34'	8 54'	842	0.6	133	9 -	63 14	11 24'	433	2.2
82		61 55	27 28'	1552	4.1			65 29'	8 40'	878		134	- -	62 34'	10 26'	563	4.1
[illegible]	[illegible]	62 25	28 30'	1717	3.5	107	- -	65 33'	10 28'	926	0.3	135	10 -	62 48'	9 48'	508	0.4
		62 56	26 01'	889		108	13 -	65 30'	12 00'	183	1.1	136	- -	63 01'	9 11'	482	4.8
		62 56	25 30'	755		109	18 -	65 29'	13 25'	72	1.5	137	- -	63 14'	8 31'	559	0.6
84	17 -	62 58	25 24'	1192	4.8	110	19 -	66 44'	11 33'	1471	0.8	138	- -	63 26'	7 56'	887	0.6
[illegible]	- -	[illegible] 21	25 21'	320		111	20 -	67 14'	8 48'	1619	0.9	139	- -	63 36'	7 30'	1322	0.6
[illegible]	[illegible]	[illegible]	25 47.6	143		112	- -	67 57'	6 44	2386	1.1	140	11 -	63 29'	6 57'	1469	0.9
[illegible]	[illegible]	[illegible]	24 56.2	207		113	21 -	69 31'	7 06'	2465	1.0	141	- -	63 22'	6 58'	1279	0.6
		64 58	24 25'	143	6.9	114	22 -	70 36'	7 29'	1456	1.0	142	- -	63 07'	7 05'	1105	0.6
[illegible]	[illegible]	63 47'	27 26	584	8.4	115	23 -	70 50'	8 29'	162	0.1	143	- -	62 58'	7 09'	731	0.4
[illegible]		63 45	[illegible] 06	1070	4.4	116	- -	70 05'	8 26'	699	0.4	144	- -	62 49'	7 12'	520	1.6
[illegible]		63 33	[illegible]	[illegible]	3.4	117	24 -	69 13'	8 23'	1889	1.0						