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HEXACTINELLIDA.

BY

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WITH 9 FIGURES IN THE TEXT, AND A LIST OF STATIONS.

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The present collection although consisting of about a hundred specimens contains few new species. This is an excellent sign that in some localities at least we are reaching the point where the species of sponges may be catalogued with the knowledge that the list will be tolerably complete. The Ingolf Hexactinellida have been a source of great interest and although they may have contributed little to our knowledge in the form of new species, an opportunity has been afforded for bringing our present knowledge of the distribution of the Atlantic species up-to-date, and of correlating our knowledge of these forms generally. It may be of interest to state here that I have searched all the literature dealing with the Hexactinellida known to me so that my lists of authors' references under each species, and my geographical and bathymetrical distribution tables are, so far as I am aware, absolutely complete.

One of the most important conclusions which can be drawn from the study of the present collection is that the spicules in the Hexactinellida are much more subject to variation than is usually supposed. And not only is the actual form variable but the ease with which whole categories may disappear from individuals surpasses even that with which one is familiar in the Tetraxonida. I have repeatedly called attention to this fact in the following pages, as in Asconema setubalense, etc. Although I have established several new varieties on the very slender pretext of differences in the shape of certain spicules, a fact which must appear inconsistent with the opinions voiced above, it is rather the geographical separation between the holotype and the present specimens which has influenced in the formation of these new varieties.

List of species obtained.

1. *Euplectella suberea* Thomson.
2. *Malacosaccus unguiculatus* Schulze, var. *arctica* var. nov.
3. *Malacosaccus floricomatus* Topsent.
4. *Leucopsacus ingolfi* sp. n.
5. *Caulophacus arcticus* (Hansen), var. *grœnlandica* var. nov.
6. *Asconema setubalense* Kent.
7. *Rossella mortenseni* sp. n.
8. *Schaudinnia rosea* (Fristedt).
9. *Trichasterina borealis* Schulze.
10. *Hyalonema kentii* (Schmidt).
11. *Pheronema carpenteri* Kent.
12. *Farrea occa* Bowerbank.
13. *Aphrocallistes beatrix* Gray.
14. *Hexactinella grimaldii* Topsent.

Species 1. **Euplectella suberea** Wyville Thomson 1877

Other references to this species are:—

Milne-Edwards 1881; Filhol 1885; Perrier 1886; Schulze 1886, 1887, 1895, 1899A, 1904; Topsent 1892, 1904A.

The species is represented by a large specimen, practically complete, standing about 22 cms. high, two smaller specimens and a few fragments. They are quite typical in every way and since our knowledge of this species is fairly extensive nothing need be added here concerning the anatomy of the present specimens. They do, however, add to our knowledge concerning the geographical distribution of the species, the present instance being the most mortherly record we have. This deep-water sponge is now known to extend throughout practically the whole of the Atlantic Ocean.

Previously known distribution:— N. Atlantic (Milne-Edwards, Filhol, Perrier); Cape Bojador, W. of Gibraltar, Between Pernambuco and Bahia, N. W. of Guadeloupe, E. of Bahia, Sansibar, (Schulze); Azores (Topsent).

Bathymetric distribution:— 818—3000 fathoms.

Registered Nos. and localities:— R. N. 3. ii, iii, iv, stn. 78, 60°37′ N, 27° 52′ W, 799 faths., bottom temp., 4°5′; R. N. 15. i, stn. 37, 60°17′ N, 54°05′ W, 1715 faths., bottom temp. 1°4.

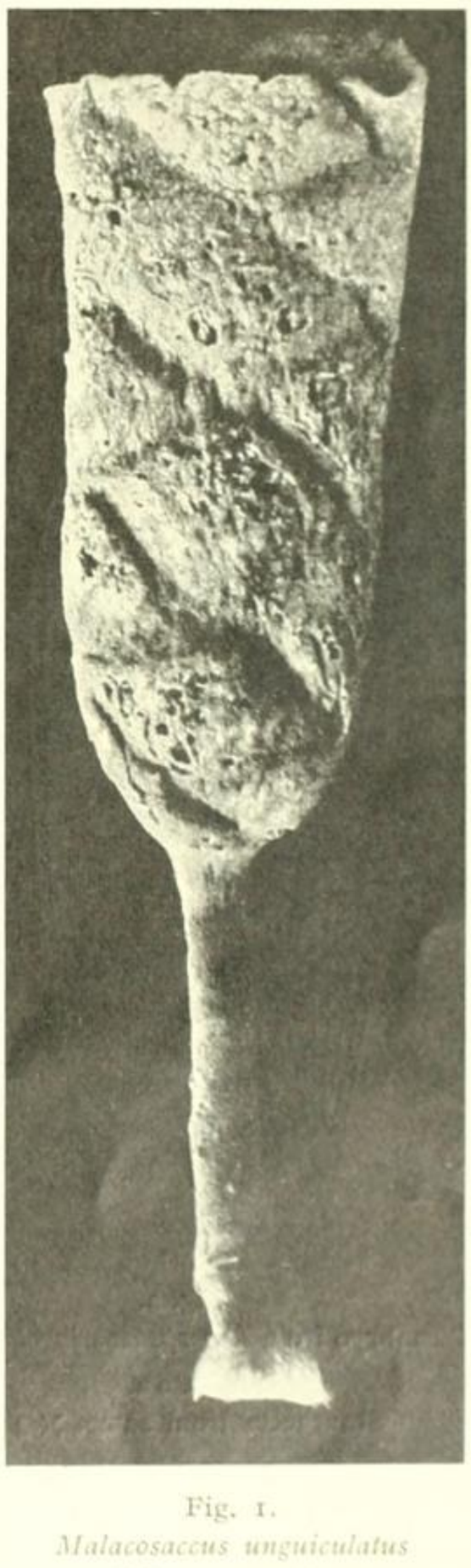


Fig. 1.
Malacosaccus unguiculatus Sch. var. *arctica*.
× 2/3.

Species 2. **Malacosaccus unguiculatus** Schulze
Var. **arctica** var. nov.

A very handsome specimen measuring about 18 cms. in total length and consisting of an elongated sac-like body surmounted on a stout stalk is the sole representative of the genus from Greenland. The differences between the present specimen and the holotype of the species are so small that they might almost be ignored. They are:— the differences in the external form, difference of locality and the slightly longer distal rays of the hypodermal hexacts of the present specimen.

Registered No. and locality:— R. N. 6, 59°12′ N, 51°05′ W, 1870 faths., bottom temp. 1°3.

Species 3. **Malacosaccus floricomatus** Topsent 1901, 1904 A.

Also Arnesen 1920.

The characteristic external form of this species renders it readily recognisable. One specimen only is present. It is stalked and stands 4.5 cms. high. The colour, in spirit, is pale yellow. The remarks made by Arnesen (1920, p. 7) concerning this species are applicable to the present specimen but, all things considered, I am of the opinion that the specimens from the Azores, Bay of Biscay and Greenland may be regarded as representing a single species.

Previously known distribution:— Azores (Topsent); Bay of Biscay (Arnesen).

Bathymetric distribution:— 2300—2500 faths.

Registered No. and locality:— R. N. 15. ii, stn. 37, 60°17′ N, 54°05′ W, 1715 faths., bottom temp. 1°4.

Species 4. **Leucopsacus ingolfi** n. sp.

(Figs. 2 and 2a).

It is of interest to record a species of this genus from the Greenland Seas which differs from the species described by Ijima (1903) from Japan in very small details only. There are two specimens present, the larger measuring about 1 cm., the smaller about 5 cm. in diameter. Both agree in all details so that it will suffice to describe only the holotype, R. N. 70. The disposition of the spicules in the skeleton is exactly the same as that figured by Ijima (1. c. Pl. III, fig. 37), and the same categories of spicules are present as in *L. scoliodocus* Ij. In fact, the only differences between that species and the present one are slight differences in the structure of the spicules. The external form is sac-shaped, as in the Japanese forms. R. N. 78 contains a large number of ripe ova and embryos at an advanced stage of development.

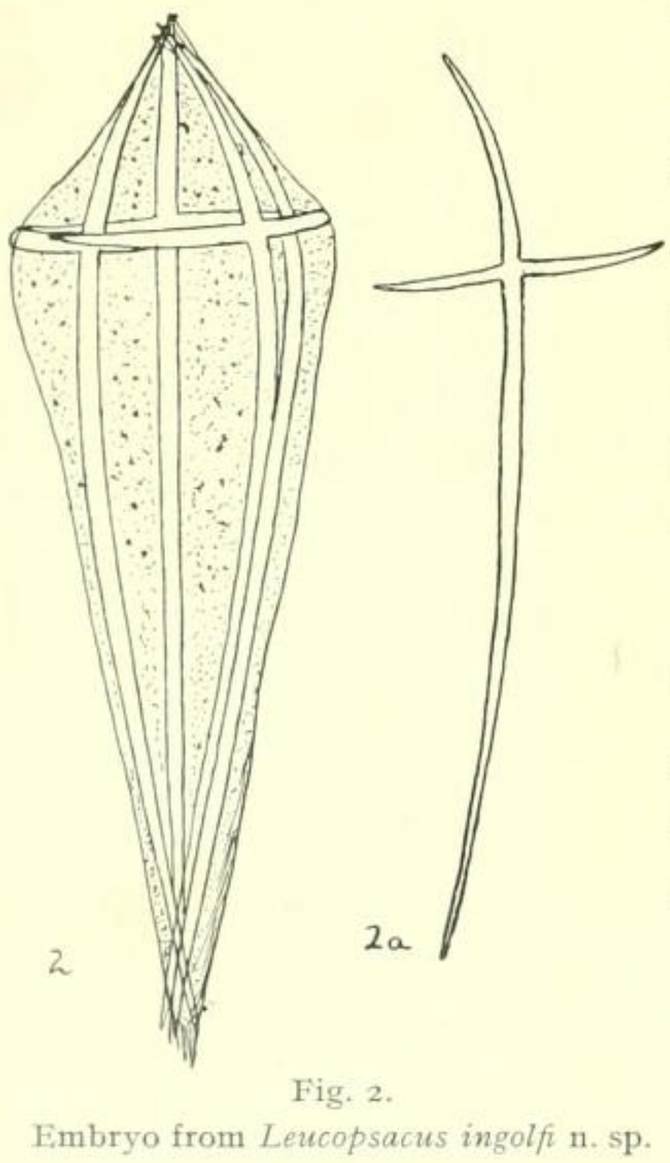


Fig. 2.
Embryo from *Leucopsacus ingolfi* n. sp.

Fig. 2 a.
Stauractin from same. × 440.

The wall is supported in the following manner. The dermal surface is smooth and is supported by a layer of *oxypentacts* whose proximal rays measure .4 mm. and whose tangential rays measure .18 mm. in length. The ends of these rays are slightly microspined and, in addition, there is the vestige of a distal ray.

Oxyhexacts: Immediately beneath the dermal layer of pentacts are several layers of long-rayed oxyhexacts differing little from the oxypentacts except that the six rays are present and all of the same length. These spicules are very variable in size, each ray of a typical spicule measures on an average .3 mm. in length and is slightly microspined, especially at the end. They form the main skeleton of the sponge and extend from the line of the pentacts to the gastral surface. There are no small gastral hexacts as in *L. scoliodocus*.

Oxydiacts: Smooth oxydiacts with microspined ends occur in the choanosome in bundles of 3—6, arranged with no apparent order but lying for the most part parallel with the dermal and gastral surfaces.

Microscleres. 1) Hexactinose discohexasters: These spicules are very similar to the corresponding spicules of *L. scoliodocus* except that the terminal anchor teeth are only two in number. They are somewhat rare and confined to the inner half of the choanosome. Axial length, .07 mm.

2) Hexasterose discohexasters: These are much more abundant than the preceding, especially in the periphery of the wall. The number of terminal or secondary rays on a single primary or principal ray is usually 4, but as few as 2 or as many as 6 may be found. The total diameter of the spicule varies a little but an average diameter is about .44 mm.

The reproductive elements present in one of the specimens, R. N. 78, are of two kinds. The first consists of single cells about .030 mm. in diameter, whose nuclei contain conspicuous nucleoli. They are rarely met with but the few seen had every appearance of the typical sponge ovum. The second type of reproductive body present is, to all intents and purposes, a fully-grown larva. Examples of these are of a peculiarly modified spindle shape which can be best appreciated by reference to the diagram (fig. 1). They are about .2 mm. long and about .055 mm. across at the thickest point. The state of preservation does not permit of minute histological examination. There is a certain amount of similarity between these larvae and those of *Vitrollula fertilis* Ijima (1904, Pl. III, figs. 20 and 21). The only spicules present in the larvae at this stage of development are oxystauractins composed of a long proximal ray running almost the whole length of the larva and ending in three shorter rays set each at right angles to each other. No other developmental stages were found.

The present species differs from the only other Atlantic species of the genus, *L. scoliodocus* Ij. var *retroscissus* Topsent (1904C) in the smaller size of the spicules and the fewer number of categories of microscleres.

Registered Nos. and localities:— R. N. 70, 65°14′ N, 30°39′ W, 752 faths., bottom temp. 2°1; R. N. 78°61′ 32. N. 11°36′ W, 720 faths., bottom temp. 2°4.

Species 5. **Caulophacus arcticus** (Hansen)

Var. **grœnlandica** var. nov.

Numerous stalks are present from various localities some of which bear at the end the remains of the sponge-body. Only one specimen is complete and it is on this that the identification of the variety is based. Presumably, the stalks and other fragments belong to the same species as the complete specimen referred to. This bears a strong resemblance to *C. arcticus* (Hansen), as re-described and figured by Schulze 1903, both in external form and spiculation. The actual points by which the present examples differ from the type of the last-named species are very slight and certainly not sufficient to justify our regarding the Ingolf specimens as representatives of another species. Indeed, it is doubtful whether these differences are sufficiently important to warrant the formation of a variety.

The following point is the only one on which the holotype of Hansen's species and the present variety from Greenland do not agree, viz:— the number of secondary or terminal rays to the discohexasters. In the

holotype, according to Schulze's figures (l. c. Pl. 1, fig. 3—7), these vary from 7—18 in number, while in the present forms the number varies from 4—12.

C. latus, the South Atlantic representative of the genus, is very similar to the more northerly species in many respects. In fact, it differs from it only in the presence of small, smooth-rayed hexasters. Nevertheless, R. N. 7 is so like *C. latus* in external form that I am tempted to suspect that the North and South Atlantic species, so called, are no more than geographical varieties.

Registered Nos. and localities:— R. N. 7, stn. 113, 69°31′ N, 7°06′ W, 1309 faths., bottom temp. —1°0; R. N. 19, stn. 112, 67°57′ N. 6°44′ W, 1267 faths., bottom temp. —1°1; R. N. 30, stn. 19, 60°29′ N, 34°14′ W, 1566 faths., bottom temp. 2°4, R. N. 39, stn. 118, 68°27′ N, 8°20′ W, 1060 faths., bottom temp. —1°0; R. N. 64, "Michael Sars" Stn. 102, 29/8 1902, 63°13′ N, 6°32′W, 975 faths., bottom temp. —0°51.

Species 6. **Asconema setubalense** Savile Kent 1870.

Other references to this species are:—

Marshall 1876; Schulze 1886, 1887, 1899, 1897; Agassiz 1888; Topsent 1892, 1904A; Brøndsted 1916; (for further references vide Schulze 1887, p. 113).

By far the most conspicuous in the collection, numerically this species affords some interesting data on variations in the Hexactinellida. Altogether the collection contains some thirty specimens, many of which are extremely fragmentary but others are complete or nearly so. In the complete specimens the external form may be either cup- or goblet-shaped, attached directly by the base or carried on a short, stout peduncle. The smallest is more or less sperical, about 5 mm. in diameter and in appearance very like the various species of *Leucopsacus*. This lends support to the view expressed by various authors that the species of *Leucopsacus* are but young forms of sponges belonging to other genera. The largest is about 12 cms. high. The colour varies from white to grey, brown and green, in spirit.

It was a matter of no small surprise to me to find, as I eventually did, that these thirty specimens were all members of one and the same species for not only did they differ in colour but the size of the oscules and pores and the texture of the sponges themselves were by no means constant. These all again were determined by the variations in the structure of the skeleton and the varying sizes of the spicules composing it. In some cases the diacts of the skeleton are not numerous and but sparsely present while in others they are abundant and form the most conspicuous part of the skeleton. Sometimes the pentacts are relatively few in number. According as to whether the spicules are numerous or sparse so the texture of the sponge itself varies and since the former may vary considerably, so must the latter since it is dependent on the former. One other point may be recognised in this connection, that the size of spicules, varying considerably as it does in a species, influences the texture of the sponge. If we imagine two sponges, one in which the spicules are few in number and comparatively slender the resulting skeleton will be by no means so stout and well-knit as that of a second in which the spicules are not only more numerous but thicker. Two such sponges, representing these extremes, would present marked differences in appearence when placed side by side. I have little doubt that the fact that some of the present specimens are fragmentary while others are whole and unbroken is due in no small measure to

these causes. I emphasize the question of texture and its variability because it has so often been used as a specific character and in my opinion, it is one of the least reliable that may be chosen. We know that the size of spicules varies considerably as also the proportions in which they may be present and since the texture of a sponge depends so largely on the skeleton it also must vary proportionately. Especially is this so when we remenber that other factors also influence preserved specimens, such as the age of the specimen, the mode of preservation, etc.

The skeleton, when examined microscopically, exhibits a wide range of variation in the proportions in which the various spicules are present, in addition to the variations in the size of the spicules themselves. For example, in one specimen the hypodermal pentacts were few in number and altogether masked by the enormous numbers of diacts present. In another the small pentacts were few in number. The actual dimensions of the various spicules varied enormously from one to the other of the thirty specimens examined. Regarding the microscleres, while the actual dimensions did not vary to any great extent it was noticeable that frequently one or other of the categories would be partially or even completely absent. This latter point recalls a similar condition found in *Aphrocallistes beatrix* (q. v.). The spining of the rays of the diacts and the larger pentacts was also found to vary from, on occasion, completely absent to abundantly present.

Previously known distribution:— Coast of Portugal (Kent, Jeffreys, Thomson); Bay of Biscay (Norman); East Coast of North America (Schulze); Azores (Topsent); North East Greenland (Brøndsted).

Bathymetric distribution:— 93—800 faths.

Registered Nos. and localities:— R. N. 3.i, stn. 78, 60°37′ N, 27°52′ W, 799 faths., bottom temp. 4°5; R. N. 9, 84, stn. 25, 63°30′ N, 54°25′ W, 582 faths., bottom temp. 3°3; R. N. 11, 75, stn. 28, 65°14′ N, 55°42′ W, 420 faths., bottom temp. 3°5; R. N. 12, stn. 7, 63°13′ N, 15°41′ W, 600 faths., 4°5; R. N. 14, 38, 76, stn. 90, 64°45′ N, 29°06′ W, 568 faths., 4°4; R. N. 17, stn. 28, 65°14′ N, 55°42′ W, 420 faths., 3°5; R. N. 18, stn. 94, 64°56′ N, 36°19′ W, 204 faths., 4°1; R. N. 25, 43, stn. 143, 62°58′ N, 7°09′ W, 388 faths., —0°4; R. N. 32, 50, stn. 54, 63°08′ N, 15°40′ W, 691 faths., 3°9; R. N. 37, stn. 53, 63°15′ N, 15°07′ W, 795 faths., 3°08; R. N. 46, stn. 59, 65°00′ N, 11°16′ W, 310 faths., — 0°1; R. N. 47, stn. 76, 60°50′ N, 26° 50′ W, 806 faths., 4°1; R.N. 57, 67°16′ N, 11°15′ W, 192 faths.; R.N.61, "Michael Sars", stn. 35, 1902, 62°58′ N, 1°56′ E, 620 faths.; R.N.63, "Michael Sars", stn. 85, 1902, 62°53′ N, 9°6′ W, 245 faths.; R. N. 80, stn. 57, 63°37′ N, 13°02′ W, 350 faths., 3°4; R.N.86, "Michael Sars", stn. 85, 1902, 62°53′ N, 9°6′ W, 245 faths.; R. N. 87, "Michael Sars" stn. 74, 1902, 60°19′ N, 5°39′ W, 620 faths.; R. N. 88, 66°16′ N, 26°8′ W, 330 faths.; R. N. 89, "Ryders Exp." E. Greenland.

Species 7. **Rossella mortenseni** n. sp.

(Figs. 3—9).

The two specimens referred to this species are of the usual Rossellid type and have the appearance somewhat of *Acanthascus*. R. N. 58, the holotype, is sub-spherical with a central gastral cavity opening at the apex. There is a well-developed basal tuft of long spicules and the general surface of the body is beset with long diacts projecting singly or in tufts. The colour is a dark brown throughout. The total diameter of the specimen is about 5 cms. The second specimen is slightly larger than the first and, but for the fact that

the surface has been very badly worn away in places, there is no essential difference between the two. The third is a young form, about 1.5 cms. in diameter and resembles the young forms of *Pheronema carpenteri* so much that I had at first mistaken it for a young *Pheronema*.

The skeleton is quite typical in structure. By far the most conspicuous element is the collection of diacts which fill the choanosome, many projecting at right-angles to the surface. The dermal spicules are pentacts and hexacts. The microscleres are of two sorts only, oxyhexasters and discohexasters. In one of my preparations a few large smooth-rayed hexasters were present, with rays .15 mm. long, which I regard as extraneous since a similar spicule has not been found in the other specimens.

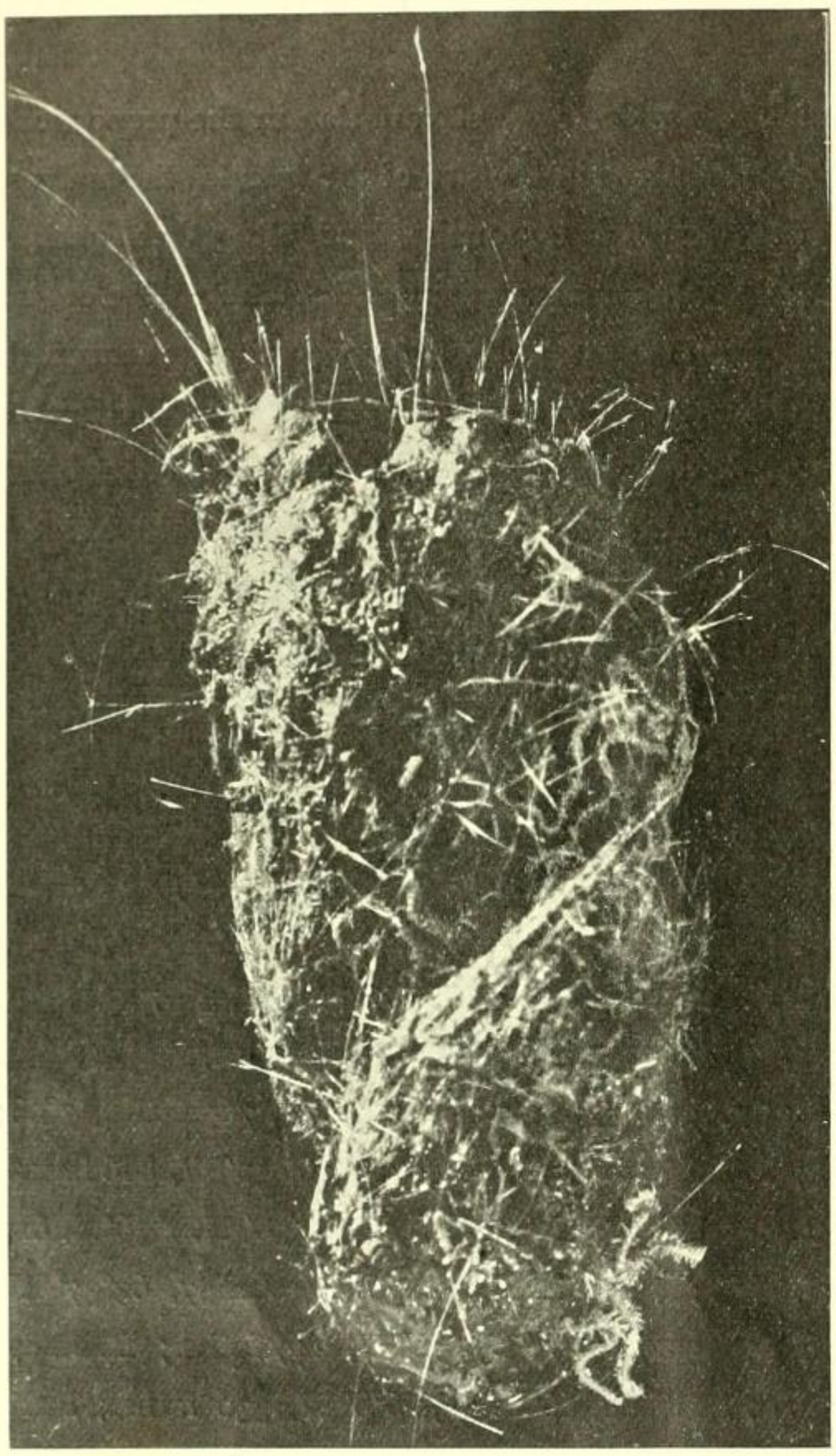


Fig. 3. *Rossella mortenseni* n. sp. Slightly enlarged.

Spicules:— 1) Diacts: These are of the usual *Rossella*-type with spiny ends, of various sizes. They form the main skeleton, the majority of them being distributed in loose bundles in the choanosome while others project beyond, and at right-angles to, the surface.

2) Dermal pentacts and hexacts: The dermal tissues abound with spined pentacts whose rays measure .12 mm. in length. Often these spicules are represented by hexacts or, more rarely, tetracts (figs. 4—6).

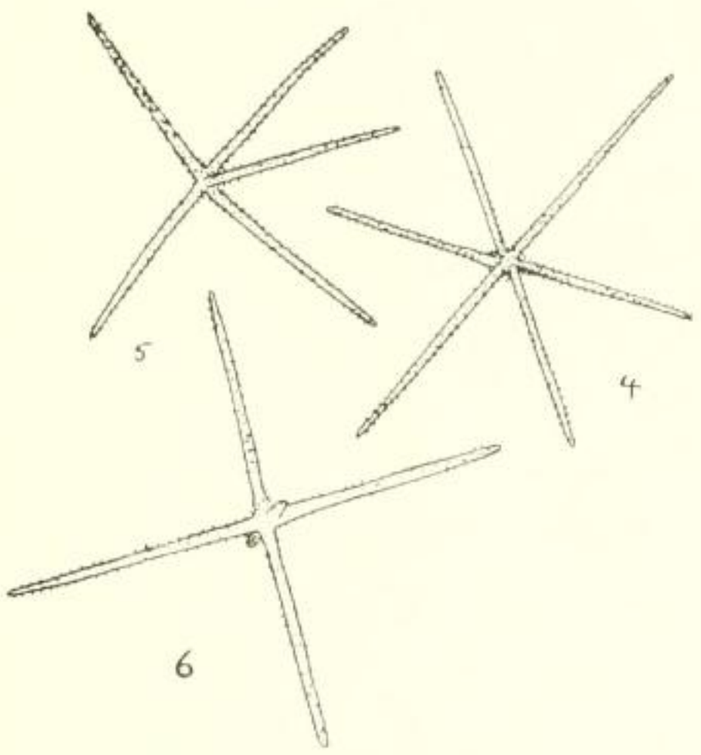
3) Hypodermal Oxypentacts: Schulze (1887) in his description of *Acanthascus grossularia*, says, "In the dermal skeleton, medium- sized, smooth, hypodermal oxypentacts occur, in which the proximal ray is radially disposed, while the four long tangentials, intersecting at right angles, follow the superficial curvature of the sponge in being slightly curved inwards". The smooth-rayed hexasters referred to above as being possibly extraneous may be spicules corresponding to those described by Schulze in the passage quoted. Certainly their tangential rays are curved and flexuous while occasionally the distal ray is absent so that the spicule is in effect a pentact. The apparent absence of this spicule from the second specimen may be due to the fact that the dermal tissues have been seriously damaged and torn.

4) In addition to the diacts, the choanosome contains a few large smooth-rayed hexacts, the rays of which may measure 10 mm. or more in length.

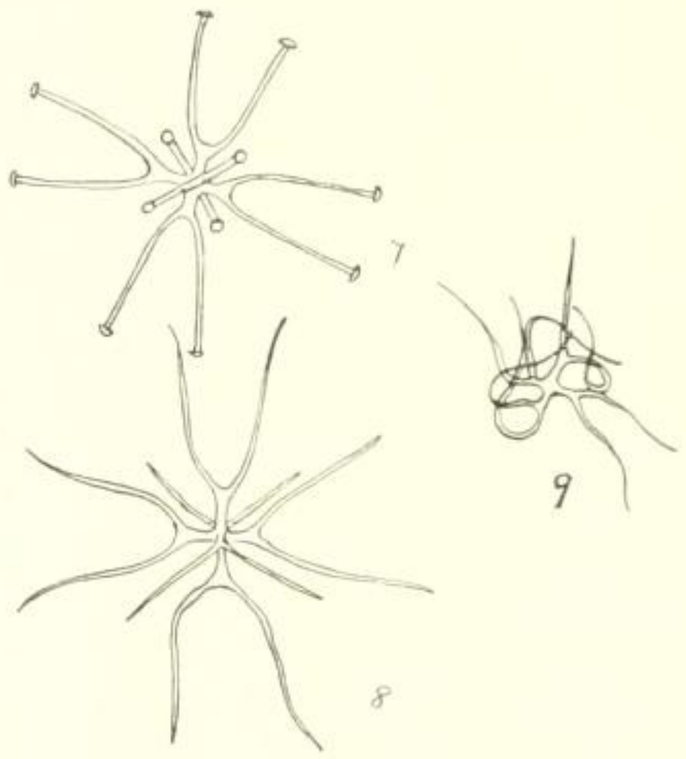
5) At certain parts of the surface of the sponge, pleuralia may be seen projecting at right angles to

it for a distance of about 1 cm. At the distal end these bear a variable number of rays, usually 3—5, disposed parallel to the general surface each ray usually being nearly 1 cm. in length. Over the greater part of the surface, these spicules are wanting and where they do occur one may not be sure that the variation in the number of rays may not be due to damage in which some of the rays were broken. A few of these spicules show up well in the photograph (vide fig. 3).

Microscleres:— 1) Oxyhexasters: Of the usual type with six short primary rays about .005 mm. long which bifurcate into two divergent, slightly flexuous rays about .028 mm. long. (figs. 8, 9). The rays



Figs. 4—6.
Dermal hexact, pentact and tetract of *Rosella Mortenseni*. × 48.



Figs. 7—9.
Discohexaster, Oxyhexaster, and Oxyhexaster with distorted rays from *Rosella Mortenseni*. × 480.

of these spicules are frequently irregular or distorted. This reaches its height in the young specimen referred to where about 30 % of these spicules are distorted as in fig. 9.

2) Discohexasters: Of the same size and shape as the oxyhexasters but with a slight disc at the end of each ray (fig. 7). This type of microsclere is much less common than the previous form.

Registered Nos. and localities,:— R. N. 58, stn. 166 "Thor", 957 metres, 62°57′ N, 19°58′ W, 14 July '03. R. N. 2, 63°04′ N, 9°22′ W, 262 faths.

Species 8. **Schaudinnia rosea** (Fristedt).

Synonymy:— *Hyalonema rosea* Fristedt 1887.
Schaudinnia arctica Schulze 1899B, 1900A.
Schaudinnia rosea Lundbeck 1909.
Schaudinnia rosea Brøndsted 1914.

There are two examples of this species present in the collection. R. N. 51 consists of a single tube, somewhat flattened, about 10 cms. long and from 2 to 3 cms. in diameter. R. N. 52 consists of a number of fragments which, when pieced together, form a sponge similar in appearance to the larger of the two tubes

in the specimen figured by Schulze (1. c. pl. 1, fig. 1). Undoubtedly these two specimens belong to the same species, for, although there are a number of minor differences between them they agree in the essential features.

If a comparison be made between the descriptions and figures given by Fristedt and Schulze for *Hyalonema rosea* and *Schaudinnia arctica* respectively, it is apparent that the only points of difference between the two species are:— a) the external form; b) the absence of discohexasters in the former; c) the absence of spines on the hypodermalia. Taken altogether, these points seem sufficiently important to mark a separation into two species, but I think it can be shown that they are not so significant as may appear and that the two species are, in reality, one and the same species.

a) The external form. The external form of *Hyalonema rosea* as figured by its author (l. c. Pl. 26, fig. 5) resembles almost exactly any one of the fragments of R. N. 52. In other words, the specimen described by Fristedt was not, as its author supposed, a complete example of a "round", "compressed" sponge but a fragment of a tubular sponge. The fact that the "lower surface is a little concave" in Fristedt's type-specimens only goes to strengthen the view that they were portions of a tubular sponge such as that described by Schulze.

b) The absence of the discohexasters. The discohexasters are rare in this species and it is not impossible that Fristedt may have overlooked them. On the other hand, their total absence from his specimen would not prove an insurmountable obstacle to the present view expressed above (cf. the presence or absence of the microscleres in *Aphrocallistes beatrix* and *Asconema setubalense*).

c) The absence of spines on the hypodermalia. The spining of the rays of the Hypodermalia appears to be a variable feature for in R. N. 52 they are practically all smooth while in R. N. 51, 75% of them are strongly spined (cf. my remarks on *Asconema setubalense*).

The British Museum possesses a fragment of Schulze's holotype of *S. arctica* and a comparison of it with the two present specimens leaves no doubt in my mind as to the synonymy with Fristedt's *Hyalonema rosea*.

Previously known distribution:— East Coast of Greenland (Fristedt, Lundbeck, Brøndsted); North of Spitzbergen (Schulze).

Bathymetric distribution:— 50—500 faths.

Registered No. and locality:— Forsblads Fjord, E. Greenland, 50—90 faths.

Species 9. **Trichasterina borealis** Schulze 1899B, 1900A.

The species is represented by a single sac-shaped specimen about 1 cm. high and two bottles full of small fragments. The agreement between the single complete specimen and the holotype is very close in practically all respects both macro- and microscopic. So far as the fragments are concerned, it is impossible to compare anything but the details of the skeleton. In this the agreement with the holotype is again evident except in one respect, viz:— the presence of a discohexaster. No discohexasters were found in the holotype but in two of the specimens of the present collection assigned to this species these spicules, almost identical with those of *Asconema setubalense* (vide Schulze 1887, Pl. XXI, fig. 11), were found to be present, abundantly

in one but sparsely in the other. Leaving aside the question of the discohexasters, for the moment, the three specimens from Greenland are quite obviously individuals of a single species, if we are to judge by the other details of the skeleton. All possess the extremely characteristic trichasters and the single complete specimen is so like the holotype as to leave no doubt as to their identity with Schulze's species. Assuming this to be the case, the presence of the discohexasters in two of the specimens need afford no obstacle. These microscleres are absent in one, sparingly present in another, plentiful in the third but absent in the holotype. Obviously we have yet another case of the sporadic occurrence of a form of microsclere, similar to that which obtains in *Asconema setubalense*, *Aphrocallistes bocagei*, etc., upon which I have already remarked. One may suppose that the holotype happened to be devoid of this particular category of spicule which, in reality, should be normally present in all members of the species. On the other hand, it is quite conceivable that the discohexasters belong properly to *Asconema setubalense*, which is apparently present in the Greenland seas in large quantities, and not to the sponges in which they were found. In either case the value of the species, and of the identification is unaltered.

Previously known distribution:— Arctic (Schulze).

Registered Nos. and localities:— R. N. 55—56, No. 21, "Ryder Exp." 74°27′ N, 15°20′ W, 127 faths.; R. N. 67, "Belgica" Exp., 77°31′ N, 18°24′ W, stn. 45.

Species 10. Hyalonema kentii (Schmidt).

Asconema kentii Schmidt 1880.

Hyalonema kentii Schultze 1886, 1887, 1893, 1899A.

There are two specimens which I propose to assign to this species. Unfortunately both are dry and one (R. N. 29) badly damaged. R. N. 83 can be identified as belonging to this species with a fair amount of certainty. The spicules are very clearly like those figured by Schulze (1887) but the external form is slightly different to that so far recorded for the species. The sponge consists of a spindle-shaped body about 1.75 cms. long and .9 cm. in diameter at the thickest part, which is approximately at the centre. The lower pole bears a short tuft of long slender spicules about 1 cm. long. At the other is a shallow depression surrounded by a thin margin and bearing in the centre a conical protuberance. The external appearance resembles that of *H. apertum* (vide Schulze 1887, Pl. XXXVII, figs. 2 and 3). R. N. 29 consists of a spindle- shaped body about 3 cms. long and about 1 cm. in diameter at the centre. I have been unable to find any trace of the dermal layer or its spicules. There is no cup-shaped depression at the distal pole but the end of the sponge is sharply-pointed in a manner which suggests the conical protuberance of the other specimen. The sponge is anchored at the proximal end by a tuft of spicules 1.5 cms. long. From the incomplete spiculation of this damaged specimen there can be little doubt that it is a *Hyalonema* and very near to *H. kentii*.

Previously known distribution:— G. of Mexico and the Caribbean Sea.

Registered Nos. and localities:— R. N. 29, 83, 61°44′ N, 27°00′ W, 485 faths., bottom temp. 6°1.

Species 11. **Pheronema carpenteri** Savile Kent 1870.

Other references to this species are:—

Gray 1870; Marshall 1876; Schulze 1886, 1887, 1893, 1904.

Synonymy:— *Holtenia carpenteri* Wyville Thomson 1869.

— — Carpenter and Thomson 1896.

— — Barboza du Bocage 1871.

This species appears from all accounts to be a very prolific member of the sponge fauna of the Atlantic Ocean. Thomson (l. c.) reports having obtained some 40 specimens at a depth of 500 faths. to the north of Scotland. The present specimens are ten in number including two very fine sponges 10 cms. high. The rest are of varying sizes, four of them being quite young, the smallest no more than 1 cm. in diameter. From the point of view of their spiculation all ten specimens belong without doubt to the above species but after having noted the slight differences in external form met with in even this small collection of sponges, I feel very strongly inclined to suggest that *P. grayi* represents nothing more than a variety of the present species. In fact, I am inclined to regard it as standing in the same relation to *P. carpenteri* as the various subspecies of *Aphrocallistes beatrix* do to *A. beatrix* itself, in which latter case, although for the purposes of this report I have recognised the four separate subspecies, it is a very debatable point whether such action is entirely justifiable and whether we ought not abandon all names but that of the type species *beatrix*. Topsent (1904A) sums up very clearly and concisely what he considers the essential differences between the two species *P. carpenteri* and *P. grayi*, but I suggest that there is not one of the supposed differences which may not be due to the variations normal to a sponge species. In the Greenland specimens the colour varies from yellow to a greyish-brown, in spirit, while the shape is usually globular or slightly ovoid. The spicules of which the basal tuft is composed vary in the manner in which they emerge from the base of the sponge. In some cases they are collected in tufts, in others it is difficult to see any sign of tufts at all. In one specimen the base of the sponge was entirely devoid of a basal tuft and the projecting spicules were disposed in a manner regarded by Topsent (l. c.) as characteristic of *P. grayi*. The very small specimens were exactly the same, in appearance, as the young forms of *P. grayi* figured by Topsent (1892, Pl. V, fig. 8). Despite my strong convictions on this question of the validity of the species *P. grayi*, I do not wish to commit myself to a decided opinion without having first examined more material than it has been my good fortune to obtain, hitherto.

Previously known distribution:— Atlantic Ocean, North of Zanzibar (Kent, Schulze).

Bathymetric distribution:— 340—1600 faths.

Registered Nos. and localities:— R. N. 1, stn. 81, 61°44′ N, 27 00′ W, 485 faths., bottom temp., 6°1; R. N. 49, stn. 84, 62°58′ N, 25°24′ W, 633 faths., bottom temp., 4°8; R. N. 59—65, "Michael Sars", stn. 79, 61°8′ N, 9°46′ W, 450 faths., 1902; R. N. 60, 66, stn. 76, 59°29′ N, 7°51′ W, "Michael Sars", 687— 580 faths., 1902.

Species 12. Farrea occa Bowerbank.

The following is a list of the references to this species:—

Bowerbank 1862, 1869, Gray 1867; Kent 1870; Carter 1873, 1874, 1885; Marshall 1876; Priest 1884; Schulze 1886, 1887, 1899 A, 1900 B, 1902, 1904; Topsent 1892, 1901 A, 1901 C, 1904 A.

There are several fragments belonging to the genus *Farrea* which I assign with some hesitation to this species. In all cases little more than the main skeleton is left, often coated with incrustations of *Hamacantha johnstoni*, while the loose spicules have in most cases disappeared entirely so that there can be no certainty about the identification of these fragments. However, since the main skeleton is very like that of *F. occa*, and since the latter species is found abundantly in neighbouring seas it may be fairly safely assumed, I think, that the Greenland fragments are of the same species.

Previously known distribution:— Cosmopolitan. The following is a comprehensive list of localities recorded for this species, given for the first time:— Coast of Portugal, Japan (Carter); Japan, Manila, California, Indian Ocean generally (Schulze); Azores, Antarctic (Topsent). (Topsent 1892 D gives the Antilles in addition to those recorded above but at the moment I am not clear as to the source of his information on this point).

Bathymetric distribution:— 130—775 faths.

Registered Nos. and localities:— R. N. 8, stn. 81, 61°44′ N, 27°00′ W, 485 faths., bottom temp. 6°1; R. N. 27, 28, 33, 42, 45, 82, stn. 78, 60°37′ N, 27°52′ W, 799 faths., bottom temp. 4°5.

Species 13. Aphrocallistes beatrix Gray 1858.

In 1904, Schulze showed that the six known species of *Aphrocallistes* represented nothing more than two real species *A. beatrix* and *A. vastus*, and that all the others were but varieties of one or other of these two. A concise and lucid résumé of the conclusions reached by that author are given by Arnesen (1920, p. 10). The result of Schulze's work was, in effect, to establish this fact, that the species might be conveniently divided into four subspecies, the basis for distinction between them being the external form. Since then Ijima (1916) has described a fifth, subsp. *orientalis*. Before proceeding further I propose to tabulate a complete list of the references to the various subspecies.

Species Aphrocallistes beatrix Gray.

Subspecies 1. A. beatrix beatrix Gray.

Gray 1858; 1867; Carter 1874; Marshall, 1876; Priest 1884; Schulze 1886, 1887, 1895, 1900 B, 1902, 1904; Stephens 1915; Ijima 1916; Arnesen 1920.

Subspecies 2. A. beatrix bocagai Wright.

Wright 1870; Kent 1870; Schmidt 1870, 1880; Carter 1874; Marshall 1876; Schulze 1886, 1887, 1895, 1899 A, 1900 B, 1902; Agassiz 1888; Kirkpatrick 1889; Topsent 1892, 1904 A.

Subspecies 3. A. beatrix ramosus Schulze.

Schulze 1886, 1887, 1895, 1902; Topsent 1892.

Subspecies 4. **A. beatrix azoricus** Topsent.

Topsent 1901 B, 1904 A.

Subspecies 5. **A. beatrix orientalis** Ijima. 1916.

The Ingolf material consists of a number of fragments of various sizes belonging to the *subsp. bocagei* Wright.

Previously known distribution:— Subsp. 1, Indian Ocean; subsp. 2, cosmopolitan; subsp. 3, Pacific Ocean; subsp. 4, Atlantic; subsp. 5, Pacific.

Bathymetric distribution:— 70—600 faths.

Registered Nos. and localities:— R. N. 5, 44, stn. 89, 64°45′ N, 27°20′ W, 310 faths., bottom temp. 8°4; R. N. 10, 26, 77, 85, stn. 9, 64°18′ N, 27° 00′ W, 295 faths., bottom temp. 5°8; R. N. 34, stn. 73, 62°58′ N, 23°28′ W, 486 faths., bottom temp. 5°5′; R. N. 69, stn. 10, 64°24′ N, 28°51′ W, 788 faths., bottom temp. 3°5; R. N. 72, stn. 81, 61°44′ N, 27°00′ W, 485 faths., bottom temp., 6°1; R. N. 74, stn. 97, 65°28′ N, 27°39′ W, 450 faths., bottom temp. 5°5.

Species 14. **Hexactinella grimaldii** Topsent 1890, 1892, 1904 A, 1904 B.

The species is represented by a number of fragments of what were presumably lamellar or semiinfundibular sponges. One fairly large fragment bears what might conceivably have been a stout stalk but the fragments are too small to say anything definite concerning the external form. The agreement with the holotype is very close in all details except that the rays of the large hexacts are longer, a very minor point, and the scopulae appear to have 4 rays, invariably.

Previously known distribution:— N. Atlantic (Topsent).

Bathymetric distribution:— 275—800 faths.

Registered Nos. and localities:— R. N. 4, stn. 53, 63°15′ N, 15°07′ W, 795 faths., bottom temp., 3°08; R. N. 16, 31.i, stn. 21, 58°01′ N, 44°45′ W, 1330 faths., bottom temp. 2°4; R. N. 20, stn. 19, 60°29′ N, 34°14′ W, 1566 faths., bottom temp. 2°4; R. N. 22, 28, 33.i, stn. 78, 60°37′ N, 27°52′ W, 799 faths., bottom temp. 4°5; R. N. 46, stn. 54, 63°08′ N, 15°40′ W, 691 faths., 3°9; R. N. 48, stn. 84, 62°58′ N, 25°24′ W, 633 faths., bottom temp. 4°8; R. N. 70, stn. 46, 61°32′ N, 9°43′ W, 643 faths., bottom temp. 4°17.

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THE INGOLF-EXPEDITION

1895—1896.

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
1	62° 30′	8° 21′	132	7°2	24	63° 06′	56° 00′	1199	2°4	45	61° 32′	9° 43′	643	4°17
2	63° 04′	9° 22′	262	5°3	25	63° 30′	54° 25′	582	3°3	46	61° 32′	11° 36′	720	2°40
3	63° 35′	10° 24′	272	0°5		63° 51′	53° 03′	136		47	61° 32′	13° 40′	950	3°23
4	64° 07′	11° 12′	237	2°5	26	63° 57′	52° 41′	34	0°6	48	61° 32′	15° 11′	1150	3°17
5	64° 40′	12° 09′	155			64° 37′	54° 24′	109		49	62° 07′	15° 07′	1120	2°91
6	63° 43′	14° 34′	90	7°0	27	64° 54′	55° 10′	393	3°8	50	62° 43′	15° 07′	1020	3°13
7	63° 13′	15° 41′	600	4°5	28	65° 14′	55° 42′	420	3°5	51	64° 15′	14° 22′	68	7°32
8	63° 56′	24° 40′	136	6°0	29	65° 34′	54° 31′	68	0°2	52	63° 57′	13° 32′	420	7°87
9	64° 18′	27° 00′	295	5°8	30	66° 50′	54° 28′	22	1°05	53	63° 15′	15° 07′	795	3°08
10	64° 24′	28° 50′	788	3°5	31	66° 35′	55° 54′	88	1°6	54	63° 08′	15° 40′	691	3°9
11	64° 34′	31° 12′	1300	1°6	32	66° 35′	56° 38′	318	3°9	55	63° 33′	15° 02′	316	5°9
12	64° 38′	32° 37′	1040	0°3	33	67° 57′	55° 30′	35	0°8	56	64° 00′	15° 09′	68	7°57
13	64° 47′	34° 33′	622	3°0	34	65° 17′	54° 17′	55		57	63° 37′	13° 02′	350	3°4
14	64° 45′	35° 05′	176	4°4	35	65° 16′	55° 05′	362	3°6	58	64° 25′	12° 09′	211	0°8
15	66° 18′	25° 59′	330	—0°75	36	61° 50′	56° 21′	1435	1°5	59	65° 00′	11° 16′	310	0°1
16	65° 43′	26° 58′	250	6°1	37	60° 17′	54° 05′	1715	1°4	60	65° 09′	12° 27′	124	0°9
17	62° 49′	26° 55′	745	3°4	38	59° 12′	51° 05′	1870	1°3	61	65° 03′	13° 06′	55	0°4
18	61° 44′	30° 29′	1135	3°0	39	62° 00′	22° 38′	865	2°9	62	63° 18′	19° 12′	72	7°92
19	60° 29′	34° 14′	1566	2°4	40	62° 00′	21° 36′	845	3°3	63	62° 40′	19° 05′	800	4°0
20	58° 20′	40° 48′	1695	1°5	41	61° 39′	17° 10′	1245	2°0	64	62° 06′	19° 00′	1041	3°1
21	58° 01′	44° 45′	1330	2°4	42	61° 41′	10° 17′	625	0°4	65	61° 33′	19° 00′	1089	3°0
22	58° 10′	48° 25′	1845	1°4	43	61° 42′	10° 11′	645	0°05	66	61° 33′	20° 43′	1128	3°3
23	60° 43′	56° 00′	Only the Plankton-Net used		44	61° 42′	9° 36′	545	4°8	67	61° 30′	22° 30′	975	3°0

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
68	62° 06′	22° 30′	843	3°4	92	64° 44′	32° 52′	976	1°4	118	68° 27′	8° 20′	1060	—1°0
69	62° 40′	22° 17′	589	3°9	93	64° 24′	35° 14′	767	1°46	119	67° 53′	10° 19′	1010	—1°0
70	63° 09′	22° 05′	134	7°0	94	64° 56′	36° 19′	204	4°1	120	67° 29′	11° 32′	885	—1°0
71	63° 46′	22° 03′	46			65° 31′	30° 45′	213		121	66° 59′	13° 11′	529	—0°7
72	63° 12′	23° 04′	197	6°7	95	65° 14′	30° 39′	752	2°1	122	66° 42′	14° 44′	115	1°8
73	62° 58′	23° 28′	486	5°5	96	65° 24′	29° 00′	735	1°2	123	66° 52′	15° 40′	145	2°0
74	62° 17′	24° 36′	695	4°2	97	65° 28′	27° 39′	450	5°5	124	67° 40′	15° 40′	495	—0°6
	61° 57′	25° 35′	761		98	65° 38′	26° 27′	138	5°9	125	68° 08′	16° 02′	729	—0°8
	61° 28′	25° 06′	829		99	66° 13′	25° 53′	187	6°1	126	67° 19′	15° 52′	293	—0°5
75	61° 28′	26° 25′	780	4°3	100	66° 23′	14° 02′	59	0°4	127	66° 33′	20° 05′	44	5°6
76	60° 50′	26° 50′	806	4°1	101	66° 23′	12° 05′	537	—0°7	128	66° 50′	20° 02′	194	0°6
77	60° 10′	26° 59′	951	3°6	102	66° 23′	10° 26′	750	—0°9	129	66° 35′	23° 47′	117	6°5
78	60° 37′	27° 52′	799	4°5	103	66° 23′	8° 52′	579	—0°6	130	63° 00′	20° 40′	338	6°55
79	60° 52′	28° 58′	653	4°4	104	66° 23′	7° 25′	957	—1°1	131	63° 00′	19° 09′	698	4°7
80	61° 02′	29° 32′	935	4°0	105	65° 34′	7° 31′	762	—0°8	132	63° 00′	17° 04′	747	4°6
81	61° 44′	27° 00′	485	6°1	106	65° 34′	8° 54′	447	—0°6	133	63° 14′	11° 24′	230	2°2
82	61° 55′	27° 28′	824	4°1		65° 29′	8° 40′	466		134	62° 34′	10° 26′	299	4°1
83	62° 25′	28° 30′	912	3°5	107	65° 33′	10° 28′	492	—0°3	135	62° 48′	9° 48′	270	0°4
	62° 36′	26° 01′	472		108	65° 30′	12° 00′	97	1°1	136	63° 01′	9° 11′	256	4°8
	62° 36′	25° 30′	401		109	65° 29′	13° 25′	38	1°5	137	63° 14′	8° 31′	297	—0°6
84	62° 58′	25° 24′	633	4°8	110	66° 44′	11° 33′	781	—0°8	138	63° 26′	7° 56′	471	—0°6
85	63° 21′	25° 21′	170		111	67° 14′	8° 48′	860	—0°9	139	63° 36′	7° 30′	702	—0°6
86	65° 03′6	23° 47′6	76		112	67° 57′	6° 44′	1267	—1°1	140	63° 29′	6° 57′	780	—0°9
87	65° 02′3	23° 56′2	110		113	69° 31′	7° 06′	1309	—1°0	141	63° 22′	6° 58′	679	—0°6
88	64° 58′	24° 25′	76	6°9	114	70° 36′	7° 29′	773	—1°0	142	63° 07′	7° 05′	587	—0°6
89	64° 45′	27° 20′	310	8°4	115	70° 50′	8° 29′	86	0°1	143	62° 58′	7° 09′	388	—0°4
90	64° 45′	29° 06′	568	4°4	116	70° 05′	8° 26′	371	—0°4	144	62° 49′	7° 12′	276	1°6
91	64° 44′	31° 00′	1236	3°1	117	69° 13′	8° 23′	1003	—1°0					