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CONTENTS:

OSKAR CARLGREN: ZOANTHARIA.

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COPENHAGEN.

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ZOANTHARIA.

BY

OSKAR CARLGREN.

WITH 7 PLATES AND 6 FIGURES IN THE TEXT.

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THE present paper on the Zoantharia (Zoanthidae) has been drawn up according to the same plan as my report on the Ceriantharia of the Ingolf-Expedition. Thus, it comprises not only the Zoantharia collected during the Ingolf-Expedition but also all the other northern and arctic forms of this group of animals which have been sent to me for examination, especially from the Riksmuseum in Stockholm but also from the museums in Copenhagen, Upsala, Bergen, Trondhjem and Tromsø. Besides, I have had the opportunity of examining some forms from the museums in Vienna and Berlin. To the chiefs of the Invertebrate departments or the custodians of the Coelenterata at these museums I would offer my best thanks for having lent me the material required. I am also greatly indebted to my colleague Docent Nils Holmgren in Stockholm for helping me to photograph the originals for the figures reproduced on Pl. 2.

The paper is divided into three parts:

1. Literature and summary of the northern and arctic Zoantharia.
2. Contribution to the systematic classification of Zoantharia (Zoanthidae).
3. Description of the species.

Section I.

Literature and summary of the northern and arctic Zoantharia.

THE first species of Zoantharia (Zoanthidae) described from northern waters was Epizoanthus incrustatus, which forms colonies and lives symbiotically with Enpaguridae. This easily known species was found on the Norwegian coast by Düben and Koren, who in 1847 called it Mamillifera incrustata. M. Sars (1851, 1860) and Danielssen (1859) also observed this species from other localities on the same coast. In the year 1860 Sars mentioned a new species from Finmarken, which he named Zoanthus arcticus and in 1868 Norman described from the Shetland Islands Z. incrustatus and Z. anguicomus, the latter for the first time. A fourth species found in the Trondhjem Fjord was described by Koren and Danielssen in 1877 under the name of Zoanthus norvegicus. In the year 1877 Marenzeller mentioned Zoanthus arcticus from the regions round Smith Sound, which however is identical with Epizoanthus lindahli described later in this paper, and in 1886 (p. 16) the same author stated, that Palythoa norvegica had been dredged near Jan Mayen, a statement however which proved to be incorrect, as the specimens on closer examination were found to be identical with or at any rate closely related to Epizoanthus glacialis, a species described later by Danielssen. The same year (1886, p. 52) C. Aurivillius put forward a new species E. couchii unknown in the Norwegian fauna, a statement however that could not be maintained, as the species in question is closely related to Epizoanthus erdmanni of the present work and may possibly even be considered a variety of the latter species. Thus, up to 1890 4 species of Zoanthidae living at the Norwegian coasts or in the northern seas, namely, Epizoanthus incrustatus, E. arcticus, E. norvegicus and Parazoanthus anguicomus, had been described in some detail, though very incompletely.

During the period from 1860—1880 the well-known naturalist Verrill provided us with information regarding some Zoanthidae from the coasts of North America. In the year 1864 he described from New Jersey Zoanthus (Epizoanthus) americanus, which has later been met with very often in the arctic regions, as far as Cape Cod and also in the region Cape Cod to Cape Hatteras (Parker 1900, p. 757). In 1891 Haddon and Shackleton proved, however, that this species is identical with Sars' E. incrustatus. In the year 1882 another species of the North American Zoanthid fauna became known, namely, Epizoanthus paguriphilus, first observed in deep water off the Nova Scotian coast; like E. incrustatus this species forms carcinoecia. Further, Verrill mentions an incrusting variety of E. americanus (1882, p. 316, 1883, p. 6), which he considers to be identical with Koren and

Danielssen's E. norvegicus. In his paper of 1883, Pl. 8, fig. 6, an illustration of this variety is given. Though it is, of course, very difficult to settle the question without being in possession of the original specimens, if they exist, the variety undoubtedly belongs to a Parazoanthus species. Verrill's figure has, namely, a fairly strong resemblance to the colony figured by me on Pl. 1, fig. 19, collected at St. 2245 U. S. F. C. together with the typical E. americanus (incrustatus) and determined as such, but which on closer examination proved to be a Parazoanthus species and in my opinion no other than P. anguicomus. Lastly, in the year 1885 Verrill described another carcinom-forming species, Epizoanthus abyssorum, dredged during the Albatross Expedition in 1884, and mentioned at the same time a free variety of this species (probably a new species). Though Epizoanthus abyssorum has evidently a more southerly distribution than the other North American species mentioned, I prefer to deal with it here for comparison between E. incrustatus and E. paguriphilus. I would point out, however, that I have had very little material of the North American species at my disposal, this being the reason why these are not dealt with in greater detail here, as also because a further criticism of the species based on the literature is fairly unremunerative. A revision of the collected material of the Zoanthidae forms will certainly prove, that the number of Zoanthid species is also on this coast not so small as seems to appear from the literature. I have not thought it necessary to give a complete list of the literature of these three species here. Up to 1891 such a list has in any case been given for both of the first-named species in Haddon and Shackleton's paper (1891).

In the year 1890 the number of known northern and arctic Zoanthidae species was almost doubled by Danielssen's description of the material collected during the Norwegian North Atlantic Expedition. The new species occurring are Epizoanthus roseus, E. arborescens, E. glacialis and Mardöl erdmanni, the last of which was proved by Haddon and Shackleton's investigations (1891) to belong to the genus Epizoanthus. In 1887 (p. 316) Mortensen was of opinion, that he had found Zoanthus sulcatus and couchii in the Limfjord, a determination however which must be erroneous at least as regards the latter, as this species according to Haddon and Shackleton is an Epizoanthus species, whereas Mortensen's form appeared to belong to a genus Isozoanthus founded by me. Lastly, in 1905 Carlgren mentions from Finmarken, besides E. erdmanni, also Isozoanthus arborescens, for which he later set up the above-named genus, Isozoanthus, forming a link between the genera Epizoanthus and Parazoanthus.

Thus, when I began my paper on the northern and arctic Zoanthidae, altogether some ten species of these had been described previously, many of them, however, very incompletely and mainly according to the external features. In 1890 Danielssen certainly gives anatomical descriptions of his new species, but in many respects these are not to be trusted and are of small use for the identification of the species. Of far greater importance is Haddon and Shackleton's paper on the British species of Zoanthidae. We find here a good anatomical description, which however in some respects might have been somewhat more comprehensive. As this is the only efficient work dealing with the Zoanthidae of the North European coasts, I may refer to it specially, as it also contains an account of the most important literature on the Zoanthidae up to 1891. Of the species dealt with in the sequel, however, only E. incrustatus, E. paguriphilus and Parazoanthus anguicomus are described in detail in the above-named paper.

Of the species already known the following are described in the present paper.

Epizoanthus incrustatus, paguriphilus, abyssorum, glacialis, roseus, norvegicus and erdmanni.

Isozoanthus arborescens and

Parazoanthus anguicomus.

Further, some anatomical details of Parazoanthus dixoni are also given here.

The new species are:

Epizoanthus danielsseni, lindahli, beerenislandicus, koreni.

Isozoanthus bulbosus, danicus, magnisulosus, multisulosus, davisi, ingolfi, dubius, islandicus.

Parazoanthus haddoni.

All told the descriptions thus comprise 22 species, showing that the northern and arctic Zoanthid fauna is not so poor as was formerly thought.

In the present paper I do not occupy myself very much with the geographical distribution, as I shall return to this subject later on when dealing with the Ceriantharia and Actinaria of the same regions. Along with this I propose to make a more detailed comparison between the Actinian fauna of the arctic and antarctic waters. It is worth noting, that though the number of known species from these regions has increased considerably, no representatives of the microcnemic Zoanthidae have been found there. The occurrence of the new genus Isozoanthus in both of these zones is also worthy of note, though it is not impossible, that this genus like the genera Epizoanthus and Parazoanthus also occurs in the intermediate regions. There seems to be a great difference in the distribution towards the north between the genera Epizoanthus and Isozoanthus on the one side and Parazoanthus on the other, the latter not being represented in the true arctic fauna, in which both the first-named occur. Towards the north the genus Parazoanthus seems to be replaced by Isozoanthus, of which a decidedly arctic species, I. bulbosus, has been met with so high up as north of Spitzbergen at 81° N. Lat., this being the northernmost place of occurrence of any Zoanthid species. It is as yet too early to foretell, what the conditions are in the antarctic region, but I am of opinion, that they are similar there. The material at my disposal from this region is, however, too limited to allow of any certain decision. The Zoanthid fauna seems to be poorer and to decrease more quickly towards the south, than is the case in the northern waters towards the north.

Section II.

Contribution to the systematic classification of the Zoanthidae.

Among the Anthozoa, at least among the forms generally comprised under the name sea-anemones, there is hardly a group which is so uniform in its morphological characteristics as the Zoantharia (Zoanthidae). The few genera are generally easily distinguished from each other, whereas it is more difficult to separate the species within the different genera. A number of Zoantharia species have been described especially in the older literature and almost exclusively from outer

characteristics, which however are often so little distinct, that an identification is only possible in exceptional cases. This is all the more difficult as the group of Zoantharia evidently comprises many species that are probably in process of differentiation. An attempt to bring some order into the classification was tried in 1891 by Haddon and Shackleton, who quite reasonably founded their classification on anatomical characters. Other scientists, as Duerden and several others, have followed in their footsteps but we are still without sufficiently good characteristics for the separation of quite a number of species.

Thus, many of the characteristics on which the classification of the species has been founded are found to be of small importance. Regarding the appearance of the cœnenchyme, firstly, it may sometimes give us good hints but we still know too little of its variations, which are caused by the object on which the cœnenchyme is fixed. That a variation takes place is almost certain, but its limits cannot be determined as yet. That the cœnenchyme may have a different appearance in the same species is seen in Epizoanthus incrustatus, which may have both a carcinœcium-forming cœnenchyme and a slightly tube-shaped cœnenchyme, on the supposition that the free variety barlesi of E. incrustatus belongs to this species. Pax' investigations of West Indian species of Palythoa seem to indicate, that a variation occurs, even though it seems possible here that separate species have been dealt with. The canal-system in the cœnenchyme might also be of use for the separation of the species, though but very little information thereon has been published as yet.

The outer appearance of the polyp may sometimes show very good characteristics for identification, but the species are often so little distinguished from each other that two polyps alike in outer appearance may nevertheless belong to 2 different genera (cf. e. g. figs. 13, 19, Pl. 1). The relation between height and breadth has been used for differentiation of species, but is such a weak character that the different degrees of contraction in different polyps may change the proportion between height and breadth. Even the capitular region and the distal contours of the polyp are always somewhat different in appearance according to the amount of contraction. Thus, the greatly distended polyps of one species cannot be summarily compared with the greatly contracted ones of another. The furrows on the capitulum, which generally correspond to half the number of mesenteries, are also a much used, specific character, but this method has the fault, that the character is variable, as furrows are not always found corresponding to the youngest mesenteries and the number of mesenteries and thus also the number of capitular furrows change according to the age of the polyps, the older ones having more mesenteries and consequently more capitular furrows than the younger, and even in the former a variation also occurs though within certain limits. In characterising the species according to the capitular furrows, it is thus necessary to pay attention to well-developed polyps, which often necessitates having large material.

Most of the Zoanthidae are, as already known, incrusted with foreign bodies, foraminifera, sand-grains and sponge needles. Regarding the incrustation generally, it seems in each separate species to consist of the same material, as shown by Haddon and Shackleton, though small variations naturally always occur; but I know more than one case, especially in I. bulbosus, where two different specimens of the same species have had quite different incrustations, for which reason I think it possible that similar conditions may be observed among other species. Though, in my

opinion, a different incrustation in two otherwise similar forms does not entitle us to set up two different species, and the incrustation thus theoretically is of no great value for the characterization, yet in practice, owing to what has been said above, it may be used to help in the characterization of a species.

Regarding the arrangement and appearance of the tentacles, they give at least in preserved specimens no assistance in the identification of the species, the appearance and arrangement being almost the same in all species of Zoanthidae. The number varies in different species but as it is dependent on the number of mesenteries, it is of no practical importance for the classification.

Even the structure of the œsophagus provides no basis for the identification of the species, as it is fairly uniform. Whether it is elongated or not, whether the diameter is small or large, is generally dependent on its more or less contracted state. The appearance of the siphonoglyphe is only exceptionally of importance for the classification, especially as in the Zoanthidae, in contrast to what we find in the Ceriantharia, it is only the directive mesenteries which are always attached to it The same applies to the prolongation of the siphonoglyphe (hyposulcus) which, at any rate in all species examined by me, showed almost the same degree of development.

As to the finer anatomical structure, the body-wall, especially the structure of the mesoglœa, provides one of the best characters for the separation of the species, even though variations may sometimes occur within the same species. The different sizes of the ectoderm, endoderm and mesoglœa in relation to each other should be fairly constant in the different species, whereas the size of the germ-layers varies with the state of contraction. The ectoderm may vary greatly in appearance in the different species but above all the appearance of the mesoglœa is of importance for the classification, as it either contains but few cells, or is provided with numerous cells, cell-islets or lacunae arranged in a manner often very characteristic for the species.

The appearance and structure of the sphincter help to characterize the genera but are not always of such great importance for the separation of the species, though in a few cases very characteristic sphincters occur. It must also be observed that there is a variation in the appearance of the muscle, which at least in many cases may be connected with the state of contraction of the sphincter.

The number of the mesenteries gives a very good character for the separation of the species, but the variations are not so unimportant, even in full-grown polyps. Furthermore, it has to be mentioned, though already pointed out previously in discussing the capitular furrows, that the mesenteries increase in number with age, so that only full-grown specimens of different species can be compared with certainty. The breadth of the micro-mesenteries may vary in different species, though this is fairly seldom, as it is generally of importance for the separation of species. It must specially be pointed out, that in different species the breadth is compared at the same part of the body, as for example the lower part of the œsophagus, the micro-mesenteries in the different parts of the body being of extremely varying breadth, in the distal part well developed but tapering quickly downwards. But even if we consider this, we run the risk of making mistakes in classifying, as the state of contraction of the pylop changes the position of this zone very considerably. The appearance of the longitudinal muscles in the mesenteries may often be very characteristic, but even here we

must notice, that a specimen expanded broadwise gives quite a different appearance from a specimen with mesenteries contracted broadwise. The parieto-basilar muscles seem generally to be weak, sometimes they may be more differentiated, but are on the whole of small importance for classification. The distribution of the longitudinal and the parieto-basilar muscles on the body-wall is sometimes small, sometimes greater and is sometimes of use for the separation of the species. The macro-mesenteries project more or less into the gastrovascular cavity, so that it would seem as if this might be a fairly useful character. It must be pointed out, however, that the appearance of the mesenteries is quite different in contracted and expanded specimens of the same species and it is also of importance in the same respect whether the sexual organs are developed or not. If the sexual organs are much developed, namely, the mesenteries are considerably broader than is otherwise the case.

The structure of the filaments is of no great use for the classification of the species, as it is mainly the same in all forms.

As has been pointed out, there is great uniformity in structure and appearance in most of the species within the genera, for which reason the identification of many species is distinctly difficult. As most of the Zoanthidae are besides incrusted so much, that in many cases it is quite impossible to get moderately good sections, it is obvious that the identification of Zoanthidae-species and the setting up of new species is in most cases a matter of considerable difficulty. It was of great importance, therefore, to find some more pecularities of organisation, which showed such great differences in the different species, that they could be used for their identification. As I have found regarding the Actiniaria, that the structure, size and arrangement of the nematocysts provide good characters for identification, I have investigated if the same was the case in the Zoantharia. Even if this is not so much the case in the Zoantharia as in the Actiniaria — as the first-named show great uniformity probably even in the nematocysts, the structure, size and arrangement of the nematocysts in the Zoantharia may nevertheless contribute to the identification of the species. As in the Actinaria there may certainly be some species of a genus which have almost the same distribution, structure and size of the nematocysts, whereas other species may show great differences in this respect. As the length and breadth of the nematocysts seem to be constant — of course with a certain amount of variation — the measurements of the nematocysts are in my opinion more suited to the determination of a species than most of the measurements of Zoanthidae, even more suited than most of the other structural characters, though of course with certain exceptions. In the following I have also taken account of the nematocysts as far as possible in the description of the species. Especially the large nematocysts with much coiled spiral threads, which are found in the body wall and filaments, sometimes in the tentacles and the œsophagus, appear to be of varying size in the different species. It must be observed that the range of variation seems great in certain cases. It is possible, however, that this condition is only apparent. I cannot set aside the possibility, namely, that some of the large nematocysts with greatly twisted threads, which have a thinner wall than the other capsules, may to some extent change their dimensions in different liquids of preservation, i. e. not be quite resistant. The relation between length and breadth would thus be different in varying degrees of contraction. I cannot however express my opinion on this point with certainty, as none of the experimental proofs in this respect could be made by me. Without denying the possibility that the large

nematocysts may change their form a little in the different liquids of preservation, these capsules may nevertheless be considered resistant on the whole. This is also indicated by the agreement in numbers I obtained in species where a large material was examined. It seems to me at any rate, that data regarding the structure, size and distribution of the nematocysts must be taken into consideration in the characterisation of the different forms of Zoanthidae. Such data may often give reliable information as to whether we have a constant species before us and are at any rate for the sake of control of great value.

The arrangement, size and structure of the nematocysts have been examined in preparations embedded in glycerine diluted with water. As to the filaments it is generally very difficult to separate them from other parts of the mesentery. Parts of these break loose when the filaments are removed. We might imagine, therefore, that the nematocysts are not always lying in the filament but in other parts of the mesentery. This does not seem however — at any rate not as a rule — to be the case, as I have found none of the capsules characteristic of the species in sections of the non-filamentous part of the mesenteries. There are exception to this rule however, to be mentioned later in the present paper. In a bottle with 6 colonies of Epizoanthus incrustatus from the neighbourhood of Iceland I found that two of the colonies had some peculiar, egg-shaped nematocysts in the mesenteries, which were not present in the other colonies from the same locality. At first sight I thought I had another species before me or at any rate a variety, but as I could find no other characters separating these colonies from the normal ones, I had to look for another explanation. This was soon obtained, all the sooner because it struck me in the first examination that these nematocysts closely resembled the nematocysts of Hydrozoa. In this case they should not lie in the filament itself but inside this in the entoderm. On closer examination of the section this was found to be correct. The egg-shaped capsules have thus undoubtedly been taken in together with the food. I have found the same kind of nematocysts in a colony of Epizoanthus erdmanni also from Iceland. Even in this colony the capsules seemed to be lying in the entodermal part of the mesentery, though the fixing was hardly so good here that they could be said with absolute certainty to be found in the entoderm only. If this kind of unusual capsule occurs in the filament, especially if only in certain specimens of a species, there is reason to suspect that we are dealing with capsules that have penetrated into the animal from without and not a normal component. I think it necessary to point this out specially for the sake of future investigations.

In all the specimens examined by me the nematocysts are almost always arranged in the same way. In the ectoderm of the cœnenchyme and of the body-wall only nematocysts with greatly twisted thread are found. Regarding the distribution of the nematocysts in the body wall, they are most numerous in the proximal part, in the capitular region they are scarce or absent. Yet sometimes the nematocyst-capsules there are more numerous and of a different size and appearance than in the other parts of the body-wall. In the ectoderm of the tentacles there are always extremely numerous spirocysts (thin-walled capsules), less numerous typical, thick-walled capsules, sometimes similar capsules as in the body-wall, though never abundantly.

The oral disc shows, in the few cases I have examined this, the same distribution of the capsules as occurs in the tentacles. In the œsophagus there is mostly thick-walled capsules, in some

of which the basal part of the spiral thread is fairly distinct; more seldom and more scattered we also find some nematocysts of the same kind as in the body-wall. In the filaments we find the same sort of capsules as in the body-wall, sometimes in two different sizes, and also some thick-walled capsules through which the basal part of the spiral thread can be seen and often, further, typical, transparent thick-walled capsules.

Though I hope that the nematocysts of the Zoantharia species may be of use in the identification of these species and make this to some extent easy, I am however fully aware that we are still far from having discovered the special characters of many species. The large number of Zoanthidae described in this paper may appear surprisingly great to many Actiniae specialists. But I would remark, that the material investigated from northern and arctic seas is undoubtedly the largest that any scientist has had for examination. It is of course quite possible, that later investigations may show, that some of the species described here are varieties of other species or that what is considered a variety here may come to be regarded as a separate species. Taken on the whole, I feel convinced, however, that the number of species will not be much reduced, as most of the species, of which I have had a rich material, are certainly good species.

As already pointed out in 1900, the distribution, size and structure of the nematocysts are in the Actiniae of no small importance for the identification of the species, a theory that has been confirmed by my later investigations on the Actiniae. Pax doubts their importance, but so far as I can find, he has not made any extensive investigations on a large number of species to clear up the question. He admits, however, that in a few cases the capsules may serve as good characters. As evidence for his view he refers to some measurements made by me on 3 species belonging to the genus Actinioides and finds them to be almost the same, from which he draws the conclusion that the nematocysts are of no great importance for the classification. I do not agree with him here, for the same might be said about any organs of the species, if we agreed with Pax's standpoint. How often do we not find, that the sphincters, the arrangement of the mesenteries and a great many other organs show agreement in many species of a genus of Actinaria, yet nobody would deny their great importance for the classification of this group. The occurrence of certain kinds of nematocysts, their size and arrangement, is a character as good as any, even if it is not always of importance for the separation of closely-related species. For the separation of many genera of Actinaria they may also be used with advantage, for, so far as I have found in the abundant material investigated, many genera have nematocysts of a certain nature and arranged in a certain manner. It is at any rate a fact, that the nematocysts are found to be indispensable for the separation of the species, as soon as the expert has recognized their utility. In some cases, I may say, it is only a closer study of the nematocysts, which has given a starting point for the separation of the species belonging to two nearly allied genera — species which showed so great a resemblance that it would hardly have been possible to separate them, had not the different size of the nematocysts in certain parts of the body opened up the possibility for a grouping of the species. In another paper I shall deal further with these features. I would therefore recommend those who write on the Actiniaria, to pay particular attention to the arrangement and structure of the nematocysts, being convinced that many systematic errors would be avoided if the capsules were only subjected to a proper examination.

Section III.

Description of the species.

Family *Macrocnemina*e Haddon & Shackleton 1891.

Genus *Epizoanthus*. Gray 1867.

Macronemic Zoantharia with a single mesoglœal sphincter muscle. The body wall is incrusted. The ectoderm is usually continuous but may be discontinuous; cell-islets and lacunae often in the mesoglœa. Diœcious polyps connected by cœnenchyme, which may be band-like, incrusting or greatly reduced, as in the free forms.

As Haddon and Shackleton have given a good diagnosis of the genus, I have used it in the main here. Of the 11 Epizoanthus species described here 4 are new: *lindahli*, *danielsseni*, *beerenisiandicus* and *koreni*. *E. incrustatus* and *paguruphilus* have previously been described in detail by Haddon and Shackleton (1891) but their description needs supplementing on several points. Regarding *E. norvegicus* these authors also give some anatomical information and show that *Mardœl erdmanni* Dan. is an Epizoanthus-species. The other species are described entirely from outer appearance or the anatomical description is so bad, that it cannot be used for a characterization of the species.

Four of the species *E. incrustatus*, *paguriphilus*, *lindahli* and *koreni* have been dredged by the Ingolf-Expedition.

Synopsis of the *Epizoanthus*-species described here

A. Species with carcinœcium
  a. Without ventral polyp. Ectoderm of the body wall continuous.
    b. The capitular region of the polyps in the contracted state truncate, disc-like, number of mesenteries 32—42 ..... *incrustatus*.
    bb. The capitular region of the polyps in the contracted state not truncate, not disc-like, number of mesenteries about 46 ..... *abyssorum*.
  aa. With ventral polyp. The ectoderm of the body wall discontinuous, except in the capitular region; number of mesenteries 64—80 ..... *paguriphilus*.

B. Species without carcinœcium
  a. The ectoderm of the body wall in the polyp discontinuous ..... *norvegicus*.
  aa. The ectoderm of the body wall in the polyp continuous.
    b. Single unattached polyps or free colonies.

c. The large nematocysts of the filaments and of the capitular region have the same structure, narrow and long (4 times longer than broad), unlike those in the other parts of the body wall ..... *lindahli.*

cc. The large nematocysts of the filaments are of moderate length (length being at most as 3·5 times breadth). The capsules of the capitular region, if any, resemble those in the other parts of the body wall..... *erdmanni.*

bb. Polyps and colonies attached. The cœnenchyme more or less developed.

d. The large nematocysts of the filaments are narrow and long (the length being more than 4 times the breadth). The capsules of the capitular region of the same kind, but unlike those in the other parts of the body wall..... *danielsseni.*

dd. The large capsules of the filaments are of moderate length (the proportion between length and breadth being at most as 3·5 to 1). The capsules of the capitular region, if any, resemble those in the other parts of the body wall.

e. The sphincter comparatively feeble, number of mesenteries about 32. The large nematocysts of the filament 22—31 μ long, 12 μ broad ..... *roseus.*

ee. Sphincter strong

f. The large nematocysts of the filaments 34—41 μ long and 10—12 μ broad. Cell-islets and lacunae often found at the base of the insertion of the mesenteries, number of mesenteries 38—42..... ..... *beerenislandicus.*

ff. The large nematocysts of the filaments 26—36 μ long and 10—12 μ broad. Cells numerous, cell-islets more scarce in the mesoglœa of the body wall, but not present near the base of the mesenteries; number of mesenteries 36—52 .... *glacialis.*

fff. The large nematocysts of the filaments 26—29 μ long and 10 μ broad. Numerous oval or round and separate, large cell-islets, further, large lacunae containing cells in the mesoglœa of the body-wall; number of mesenteries about 36.. *koreni.*

Species **Epizoanthus incrustatus** Düb. & Koren.

Pl. 2, fig. 26.

Mammillifera incrustata n. sp. Düben & Koren 1847. Förhandl. Skand. naturf. Möde p. 268. Isis 1848 p. 536. Sars 1851. Nyt Mag. Naturv. 6 (2), p. 142, Danielssen 1859. Nyt Mag. Naturv. 11, p. 45.

Zoanthus incrustatus Düb. & Koren, Sars 1860. Förhandl. Vidensk. Christiania, p. 141. Förh. Skand. Naturf. Kobenhavn 8, p. 691.

Polythoa arenacea d. Ch. p. p. Andres 1883 Le Attinie, p. 522.

Epizoanthus incrustatus (Düb. & Koren) Haddon & Shackleton, Sc. Trans. R. Dublin Soc. 1891, p. 636, Pl. 58, figs. 1—22, Pl. 59, fig. 2, Pl. 60, fig. 1 (contains a complete synonymy and list of literature of this species up to 1891).

Epizoanthus americanus n. sp. Verrill. 1867. Mem. Boston. Soc. Nat. Hist. 1, p. 34, 45.

Palythoa incrustata Roule 1900. C. R. Acad. Sc. Paris. 131 1900 p. 279.

Sidisia incrustata Düb. & Koren Arndt Jahr. Schl. Gesells. vat. Cultur 1912, p. 123.

Occurrence. Jutland Reef 60—130 fathoms, M. Uddström 1873, R. M.

Jæderen 100—150 fathoms, M. Olsson 1877, R. M.

Bergen Koren, R. M.

N. W. of Bergen 100—200 fathoms, M. Olsson 1877, R. M.

Finmarken Karlso N. of Tromso 70 fathoms, Goës & Malmgren, R. M.

— — 90 fathoms, Malmgren 1864, R. M.

— Foldenfjord, 530 m. 6·4, Nordgaard.

— Vestfjord, clay 11·8 1877, St. 252 N. N. Atlantic. Ex., Bergen M.

61° 16′ N., 1° 18′ E. 150 m. Sand, mud, shells. Greenland Ex. 21/5 1899, R. M. St. 58 Michael Sars Ex. 1900 30/8 Bergen M.

66° 35′ N., 23° 47′ W. 117 Danish fm., bottom temperature 6·5°. Ingolf-Exp., St. 29, Cop. M.

50° 57′ N., 10° 46′ W. 184 m. St. 96, 27/7. 1910 Michael Sars Exp., Bergen M.

(75 miles S. off Marthas Vineyard 86 fm., from U. S. N. M., R. M.)

- — off Marthas Vineyard U. S. Fish. Comm. Cop. M.)

40° 40′ N., 69° 30′ W. 23/5. 1888, R. M.

(40° 01′ 15″ N., 70° 22′ W. 98 fm., U. S. Fish. Comm. Albatross, R. M.).

Sandy Hook Shinnicock Bay, 18 fm. Josephine Exp., R. M.

N. America, Bank of New Yersey, R. M.

Size: The largest colony I have examined — the colony had no less than 18 polyps — had a length of 2·5 cm. and a breadth of 1·3 cm. not comprising the polyps. The largest polyp when contracted had a length of 1·1 cm.

Colour: Light sandy-coloured or dark-gray in alcohol.

External appearance: As the outer appearance of the colonies has been described in detail by Haddon & Shackleton (1891), I shall here only give a short description of the carcinœcium-forming typical forms. The cœnenchyme is well developed, forming the carcinœcia originally on gastropod-shells, which are inhabited by hermit crabs. In older specimens the polyps are arranged irregularly on the dorsal side of the carcinœcium. In the largest specimen I counted no less than 18 polyps, thus a larger number than observed by Haddon and Shackleton. No ventral single polyp is found as is the case in *E. abyssorum*. Haddon and Shackleton state, that in younger colonies the polyps are arranged in three series and describe their arrangement. Even if the development seems in many cases to proceed as described by Haddon & Shackleton, there is undoubtedly a great number of exceptions from the rule laid down by them. The only thing I have been able to determine with certainty is, that during the 2-polyp stage, one of the polyps lies nearer the apex of the gastropod, the other near the entrance to the carcinœcium, to begin with over the opening or even laterally, and that the third polyp is formed between these two. For my part I think it most probable, that the places where the polyps are formed are to a great extent dependent on the shape of the gastropod. Be this as it may, practically, the arrangement of the polyps in three series in the young specimens has hardly any importance for the classification. The polyps are cylindrical, the larger double the height of the smaller. On the contracted specimens with retracted tentacles the distal part of the polyp is broader than the other part and forms "a flattened disc-like

termination" (H. & S.), so that seen from the side the distal part is sharply truncate. The capitular furrows are well-marked, in smaller polyps the number is 15, in larger about 18, sometimes even 22. In dark specimens these furrows seem to be more distinct. The polyps show a slight bending at the entrance of the carcinœcium, i. e. forwards. The polyps as well as the carcinœcium are strongly incrusted with sand-grains. As opposed to what we find in *E. paguriphilus* I have seen no trace of the cuticle in this species.

The œsophagus is short, the siphonoglyphe distinct with a well developed hyposulcus of almost the same length as the œsophagus. Haddon & Shackleton state that the siphonoglyphe is "somewhat" indistinct. It may be, that they have come to this result, owing to their sections passing through the uppermost part of the œsophagus, where the siphonoglyphe is not distinctly developed as yet.

Anatomical description: Haddon and Shackleton have described the anatomy of this species. On several points I am able to supplement their description. The ectoderm of the body-wall is continuous and fairly low. It contains a large number of nematocysts with strongly twisted thread (length 22—24 μ, breadth 8—10 μ). Owing to the strong incrustation it is difficult to judge of their distribution on the different parts of the body. The mesoglœa is several times broader than the ectoderm. It is generally fairly homogenous, but contains here and there some scattered small cells and in the inner part very few cell-islets and lacunae. The ectoderm is thinner than the ectoderm. The incrustations are rather strong and consist almost exclusively of fairly coarse sand-grains, which fill the whole of the body-wall and may sometimes, as mentioned by Haddon and Shackleton, even penetrate into the coelenteron.

The sphincter is short but strong, the muscle-fibres are large and separated by narrow bands of connective tissue. In contracted specimens the sphincter is broad in the upper part, often filling up almost the whole breadth of the mesoglœa, but narrows quickly downwards.

The ectoderm of the tentacles is as usual high and contains numerous spirocysts. Thick-walled capsules if any are very small.

The ectoderm of the œsophagus is high and provided with numerous thick-walled, narrow nematocysts (length 17—19 μ). I have also, though seldom, found similar nematocysts as in the body-wall. The ectoderm of the siphonoglyphe is lower, and the mesoglœa is in some cases greatly thickened in other cases less so, owing to the greater or less development of the siphonoglyphe.

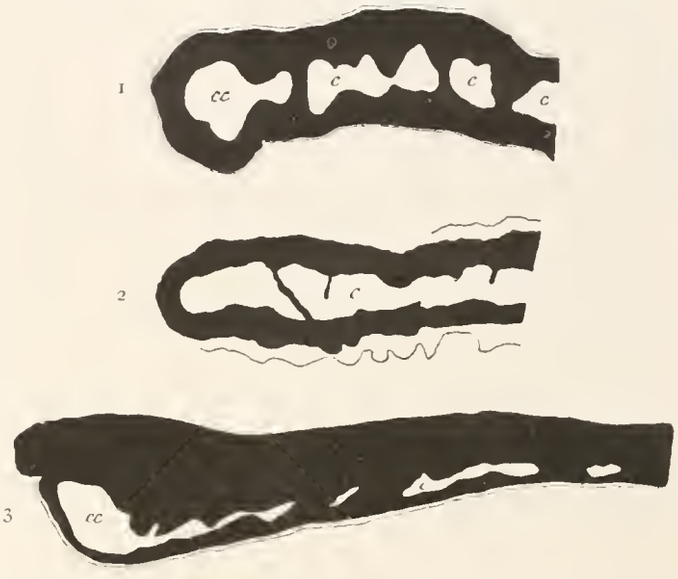
The number of mesenteries is somewhat variable. In smaller specimens I have found 32 mesenteries (18 macro- and 14 micro-mesenteries); a larger specimen had 36 mesenteries, another 38 (10 macro and 9 micro on the one side and 11 macro and 9 micromesenteries on the other). The greatest number of mesenteries I have observed was 42, in which specimen the one side had one macro- and one micro-mesentery more than the other side. The micro-mesenteries are weak and in the lower part of the œsophageal region and under the œsophagus they reach only a little way into the cœlenteron. The longitudinal as well as the parieto-basilar muscles are weak and the distribution of these muscles on the body-wall is also inconsiderable.

The filaments have the usual structure. In the cnido-glandular tract we find sometimes sparsely, sometimes more frequently, nematocysts with spiral thread which are broader at the one side than at the other (length about 24 μ, greatest breadth about 7—8 μ), further frequently thick-walled capsules (length 22 μ, breadth 3 μ).

In the mesenteries of a few specimens taken at St. 129 by the Ingolf-Expedition I found numerous egg-shaped nematocysts, sometimes large (length 19—24 μ, breadth 14—17 μ), sometimes smaller (length 17 μ, breadth 7 μ) and also some intermediate sizes. As these only occurred, however, in a few colonies and were wanting in others from the same locality, the doubt arose whether these capsules were of normal occurrence. Sections showed also, that the capsules did not lie in the cnido-glandular tract itself but in the ectoderm immediately within this. It is therefore most probable, that these nematocysts have been taken in with the food and that they are the nematocysts of hydroids, which they greatly resemble.

The species is dioecious.

The walls of the *carcinoecium* have the same structure as the body-wall of the polyps. The ectoderm is provided with a thin cuticle and contains nematocysts of the same kind as in the body-wall, which are especially numerous on the outer side of the carcinœcium. The ectoderm seems to be somewhat thinner on the inner than on the outer side and is by comparison with the mesoglœa very thin. The mesoglœa resembles the body-wall mesoglœa of the polyps and is very much incrusted. The canal-system (c text-fig. 1) of the entoderm is greatly developed and lies almost halfway between the outer and inner margins of the carcinœcium. The canals are large and broad and fuse together to irregular lacunae, which form a network. The mesoglœal pillars between the meshes are rather weak, though not so indistinct as in *E. abyssorum*. Along the upper margin of the carcinœcium runs a canal (cc) as in *E. paguriphilus*. The canal is somewhat broader than the rest of the canal-system.



Text-figure 1—3. Transverse section through the free margin (outer lip) of the carcinœcium of *Epizoanthus incrustatus* (fig. 1), *E. abyssorum* (fig. 2) and *E. paguriphilus* (fig. 3). The mesoglœa and partly also the ectoderm are seen but not the epithelium in the canal-system. *c* canals; *cc* marginal canal.

Remarks. Danielssen (1890, p. 136) states that a specimen of *Epizoanthus arcticus* was obtained at St. 252 on the Norwegian North Atlantic Expedition. From Bergen Museum I have received a colony under this name and from the above-mentioned station. The colony consisted however of *E. incrustatus*. This is probably due not to an erroneous determination of Danielssen, but more likely to a confusion of localities, for he mentions at the same time that he obtained specimens of (*Zoanthus*) *incrustatus* from St. 200.

Epizoanthus abyssorum Verr.

Pl. 2, fig. 8, Pl. 3, fig. 1, Pl. 5, fig. 7.

Epizoanthus abyssorum n. sp. Verrill p. Americ. Journ. Sc. 29 1885, p. 151.

— — Verrill Results Expl. Albatross 1885, p. 535, Pl. 9, fig. 27 b.

Occurrence: (37° N., 71° 54′ W. 2021 faths. U. S. Fish. Comm. Albatross St. 2226 from U. S. Nat. Mus. R. M.).

Dimensions: On the single specimen I have had for examination the carcinœcium was 2·5 cm. long and 2·3 cm. broad. The largest contracted polyp had a height of 1·4 cm. and a breadth at the base of 1·2 cm.

Colour grayish white purple or orange tinted at summit (Verrill) — in alcohol: whitish.

External appearance: The carcinœcium is snail-shaped with wide opening. On the inner side there seems to be a distinct cuticle as in *E. paguriphilus*. On the dorsal side of the carcinœcium emerge 3 large polyps (fig. 8, Pl. 2) resembling those of *E. paguriphilus*. They are broadest at the base, narrower upwards, somewhat wider in the distal part. The capitular region is uneven in the contracted state and does not form such a distinct, flat disk as in *E. incrustatus*, being more like *E. paguriphilus*. The capitular furrows are very indistinct in all the polyps. On each side of the entrance to the carcinœcium is a polyp, one of which covers the apex of the shell, which in contrast to the other, totally disintegrated part of the gastropod is quite fresh and occupies the greater part of the gastrovascular cavity of the polyp — the third is placed between these two polyps but a good deal further back on the first spiral of the carninœcium. Ventral polyp not developed. All the polyp-part as well as the carcinœcium is strongly incrusted with foraminifera.

The œsophagus is not long, the siphonoglyphe distinct with well-developed hyposulcus.

Anatomical description: The ectoderm of the body-wall is of moderate height, continuous and contains some equally broad nematocysts with rounded ends and greatly twisted thread (length 24—29 μ, breadth 10 μ). Presumably they are almost always present (the ectoderm was partially removed). The mesoglœa is thick, fairly homogeneous with here and there scattered spool-shaped cells, but no cell-islets (if present they are very scarce Pl. 5, fig. 7). The entoderm is almost as broad as the ectoderm. The incrustation, which consists almost exclusively of foraminifera, though also of sand-grains, fills out the ectoderm as also the mesoglœa in the body-wall.

The sphincter (Pl. 3, fig. 1) is strong, mesoglœal, finely meshed with the muscle-fibres running transversely. In the distal part it occupies the whole of the mesoglœa.

The ectoderm of the tentacles has the usual structure. The spirocysts are extremely numerous in it and the thick-walled capsules are very scarce, if the few met with are at all normal constituents of the ectoderm. The ectodermal longitudinal muscles are strong, the mesoglœa thin.

The ectoderm of the œsophagus is high and contains numerous typical nematocysts (length 24—26 μ). Whether other capsules also occur, I am not able to say with certainty owing to the strong contraction of this region. The mesoglœa is thin as usual. The siphonoglyphe and the hyposulcus have a thick mesoglœa and generally a thin ectoderm.

The number of mesenteries is not large, especially when we consider that the polyps generally have a considerable diameter. In the specimen examined by me — the section had a diameter of 0·7 cm. — the number was 46, 13 macro and 11 micro on the one side, 12 macro and 10 micromesenteries on the other. The mesoglœa of the mesenteries is thin; the longitudinal muscles on a part of the mesentery form very few but fairly deep folds especially on the micromesenteries and directive mesenteries. The parieto-basilar muscles are weak and not found on the body-wall. The micromes-

enteries are also weak and only project very little into the coelenteron. The filaments have the usual structure. So far as I can see, the nematocysts of the same kind and size as in the body-wall are scarce. The same is the case with the thick-walled capsules which are very narrow, often curved and not much thickened (length 34—36 μ).

Sexual organs. Eggs at different stages of development are found in the single specimen examined by me.

The *carcinœcium*. The inner wall of the carcinœcium is bounded externally by a fairly thick cuticle. Under this lies a continuous ectoderm with numerous nematocyst capsules of the same kind as in the body-wall of the polyps. On the outer side of the carcinœcium the ectoderm was for the most part removed. The mesoglœa on both sides of the entodermal canal-system is fairly thick and almost equally developed on both sides. The entodermal canal-system (text-fig. 2, p. 13) forms large lacunae separated by very narrow bridges of connective tissue, by means of which the two layers of the mesoglœa are easily separated from each other. In the single specimen I had for examination I found no canal in the margin of the carcinœcium that differed in size from the other parts of the canal-system (text-fig. 2). Thus, the entodermal canal-system seems to be more developed than in *E. incrustatus*; I have said, seems to be, for I have only examined the ventral margin of the carcinœcium a little way inwards. The difference in the development of the canal-system is seen most distinctly on comparing *E. abyssorum* with *E. paguriphilus*. The inner as well as the outer parts of the carcinœcium are richly incrusted with foraminifera.

Remarks. The claster of this species arising from a grain of sand (Pl. 6, fig. 27 a Verrill 1885 b) is probably another species. I have no knowledge of this form.

Epizoanthus paguriphilus Verr.

Pl. 1, fig. 8.

Epizoanthus paguriphilus n. sp. Verrill 1882 Americ. Journ. (3) 23 p. 137, 316.

— — Verrill, Verrill 1883 Report Anth. Bull. M. Comp. Zool. Cambridge p. 61, Pl. 8, fig. 5.

Zoanthus (*Corticanthus*) *paguriphilus* Verr. Andres 1883 le Attinie p. 541.

Epizoanthus paguriphilus Verr. Haddon & Shackleton 1891, p. 641, Pl. 58, figs. 23—25, Pl. 59, fig. 6, Pl. 60, fig. 5 (contains index of literature up to 1891).

Epizoanthus hirondelleï n. sp. Jourdan Bull. Soc. zool. France. Vol. 16 p. 269. 1891.

— — Jourdan. Jourdan Res. Camp. Albert I. Monaco Fasc. 8. p. 7 Tab. 1. figs. 3—5. 1895.

Occurrence: 61° 44′ N., 27° W. 485 Danish fathoms; bottom-temp. 6·1°. Ingolf-Exp. St. 81, 2 sp.

61° 28′ N., 26° 25′ W. 780 Danish fathoms; bottom-temp. 4·3°. Ingolf-Exp. St. 75, 1 sp.

60° 7′ N., 9° 33′ W. 750 m. Michael Sars Exp. 14·8. 1902. St. 79 b. Bergen Museum.

59° 28′ N., 8° W. 1100—1300 m. temperature at 1000 m. 8·07°. Michael Sars Exp. 12·8. 1902. St. 76.

Geographical distribution. North Atlantic N. E. coast of America to N. W. Europe in deep water (H. & S.), Azores J. Roule.

Dimensions: The largest carcinœcium had a length of 6 cm. and a breadth of 4·5 cm. The largest polyps were in the contracted state about 1·5 cm. broad and 1 cm. high, the smallest colony was 2·5 cm. long and 1·5 cm. broad.

Colour: Brownish or gray in spirit specimens. Verrill gives the colour as "translucent bluish or purplish-gray or grayish brown. The tentacles pale orange or salmon with lighter tips. The polyps more or less of a salmon colour".

The external appearance has been well described by Haddon and Shackleton. The species always forms large carcinœcia inhabited by Eupagurus pilosimanus. The cœnenchyme develops on the gastropod shell which it covers completely, thus forming some kind of shelter to the gastropod, especially before its shell is dissolved (Pl. 1, fig. 8). The polyps are arranged in 2 groups an outer consisting of a row of large polyps — 10 in the largest colony examined by me — and an inner one consisting of a single, smaller polyp lying centrally on the ventral side of the carcinœcium a little behind the opening of the carcinœcium.

The marginal polyps in contracted specimens are broader than long and elliptic in transverse section. Some of the polyps on the sides of the carcinœcium seem to be larger than the others, some smaller polyps occurring in the posterior region, though this is not always very apparent. Whether such a small "posterior" polyp is of normal occurrence, as stated by Haddon and Shackleton, I am unable to say for certain, but it seems hardly to be the case to judge from my specimens. But my material as well as Haddon and Shackleton's is too small to permit of any certain statement on this point, so that it may be left undecided, as also the question regarding the arrangement of the polyps. As this species seems to have been taken in great numbers during the German deep-sea expedition, I shall come back to this question later.

Capitular furrows occur but are indistinct in the preserved specimens partially owing to the irregular contraction of this region.

The species is slightly incrusted with foraminifera, mainly covering the polyps and the neighbouring parts of the cœnenchyme. The tentacles are very small.

The œsophagus is short with a deep siphonoglyphe and a well-developed hyposulcus, which has the same length as the œsophagus.

Anatomical description. Haddon and Shackleton have given a good description of the polyps of this species, but on several points their description requires supplementing.

As stated by Haddon and Shackleton the ectoderm of the body-wall is discontinuous. This does not apply however to the capitular region, especially its upper part, where the ectoderm as usual is thicker than at the other places of the body-wall. If the ectoderm is still present, there is in the upper part of the body-wall a fairly common occurrence of equally broad, thick-walled nematocysts (length 24—26 μ), but on the other hand no nematocyst capsules with greatly twisted thread, which probably may be found in the lower part. The mesoglœa is very thick in comparison with the ectoderm. It contains numerous but small cell-islets, which may sometimes be fairly elongated and even form canals. In conformity with the often-quoted authors I have not been able to find any connection between the ectoderm and the entoderm and these canals. Spool-shaped cells also occur.

The incrustation is inconsiderable and consists mainly of foraminifera together with some sand-grains. These lie in the ectoderm and in the outermost parts of the mesoglœa. The entoderm is thin and has almost the same size as the ectoderm. Haddon and Shackleton have given a

very instructive figure of a transverse section in Pl. 59, fig. 6. It must be observed however, that in my specimens the strands of the mesoglœa, separating the different parts of the ectoderm from each other, do not always lie so closely as in this figure.

As mentioned by Haddon and Shackleton the sphincter is not strongly developed, especially if the size of the polyps is taken into consideration. In the distal part of the sphincter, however, the fibres occupy almost the whole breadth of the mesoglœa, the lower third part of the sphincter being inconsiderable. Haddon and Shackleton state that "no cavities are visible, the fibres being completely embedded in the substance of the mesoglœa." This is not the case in my specimens. In the proximal part, where the muscle-meshes (in transverse sections through the sphincter) are small, it may be possible that there sometimes are no cavities, in the distal part on the other hand the muscle-meshes are large and as usual extend in a transverse direction. The parts of the mesoglœa lying between the muscle-groups are very small. The sphincter is thus fairly strong in this regard.

The ectoderm of the tentacles is high, the mesoglœa on the other hand is thin as also the layer of longitudinal muscles. In the ectoderm very numerous spirocysts are found. Whether thick-walled nematocysts occur is uncertain, but if present they are very scarce.

The ectoderm of the œsophagus is fairly high and provided with numerous, thick-walled nematocysts (length 23—29 μ, generally about 24—26 μ). The mesoglœa is fairly thin. In the siphonoglyphe the ectoderm is considerably thicker than in the œsophagus, with the condition reversed as regards the mesoglœa. The mesoglœa in the siphonoglyphe is almost homogeneous, as cells and cell-islets only occur very seldom.

The number of mesenteries is greater than in any other northern Zoantharia. In a small polyp I counted namely 64 mesenteries, 17 macro and 15 micro on each side, in a large one 80 mesenteries. The macro-mesenteries are in the œsophageal region fairly thick, owing to the fact, that the mesoglœa is well-developed here, whereas it becomes thinner below the œsophagus. The longitudinal muscles are not strong and the muscular plaits few. The parieto-basilar muscles are very weak and narrow. None of these muscles are expanded in the body-wall. The micro-mesenteries are very weak — the weakest I have ever seen — and do not reach above the entoderm of the body-wall.

The filaments have the usual structure. They contain nematocysts with greatly twisted thread, but not in great number. They are oval and fairly small (length 19—25 μ, breadth 10—12 μ). Further, they contain fairly many thick-walled, rather transparent nematocysts with distinct spiral thread and broader at the one end, with varying length (19—24—26—31 μ, breadth 6—7 μ) and also some thick-walled, narrow, typical nematocysts (length about 26 μ).

The species is diœcious.

The *carcinœcium*. The cœnenchyme and the canal-system have not been examined by Haddon and Shackleton. The outer layer of the ectoderm had fallen off. The mesoglœa sends out a number of fine outshoots, the presence of which indicates that the ectoderm is also discontinuous here. On the inner side the ectoderm is thin and discontinuous with a well-developed cuticle. On the outer side of the carcinœcium the mesoglœa is very thick, on the inner side it is thin. The entodermal canal-system (c, text-fig. 3, p. 13) thus lies quite close to the inner side of the cœnenchyme.

It consists of numerous reticular, anastomosing canals, which are generally fairly narrow but somewhat thicker towards the opening of the carcinœcium. A very large canal cc, which is in connection with the other reticulate branched canals, runs along the upper rim of the opening of the carcinœcium and is afterwards lost in the columellar region, where it divides into some smaller canals. Numerous cells and cell-islets occur in the thick part of the mesoglœa; in the part lying inside the canals, the cells and cell-islets are very scarce. No incrustations are found in the mesoglœa.

Epizoanthus norvegicus (Kor. & Dan.) Hadd. & Shackl.

Pl. 1, fig. 12, Pl. 2, fig. 22, Pl. 3, fig. 3, Pl. 5, figs. 2, 3.

Zoanthus norvegicus n. sp. Koren & Danielssen. Fauna littoral. Norveg. 3, 1877 p. 79, Tabl. 9, figs. 5—6.

Polythoa (*Endeithoa*) *norvegica* (Kor. & Dan.) Andres Le Attinie 1883, p. 531.

Epizoanthus norvegicus (Kor. & Dan.) Haddon & Shackleton Scient. Trans. R. Dublin Soc., p. 614, 132, 651, 652, Pl. 59, fig. 5.

Palythoa norvegica (Kor. &. Dan.) Arndt Jahresb. Schl. Gesells. vaterl. Cultur 1912, p. 123.

Occurrence: Norway Trondhjem Fjord: Skarn Sound on Primnoa 100—200 m. 3—11/9, 1898, Østergren R. M., Storm. Bergen Mus.

Haakon Sound 280 fms. from Bergen Mus. R. M.

(Korsfjord near Bergen 300 fms. Koren & Danielssen, Sars).

Lives on sponges, shells of Lima excavata, Primnoa and Paragorgia (Koren & Danielssen).

Dimensions: The greatest length of the polyps is 2·5 cm., greatest breadth in the distal part 0·8 cm., smallest breadth in the proximal part 0·5 cm. Outer tentacles 0·8 cm., inner ones somewhat longer (Koren & Danielssen).

Colour (from Koren & Danielssen): "The body is grayish yellow, the inside of the epidermis, the proper skin, is pale rose-coloured with a tinge of yellow. The mouth surrounded by a darker rose-coloured ring, from which fine white stripes go radially to the interior tentacles".

External appearance: The polyps are considerably larger than broad, narrow at the base and broader at the distal part. In the contracted state the distal part of the polyp is rounded not truncate. The larger polyps at least have distinct capitular furrows, which are specially prominent in expanded specimens, as they are broad. In the specimens I have examined the number of capitular furrows was 16—20, in most specimens 20, and one specimen (a double individual, see below) had even up to 24. Between the capitular furrows are distinct, fairly sharp ridges, which in the distal part often form irregular, tap-like projections.

The polyps are connected with each other by means of a very well-developed cœnenchyme, which is fairly thick and from which the polyps arise usually at a considerable distance from each other. The canals from the polyps begin to communicate a little way from the polyps, forming a network apparent to the naked eye.

The species forms large colonies. Koren and Danielssen state, that it is found "frequently

in large groups that may occupy as much space as a closed hand, wherein more than 50 polyps are attached by the same coenosark."

The number of tentacles corresponds to the number of mesenteries, being thus in larger specimens considerably greater than stated by Koren and Danielssen.

The oral disc is wide, the mouth lies on a cone, the mouth-opening is like a slit.

The œsophagus is short and the siphonoglyphe well-developed with distinct hyposulcus.

Fission. On the colony taken by Storm in Skarn Sound I observed a double polyp in the middle part. (Pl. 2 fig. 22). Almost the whole of the body-wall was continued smoothly without boundary from the one polyp to the other, but the ridges and for the most part also the capitular furrows could be seen in each polyp. The one polyp had 20, the other no less than 24 ridges and furrows. Each polyp had its special circlet of tentacles fully separated. How far a doubling of the tentacle takes place from the directive chamber, I am unable to say, as I did not wish to cut up the polyp completely but there is probably a directive tentacle on each polyp. Each polyp has its distinct œsophagus and siphonoglyphe, but a common directive chamber. The cleavage has thus taken place in the directive chamber. This condition has some resemblance to the double formations in Cribrina gemmacea previously described by me (Studien über Regenerations und Regulationserscheinungen. K. Svenska Vet. Akad. Handl. B. 37 1904 p. 82 text-fig. 13, Pl. 2, fig. 21), of course with the difference caused by the different organisation of the two groups.

Anatomical structure. Haddon and Shackleton (1891) have given some information regarding the anatomical structure of this species. They state that the ectoderm, the mesoglœa and the entoderm of the body-wall reach a considerable size and that numerous nematocysts are found in the ectoderm. Furthermore, they point out that the micromesenteries are strongly developed. In their paper we find a figure showing a section of the body-wall — evidently from the capitular region. Otherwise this species has not been subjected to any anatomical examination.

The ectoderm of the body-wall is very thick and discontinuous (Pl. 5, fig. 3) except at the capitular region (Pl. 5, fig. 2), though the discontinuity is hardly so conspicuous as in Epizoanthus paguriphilus. It contains numerous nematocysts with greatly twisted thread, which have a length of 24—29 μ and a breadth of 12 μ; they are oval and almost equally broad at both ends. Haddon and and Shackleton state that they contain pigment granules. This is however doubtful; I think it probable that small air-bubbles have penetrated into the nematocysts in sectioning and that these bubbles have been mistaken for granules. This often happens and I have had the same experience with many Zoantharia, Ceriantharia and Actiniaria. The mesoglœa is considerably thicker than the ectoderm and now and then runs out into outshoots which cut off parts of the ectoderm from each other and even end in the cuticle, though without forming such small, closed spaces as in Epizoanthus paguriphilus. The mesoglœa contains fairly many cells with outrunners, now and then cell-islets and very seldom ectodermal lacunae. The entoderm of the body-wall reaches a considerable size. The incrustation in this species is inconsiderable and lies mostly in the ectoderm and in the outer parts of the mesoglœa, consisting of sand-grains, foraminifera and sponge-needles.

The sphincter is strong, mesogloeal and finely divided. The meshes in transverse section are drawn out in a transverse direction. The sphincter lies nearer the ectoderm than the entoderm, so

that in the furrows of the capitular region it is only separated from the ectoderm by a very small part of the mesoglœa, which in this region is generally higher than in the other parts of the body and contains some nematocysts.

The tentacles have the usual structure. Besides the very numerous spirocysts the ectoderm contains numerous, thick-walled capsules (length 14—17 μ) and a few capsules of the same appearance as in the body-wall (length 24—26 μ, breadth 10 μ).

The ectoderm of the oral disc is very broad near the tentacles and contains numerous, closely packed spirocysts, near the mouth it is thinner and contains some nematocysts. The ectodermal longitudinal muscle layer is fairly strong in the outer part of the oral disc, weaker in the inner part.

A layer of fibrillae and ganglion cells is distinctly visible in the oral disc.

The ectoderm of the œsophagus is high and arranged in longitudinal folds supported by mesoglœal ridges, which emerge between the furrows. The nematocysts are scarce and thick-walled (length about 20 μ). Large-grained gland-cells are found especially in the inner parts of the ectoderm. Ectodermal longitudinal musculature is absent in this species. At the base of the ectoderm of the oral rim there seem to be numerous cells and a thread-like layer. As far as I can see — the material was not so well preserved as could be desired — it consisted of a well-developed layer of ganglion-cells and nerve-fibrillae. The mesoglœa is fairly thick; its upper part is provided with numerous cells which are scarce in the aboral part. The ectoderm of the siphonoglyphe is of the usual structure and lower than in the other part of the œsophagus. The mesoglœa is broad and much thicker than in the œsophagus. The hyposulcus has the same structure as the siphonoglyphe but the entodermal muscles here run in longitudinal direction and form some folds in the outer parts. The free border is thick and even provided with more numerous gland-cells than the inner parts.

Text-fig. 4. Transverse section through a piece of the body-wall with mesenteries and œsophagus of *Epizoanthus norvegicus*. Ectoderm shaded, mesoglœa and muscles black, entoderm not specially marked, dc: directive chamber.

The number of mesenteries varies according to the size of the polyp. In a smaller specimen 24 mesenteries were developed. 14 macro and 10 micro. Two large polyps had 46 mesenteries. They were both irregularly developed, the one side having more mesenteries than the other. One of the polyps had 13 macro and 11 micromesenteries on the one side of the sagittal plane, and 12 macro and 10 micromesenteries on the other. The other polyp had 11 macro and 9 micro mesenteries respectively and 14 macro and 12 micro. The micromesenteries are strong. The longitudinal musculature of the mesenteries is vigorous and forms fairly numerous folds. The parieto-basilar muscles are weak. The distribution of the longitudinal and the parieto-basilar muscles on the body-wall is slight. The muscles of the micromesenteries are generally well-developed (text-fig. 4).

The filaments have the usual characteristic structure. The glandular tract contains only the

frequently occurring nematocysts of the same kind and size as in the œsophagus. The species is dicœcious.

The ectoderm of the cœnenchyme contains numerous nematocysts of the same shape as in the body-wall, but seems here to be continuous. The mesoglœa contains numerous ectodermal lacunae, in which the large nematocysts, that occur in the body-wall of the polyps, are also found. The entoderm is very large in the canals.

Epizoanthus lindahli n. sp.

Pl. 2, figs. 11—13, Pl. 4, fig. 5

Zoanthus arcticus Marenzeller 1878, p. 379.

Occurrence: Baffins Bay 72° 4′ N., 59° 50′ W. 227 fms. Hard, gray clay. Ingegerd and Gladan Exp. 19/7, 1871. Josua Lindahl 3 sp. R. M. (sp. a.)

79° 13′ 1″ N., 63° 21′ 7″ W. 230 fms. 1 sp. Museum at Vienna (sp. b.)

66° 42′ N., 26° 40′ W. 590 m. Temp. at 550 m. 0·11°. 3. 8. 1900 Michael Sars Exp. St. 13 1 colony. Bergens Museum (sp. c.)

65° 00′ N., 11° 16′ W. 310 Danish fms. bottom-temp. 0·01° Ingolf Exp. St. 59 1 sp. (sp. d.)

66° 35′ N., 56° 38′ W. 318 Danish fms. bottom-temp. 3·9° Ingolf Exp. St. 32 1 colony (sp. e.)

var. *Nordgaardi* Lyngen, Nordgaard 1 sp. R. M. (sp. f.)

Dimensions: (a) Length of the colony about 2·1 cm., breadth of the largest polyp 0·6 cm., of the smallest polyp 0·3 cm. (b) length of the colony about 1·5 cm., breadth 0·4 cm. (c) breadth of the colony 2·3 cm., length of the largest polyp 1·3 cm., breadth 0·45 cm.

Colour in alcohol: dirty-gray (c) sand colour with white points of foraminifera and black points of sand-grains, specimen d dark with black sand-grains, f clear, uncoloured.

External appearance: The cœnenchyme is inconsiderable and tube-shaped as in E. erdmanni. The polyps are elongated just in E. erdmanni, narrowest at the base, increasing in size towards the point. They are broadest in the capitular region. The body-wall is rough owing to the incrustations, which mainly consist of sand-grains and also of foraminifera (especially in b). The upper contracted border is somewhat rounded — truncate. The capitular furrows are not so distinct owing to the incrustation and contraction, on the largest specimen of the colony I counted 20, on b at least 16, on d 18 probably.

The œsophagus is short, the siphonoglyphe distinct with a hyposulcus which is as long as the œsophagus.

Anatomical description: (1 specimen from Baffins Bay and another from c have been closely examined). The ectoderm of the body-wall is continuous and of moderate size, provided with a cuticle, on which detritus particles are fixed. In the lower part of the polyp the ectoderm contains many equally broad nematocysts with greatly twisted thread, having a length of 38—43 μ and a breadth of 10– 12 μ. In the capitular region similar but narrower capsules of the same kind and dimension as in the filaments. The mesoglœa is fairly thick, several times thicker than the ectoderm; it is generally rather homogeneous with a frequent occurrence of very small cells and sometimes even cell-islets (Pl. 4 fig. 5). The entoderm is extremely thin in the body-wall as well as in the mesenteries and

the œsophagus and its differentiations. The ectoderm and the mesoglœa are incrusted with sand-grains, foraminifera and a fairly large number of sponge-needles. In e and f sand-grains were almost exclusively present. The incrustation is often considerable and fills almost the whole of the mesoglœa.

The sphincter is very strong and has some resemblance to the sphincter in E. erdmanni.

The tentacles have the usual structure. The spirocysts of the ectoderm are very numerous. Besides there generally occur some thick-walled, equally broad nematocysts (length 17—19 μ) and more seldom nematocysts of the same type as in the capitular region of the body-wall (length 38—48 μ, breadth 7 μ). The ectoderm of the œsophagus is high and contains large numbers of equally broad nematocysts with greatly twisted thread (length (38) 43—48 μ breadth 7 μ). Further, very numerous typical thick-walled nematocysts occur (length 24 (26) μ). The mesoglœa is thick. The ectoderm of the siphonoglyphe is of the typical appearance, the mesoglœa thick, though very little thicker than that of the œsophagus.

The number of mesenteries was 38 in the specimen sectioned, on one side 11 macro and 9 micro-mesenteries, on the other 10 macro and 8 micro-mesenteries. In the larger specimen of the colony the number was presumably 36 (it was opened partially lengthwise). Another from colony c had 36, specimen d about 40. The micro-mesenteries are well-developed in the œsophageal region. The mesoglœa of the macro-mesenteries is fairly thick, the entoderm thin. The longitudinal musculature is moderately developed and forms few folds; in one specimen from colony c which had a very wide œsophagus and the mesenteries consequently very contracted in breadth, the musculature lay in thick folds, the mesoglœa being also here thicker than in a, where the mesenteries were much expanded in breadth. The parieto-basilar muscles are very weak. The distribution of the mesenteric muscles on the body-wall is fairly considerable.

The filaments have the usual structure. The glandular tract contains numerous, equally broad nematocysts with greatly twisted thread (length (34) 38—49 (53) μ, breadth 6—7 μ). I have not observed any thick nematocysts resembling those found in the lower part of the body-wall, if on the whole they occur they must be very scarce; in one specimen I have found a single one (length 36 μ, breadth 11 μ). Further, many thick-walled capsules occur here with distinct basal part to the spiral thread, broadest in the one end (length about 22 (19—24) μ, sometimes 26 μ, breadth about 5—6 μ). The polyps are dicœcious, one of the specimens examined was a male with developed testes.

Systematic remarks. This species is closely related to E. danielsseni, from which it differs however in external appearance, especially in the form of the cœnenchyme and with regard to the structure and distribution of the nematocysts and the mesenteries. As in E. danielsseni the capsules in the lower part of the body-wall and in the capitular region are different in this species.

var. *nordgaardi* Pl. 2, fig. 7.

As already pointed out above, the external appearance of E. lindahli is very much like that of E. erdmanni. At Lyngen Dr. Nordgaard has collected material of a Zoantharia which I determined as E. erdmanni (Carlgren in Nordgaard. Hydro. and Biol. Invest. 1895, p. 159). Two of the specimens in the collection I retained for the Riksmuseum in Stockholm. On closer examination, however, it appeared that the one specimen was not E. erdmanni but a species which must be closely related to

E. lindahli or identical therewith. But as it differs somewhat from E. lindahli with regard to the nematocysts, I have for the present set up this species as a variety of E. lindahli, leaving to later investigations, when more material has been obtained, to prove if it may possibly form a separate species. I may also mention that among the specimens sent back to Dr. Nordgaard there may possibly still be found a few specimens of this variety which I have called Nordgaardi. All these specimens certainly need revision.

Occurrence: 63° 37′ N., 20° 24′ E. Lyngen off Kaafjord. 1 sp.

Dimensions: Length 2·1 cm., smallest breadth 0·2 cm., greatest breadth 0·7 cm.

Colour in alcohol: In the lower part gray, in the upper light sand-coloured.

External appearance (fig. 7 Pl. 2). The polyp was truncate and somewhat contracted in the lower part, the upper part being expanded. The distal margin was rounded. The capitular furrows were very distinct and their number was 20. Tentacles and œsophagus as in the main form. The mesoglœa of the body-wall was considerably incrusted in the outer part, less in the inner. The incrustation consisted of sand-grains and some sponge needles. But I have not observed any foraminifera, which however are possibly dissolved, as the animal, so far as I remember, had been preserved in formaline or formaline spirit.

The *anatomical structure* seems to agree with that of E. lindahli with the exception regarding the nematocysts mentioned already. The number of mesenteries was 36, 10 macro- and 8 micro-mesenteries on either side of the polyp.

The nematocysts are generally larger than in the typical E. lindahli. In the lower part of the ectoderm of the body-wall there is a fairly frequent occurrence of equally broad nematocysts with greatly twisted thread (length 43—48 μ, breadth 10—12 μ). In the capitular region large capsules of the same kind as in the filament occur somewhat frequently (length 38—48 μ, breadth 7 μ).

The ectoderm of the tentacles contains numerous spirocysts, the thick-walled nematocysts being very scarce (length 17—19 (22) μ). Large nematocyst capsules with greatly twisted thread also occur here sparsely (length 43—48 μ, breadth 7 μ), and even sometimes smaller nematocysts of the same kind as in the filament. The oral disc has, as regards the nematocysts, almost the same structure as the tentacles.

The œsophagus is provided with numerous, thick-walled capsules about 24 μ long and less than 5 μ broad. Further very few nematocysts with greatly twisted thread occur of the same size and structure as in the filament.

The glandular tract of the filament contains partly nematocysts with greatly twisted thread, partly larger ones 43—60 μ long and 7 μ broad, sometimes curved, partly smaller ones generally curved 26—34 μ long and 5 μ broad; further thick-walled capsules with distinct basal part of the spiral thread and broader at the one end (length 22 μ, breadth 5 μ, length 24—26 μ, breadth 6 μ in the broadest end).

Epizoanthus erdmanni (Dan) Hadd. & Shackl.

Pl. 1, fig. 14, 16, 17, Pl. 2, fig. 24, Pl. 4, fig. 3, Pl. 5, fig. 4.

Mardoel erdmanni n. sp. Danielssen Norwegian North Atlantic Exped. Actinida 1890 p. 116, Pl. 6, fig. 1, Pl. 21, 22, figs. 1—7.

Epizoanthus erdmanni (Dan) Haddon & Shackleton Revision British Actiniae 1861 p. 623, 633, 635, 639;
— — (Dan). Carlgren in Nordgaard Hydrograph. and Biol. Invest. Norweg. Fjord 1905 p. 159.

? Mamillifera sp. M. Sars Nyt mag. Nat. 6·2 No. 10 1851 p. 142.

? Zoanthus arcticus n. sp. M. Sars Förh. Skand. Nat. Möde 8. 1860 p. 692 Forh. Vid. Selsk. Christiania 1860 p. 144.

? Zoanthus (str. s.) *arcticus*, Andres Le Attinie 1883 p. 546.

Occurrence: Spitzbergen 81° 14′ N., 22° 50′ E., N. E. of Seven Isls. 150 m. gray clay. Bottom temp. 2° Spitzb. Ex. 20/8 1898 No. 37 R. M. several specimens.

80° 3′ N., 8° 28′ E. 475 m. clay Bott. temp. 1·1° 14/8. 1878 N. N. A. E. St. 363 R. M.

Beeren Island 75° 38′ N., 13° 18′ E. 350 m. Bottom temp. 2·73° Spitzb. Exped. 1898 1/9 No. 41 R. M. several spec.

73° 3′ N., 18° 30′ E. 410 m. Bott. temp. 2°. Spitzb. Exp. 4/9 1898 No. 42 R. M. some spec.

73° 27′ N., 23° 11′ E. 460 m. black grayish clay Bott. temp. 2·67°. Spitzb. Exped. 12/6 1898 No. 2 R. M. 2 spec.

72° 53′ N., 21° 51′ E. 408 m. clay. Bott. temp. 1·5°. N. N. A. Exp. 30/7 1878 St. 363.

72° 27′ N., 20° 51′ E. 349 m. Sabulous clay, Bott. temp. 3·5°. N. N. A. Ex. 7/7 1878 St. 290.

Norway 70° 2′.5 N., 21° 41′ E. Kvænangen 300—343 m. Bott. temp. 2·3°. 19/4 1899 Nordgaard R. M.

Altenfjord 80 fms. clay bott. July 1890 Jägerskiöld U. U. Z. M.

69° 54′ N., 20° 27′ E. Lyngen between outer Garvik and Ulö 300 m. Nordgaard 3/5 1899. R. M.

Lyngen off the Kaafjord 250 m. bott. temp. about 2·85° 3/5 1899. Nordgaard R. M.

69° 41′ N., 15° 51′ E. 1591 m. Sabolous clay Bott. temp. 1·2°. N. N. A. E. 7/7 1877 St. 190.

Foldenfjord 530 m. 6/4 1900 Nordgaard.

Komagfjord Danielssen (*E. arcticus*) Bergens M. (R. M.).

Skatören Tromsö. 40 fms. Tromsö M.

Malangen 69° 33′ N., 18° 0′ E. 380 m. Bott. temp. 4·1°. Nordgaard 14/4 1899 (R. M.).

66° 45′ N., 15° 36′ W. 200 m. Bott. temp. 2·39°. 5/8 1900. Michael Sars Ex.

Budderbay 30/6 1884 C. Aurivillius.

Greenland 74° 52′ N., 17° 16′ W. 350 m. clay mud with sand and small stones. 4/7 1899 Greenland Ex. No. 18.

Iceland Ofjord Möller, 1 colony Copenh. M.

Dimensions: According to Danielssen the polyps in expanded state may reach a length of 3·5 cm. and a breadth of 2 cm. While considering the first to be very probable, I feel however some doubt as to whether the breadth can be so great. The specimens examined by me were very variable in size. The largest polyp (fig. 24 pl. 2) had a length of about 2·7 cm. and a breadth of 0·6 cm. at the broadest place.

Colour: (Danielssen). "The body is light brownish red almost brick-colour, somewhat grayish green with a violet play (var. *aurivillii?*). The tentacles lighter coloured, brownish red and transparent. The oral disc is still lighter in colour than the tentacles and round the outer margin of the oral disc, exactly at the base of the inner tentacular series, there is a narrow light coloured rose-

red annulus." In the preserved state most of the specimens were dirty-coloured light brown. Some of the specimens were grayish e. g. those from Altenfjord. The colony taken during the Michael Sars Expedition was black with incrusted, small, black sand-grains and the colony originating from Iceland Ofjord was even darker than is generally the case with this species.

The external appearance has been well described by Danielssen, who has also given some rather good drawings of the external appearance of the colonies. The species forms free, unfixed colonies of 1—6 seldom more polyps connected with each other by a small tube-shaped cœnenchyme, which is generally so inconsiderable that the polyps seem to grade smoothly over from one to the other (see fig. 14, 17 Pl. 1). The more developed polyps are narrow at the base, but expand gradually towards the distal part, so that the animal has its greatest breadth in the capitular region. The small, not fullgrown polyps approach the cylindrical shape. Sometimes the polyps are provided with cross-furrows, which undoubtedly have only been caused by contraction. The capitular region has generally quite distinct ridges and furrows. The number of furrows varies considerably according to the size of the polyps. Danielssen states that the species has 18 capitular furrows, here they vary between 14 and 15 in small specimens and in the large between 16 and 20, and in one polyp I have even counted up to 22. But generally the majority seem to have 18 furrows. Of 116 specimens 42 had 18 capitular furrows, 26 had 16, 17 had 17, 9 had 19, 11 had 20 and 1 specimen 22. Of the smaller specimens 14 polyps had 15 capitular furrows and 5 had 14. On the majority of the small specimens the capitular furrows were however so indistinct, that the number could not be determined with any certainty. The body-wall is more or less rough owing to the greater or less incrustation.

The tentacles are arranged as usual and seem to correspond in number with the mesenteries. The œsophagus is short with a well-marked siphonoglyphe and a fairly long and broad hyposulcus.

The anatomical structure has also been described by Danielssen, but on several points incorrectly, as e. g. with regard to the arrangement of the mesenteries, which does not differ from that of the other Zoanthidae. The ciliated streaks on the macromesenteries however have been observed by Danielssen who gives a comparatively good picture of them (fig. 5, Tab. 22 Danielssen, 1890). But on the other hand the arrangement of mesenteries and the length of the filaments on fig. 4, Tab. 22 of the same work are not in agreement with the reality. Some anatomical details are also given by Haddon & Shackleton (1891).

The ectoderm of the body-wall is fairly high, continuous and contains nematocysts with twisted thread (length 24—30 μ, breadth 10—12 μ). They are equally broad and common except in the capitular region where they are scarce. The ectoderm is provided with a distinct cuticle, on which particles of detritus are attached. According to the state of contraction of the animal, the mesoglœa may be thin or very thick, but is several times thicker than the ectoderm. It is provided with fairly numerous cells with long outshoots, whereas cell-islets only very seldom occur (pl. 5, fig. 4). Sometimes the latter may be found at the base of insertion of the mesenteries but as a rule they are not present at these places, a fact I have ascertained by means of a large number of sectioned specimens from different localities.

Haddon and Shackleton state (1891 p. 635), that on the specimens sent them by Danielssen there was "a well-marked lacuna in the mesoglœa at the base of the insertion of each mesentery."

This I have not observed and therefore think it probable, that another species has been concealed in Danielssen's specimens — such things have happened before — and been examined by Haddon and Shackleton. Thus among the specimens of *E. erdmanni* from St. 42 collected during the Spitzbergen Expedition 1898 there were many individuals which at first glance resembled *E. erdmanni* (fig. 15, Pl. 1) but actually did belong to another Epizoanthus species, i. e. *E. danielssoni*. Also a third Epizoanthus, *E. beereuislandicus*, was dredged at the same time. This latter species has laeunae at the above-mentioned places. The entoderm is thinner than the ectoderm.

The incrustation consists almost exclusively of sand-grains sometimes interspersed with a few sponge-needles and foraminifera. Sometimes the incrustation in the mesoglœa is quite inconsiderable, sometimes it fills up the whole, so that it is very difficult to study the structure of the latter.

The sphincter is not long but strong and in the greater part of its course it covers almost the whole breadth of the mesoglœa. In transverse sections through the sphincter the meshes are large whereas the ridges of connective tissue between the muscle meshes are small (Pl. 4, fig. 3).

The tentacles have the usual structure. The ectoderm is provided with numerous spirocysts and scarce thick-walled capsules (length about 17 (14—19) μ). The longitudinal muscles are fairly well-developed.

The ectoderm of the œsophagus is fairly high and elongated. The large nematocysts of the kind and size seen in the body-wall are scarce or absent, while the thick-walled capsules are numerous and 19—24 μ long. The ectoderm of the siphonoglyphe is as usual somewhat lower than that of the œsophagus, as the mesoglœa is thicker than in the œsophagus.

The number of mesenteries varies between 28 and 40. Of the following 19 specimens

2	specimens	had	28	mesenteries (1 spec. was labelled *E. arcticus*,
3	—	—	30	— Komagfjord; see below).
5	—	—	32	—
4	—	—	34	—
2	—	—	36	—
2	—	—	38	—
1	—	—	40	—

Thus, the most frequent numbers seem to be 32—34, which corresponds with the most frequent number of capitular furrows. The specimens with 30, 34 and 38 mesenteries had a few mesenteries more on the one side than on the other. The micromesenteries are fairly well-developed and project into the gastric cavity, as long as the main part of the entoderm of the body-wall is high. The longitudinal muscles of the macro-mesenteries are fairly well-developed, the mesoglœa is thin. The parieto-basilar muscles are rather weak. The distribution of the longitudinal and the parieto-basilar muscles on the body-wall is inconsiderable.

Of the proto-mesenteric filaments the shortest are those corresponding to the 6th pair of proto-mesenteries in Actiniaria, while the others are long. The filaments of the metamesenteries decrease in length towards the siphonoglyphe. The filaments have the usual structure. Nematocysts with greatly twisted thread resembling those in the body-wall occur sometimes very scarcely, sometimes more frequently. They are equally broad and 24—31 μ long, the breadth being generally 10 μ (9—12). The

thick-walled capsules have a distinct basal part to the spiral thread and are somewhat broader at the one end. They are about 19—24 μ long and of fairly common occurrence.

Both polyps from the colony taken in the Ofjord at Iceland differ from the main form with regard to the nematocysts of the mesenteries. On maceration, namely, besides the above-mentioned nematocysts, some egg-shaped capsules occurred, partly larger about 22 μ long and 19 μ broad, partly smaller, about 14 μ long and 11 μ broad, both kinds being fairly numerous. On a closer examination of the rather bad sections of this form, I found however, that these egg-shaped capsules do not lie in the filaments but inside these, though it is possible that such a foreign capsule may lie in the filaments. It is at any rate probable, that these nematocysts, just as was the case with some similar capsules in *E. incrustatus*, do not belong to the animal but are foreign capsules absorbed by it (see p. 13). It is worth observing, that the abnormal specimens of *E. incrustatus* and *E. erdmanni* originate from almost the same region.

The species is diœcious.

Remarks: I have here taken *Zoanthus arcticus* as synonym to *E. erdmanni*, though I have not been able to prove the correctness of this assumption, no type-specimens of *Z. arcticus* being present seemingly in the Bergen Museum. On the other hand, there are some specimens taken by Danielssen in Komagfjord and determined (by whom?) as *Z. arcticus*. As far as I am able to see from the anatomical examination these are no other than *E. erdmanni*, though they form no colony but are single specimens. According to the rules of priority, the species should be called *E. arcticus* and not *E. erdmanni*, if the supposition is correct that they may belong to one species. As type-specimens seem to be wanting, however, and the description of *Z. arcticus* is fairly poor, it seems advisable to retain the name *E. erdmanni*.

Danielssen states, that *E. erdmanni* occurs in two forms different as to colour, the one being darker and the other lighter grayish. Several specimens may even be quite grayish, as e. g. those from Altenfjord, but otherwise their external appearance does not differ much from that of the others. On the other hand, from the localities mentioned below there is a more slender form, which in other respects also differs a little from the main form. This variety has been named var. *aurivillii*, though it hardly differs essentially from the main form, grading into this through some transitional forms.

E. erdmanni var. **aurivillii**.

Pl. 2 figs. 18, 28, 29 Pl. 5, fig. 5.

Zoanthus Couchi Johnst. C. Aurivillius 1886 p. 52.

Occurrence: Norway Outer part of the Kwænangfjord 50—100 fms. Stone and clay. June 1884 Carl Aurivillius, several specimens Ups. M.

Finmarken Goës & Malmgren R. M. some specimens.

Jagfjord 200 m. 18. 2. 1899. Nordgaard 1 colony.

Dimensions: Length of the largest polyp: 1·7 cm., greatest breadth 0·4 cm.

Colour light grayish, in the distal end reddish (Aurivillius) in alcohol: light grayish.

External appearance: the polyps are either separate, or form colonies connected by a small tube-shaped cœnenchyme as in the main form. The number of polyps in the colonies is variable, the

greatest number observed being 7. The polyps are arranged in the same way as in the main form, but they are considerably more slender and narrower in comparison with the length than in the main form. As in the latter they are narrow at the base but expand gradually towards the distal part. The capitular region, which was contracted in most of the specimens, had distinct capitular furrows varying in number between 14 and 19 — 2 polyps had 14, 4 had 15, 13 had 16, 1 polyp 17 and another 19 furrows — the maximum frequently being thus 16. The preserved specimens had often more or less distinct cross-furrows. The tentacles were much narrower than in the main form. The œsophagus is short, the siphonoglyphe distinct, hyposulcus well-developed, though shorter than the œsophagus.

Anatomical description. The ectoderm is fairly high, continuous and contains few nematocysts or none. The mesoglœa is several times thicker than the ectoderm and like this is richly incrusted with sand-grains, which make the anatomical examination difficult. As the incrustation is not very strong, however, I have been able to make out, that the mesoglœa contains a few, large cell-islets but numerous cells (and small cell-islets). (Pl. 5 fig. 5).

The sphincter is strong. Seen in transverse sections through the sphincter the mesoglœal meshes are however fairly large.

The ectoderm of the tentacles is of the typical structure with very numerous spirocysts and fairly common thick-walled nematocysts (length 17 μ).

The ectoderm of the œsophagus is high. There is a frequent occurrence of equally broad nematocysts with twisted thread (length 24—36 μ, breadth 10—11 μ) and of thick-walled nematocysts (length 22—25 μ). The mesoglœa is thin, in the lower part it forms longitudinal ridges corresponding to the insertions of the mesenteries. The ectoderm of the siphonoglyphe is as usual thinner than in the œsophagus, the mesoglœa on the other hand is several times thicker than there. In two specimens the number of mesenteries was 32, in a third 30. At least one of the first-mentioned polyps had the normal number of developed mesenteries. The third had 9 macro and 7 micro on the one side and 8 macro and 6 micro-mesenteries on the other. The micro-mesenteries are fairly well-developed and from the œsophageal region they reach somewhat into the chambers. The longitudinal muscles are strong, especially on the directive mesenteries. The folds are however large. The parieto-basilar muscles are very weak. Moderate distribution of the longitudinal and parieto-basilar muscles on the body-wall.

The filaments have the usual structure. The glandular tract contains numerous capsules, some equally broad with greatly twisted thread (length 26—34 μ, breadth 10 μ), others thick-walled capsules broader at the one end and with distinct base to the spiral thread (length 19—22 μ).

The sexual organs were not developed in the specimens examined by me.

Epizoanthus danielsseni n. sp.

Pl. 1 fig. 13, 15 Pl. 2 fig. 6 Pl. 5 fig. 1.

Epizoanthus glacialis n. sp. pro parte Danielssen Norwegian N. Atlantic Ex. p. 129 fig. 9. Pl. 6.

Occurrence: 64°21′ N., 10°40′ E. Sabulous clay. Bottom temp. —0·7° Norwegian North Atl. Ex. Stat. 164 June 29th 1879. 5 sp. Bergens Museum. (sp. a).

73° 3′ N., 18° 30′ E. Beeren Island—Norway 410 m. Bott. temp. 2°. Gray clay. Spitzbergen Ex. 1898 4/9 No. 42 several colonies R. M. (sp. b).

Davis Straits 80 fms. 20/10. 1884. Holm. several colonies. Copenh. Museum. (sp. c).

75° 26′ N., 67° 27′ W. 260 fms. Sophia Ex. No. 582. 1 sp. R. M. (sp. d) var. *loveni* Finmarken. Oxfjord Loven. 1 colony. R. M.

Dimensions: (a) Length of the largest polyp 0·8 cm., breadth 0·7 cm., (b) length of the largest polyp 1 cm., breadth 0·7 cm. (c) length and breadth about 0·5 cm. (d) height 0·8 cm., breadth 0·6 cm.

Colour. According to Danielssen's figure 9 Pl. 6, which I consider to represent this species, the body-wall must be light-red with a yellowish tint, the latter being due to the large amount of sand in the incrustation. The capitular furrows are reddish, with a tinge of brown. The tentacles and the oral disc (the central part in the middle?) are reddish brown. In alcohol a, c and d are light sand-coloured, b dirty grayish.

External appearance. The polyps from the localities a and d formed no colonies and were fixed on stones, whereas most of the specimens from b and c generally formed colonies; c was fixed on Balani, b on stones and Rhizopoda (Rhizammina?). The polyps are seldom placed quite close together; the cœnenchyme between the different polyps is generally fairly well-developed, but very thin. On a colony from c and on those from b, when viewed externally, it looks as if the cœnenchyme is thick. This is generally not the case, however, though the irregular under-layer of tubuli pressed together makes it look thickened at some places. All the polyps were contracted and the tentacles not to be seen; in this state the breadth and the length are almost equal or the length a little greater. The distal part is somewhat broader than the proximal. On most of the polyps the upper aspect is truncate[1], sometimes they are a little rounded, especially the smaller polyps. The capitular furrows are more or less distinct, most distinct in d (fig. 13), in the smaller specimens their number could not be determined. They seem to vary between 16 and 22, a) 22, b) 18, 18—16, 16, 17, 21—18—17—18, c) 20—20—22—22, d) 18. The polyps as well as the cœnenchyme were strongly incrusted with sand-grains, which made the sectioning very difficult.

In a closely examined specimen the number of tentacles was 36. If the tentacles are double the number of capitular furrows, they must vary between 32 and 44.

The œsophagus is short with distinct siphonoglyphe and a hyposulcus which is as long as the œsophagus.

Anatomical description. The ectoderm of the body-wall is fairly high and continuous with a weak cuticle. In the lower part of the polyp are equally broad nematocysts with greatly twisted thread (length 34—41 μ, breadth 11—12 μ). In the capitular region we find similar capsules, which are however considerably narrower (length 34—41 μ, breadth 7 μ). The mesoglœa is very large, at least twice as thick as the ectoderm and is generally strongly incrusted with sand and some fora-

[1] Among the specimens of Epizoanthus glacialis collected by the Norwegian North Atlantic Expedition were also some polyps of E. danielsseni. Danielssen 1891 p. 130 says that "when the polyp (of E. glacialis) is retracted the uppermost extremity appears truncated but with a little depression in the middle and a rounded margin carrying it Pl. 6, fig. 9." This description agrees well with a polyp found in the collection which I consider to be the original of Danielsseu's fig. 9, Pl. 6 — represented in my paper in fig. 6 Pl. 2. This polyp belonged to the species E. danielsseni. The description of the upper part of the body on the other hand does not agree with E. glacialis.

minifera. It contains fairly many small cells with outshoots (Pl. 5, fig. 1). In the specimen from the locality c, which was somewhat less incrusted than the rest, there seemed to be a sparse occurrence of cell-islets of moderate size near the entoderm. Whether these may also be found in the other colonies I am unable to say owing to the strong incrustation. The ectoderm is almost as high as the entoderm.

The sphincter is very strong and resembles that of *E. glacialis*. It almost fills up the whole breadth of the mesoglœa. In transverse sections we find large muscle fibres separated by fairly thin mesoglœa-ridges, which divide up forming smaller meshes.

The tentacles have the usual structure. The ectoderm is provided with very numerous spirocysts. It contains besides many small nematocysts of the same kind and size as in the capitular region and typical thick-walled capsules (length 17—19 μ).

The ectoderm of the œsophagus is high and contains numerous thick-walled capsules with fairly distinct basal part to the spiral thread (length 24—27 μ). There is besides a sparse occurrence of large nematocysts as in the capitular region (length 38—48 μ, breadth 7 μ). The mesoglœa is thin, but thickened in the siphonoglyphe.

The number of mesenteries is variable. In two of the polyps of b it was 38 and 32 respectively, typically developed in the latter and in the first with two mesenteries more on the one side of the sagittal plane than on the other. One specimen from a had 36 mesenteries and 2 specimens from c had 36 and 30 respectively. The latter was however a small polyp.

The macro-mesenteries are large with thick mesoglœa (all the specimens were however strongly contracted). In the lower part of the œsophagus the micro-mesenteries were fairly weak and only projected very little above the entoderm of the body-wall. The longitudinal musculature is comparatively strong and when seen in transverse section lies in close folds. The parieto-basilar muscles are weak. The longitudinal and the parieto-basilar muscles extend a long way onto the body-wall.

The filaments have the usual structure. In the glandular tract there is a numerous occurrence of nematocysts with greatly twisted thread (length 34—48 μ, breadth 7 μ, sometimes 8 μ) and thick-walled capsules with distinct basal part to the spiral thread, broader at the one end than at the other (length 22 μ). Further, I have sometimes observed some very scarce nematocysts of the same kind as in the lower part of the body-wall (length (24) 26—29 μ).

The polyps are dicœcious.

var. *lovéni* Pl. 2, fig. 9.

Together with the species *E. glacialis* and *Isozoanthus ingolfi* collected by Sven Lovén in Oxfjord in Finmarken, occurred a small colony with 2 polyps (fig. 9 Pl. 2), which had a great outward resemblance to these species and a similar incrustation of sand-grains, among which a number of black. Examination of the nematocysts and the subsequent anatomical investigation showed, however, that they did not belong to these species but stood in better agreement with *E. danielsseni*, to which I provisionally refer them, though they are not in absolute agreement with this species, measurements especially of the large nematocysts, with regard to length, lie somewhat below the values found in *E. danielsseni* (even among the specimens from locality c which showed the lowest values). The incrustation is also considerably weaker, so that we may possibly have a new species before us, but

as the material is so small and not very well-preserved, I have preferred to consider this colony as a variety of *E. danielssoni*, the more so as the anatomical investigation is incomplete.

Dimensions of the largest polyp: length 0·4 cm., breadth in the capitular region 0·45 cm.

Colour in alcohol: grayish with black sand-grains.

External appearance: the polyps were cylindrical, broader in the capitular region. The distal margin is truncate, the upper part sunken. The capitular furrows are indistinct. The incrustation was not so strong as in the main form and mainly restricted to the outer part of the mesoglœa.

Anatomical description. Regarding the inner structure the lower part of the body-wall contains in the ectoderm numerous nematocysts with greatly twisted thread (length 24—36 μ, breadth 11—12 μ), in the capitular region similar capsules often occur (length 29—31 μ, breadth only 7 μ).

The sphincter was very strong, resembling that in the main form, but not drawn out so much as in the latter.

The ectoderm of the tentacles contains numerous spirocysts, fairly many nematocysts of the same kind as in the capitulum (length 31—36 μ, breadth 7 μ) and a few thick-walled capsules (length 14—17 μ). Similar capsules are also found in the oral disc.

The œsophagus contains numerous narrow, thick-walled nematocysts (length 19—22 μ). I cannot determine the number of mesenteries with any certainty, but it must be about 32 or a little more.

The glandular tract of the filament is provided with very few, uniformly broad capsules of the same kind as in the lower part of the body-wall (length 29—36 μ, breadth 12 μ) and with many capsules like those in the capitular region (length 29—38 μ, breadth 7 μ). Further, many thick-walled, narrow nematocyst capsules occur (length 19—22 μ) and thick-walled capsules with distinct basal part to the spiral thread, which are broader at the one end (length about 19 μ).

Epizoanthus roseus Dan.

Pl. 3, fig. 4, Pl. 5, fig. 6.

Epizoanthus roseus n. sp. Danielssen Norwegian North Atl. Ex. 1890. Actinida Tab. 6 fig. 10 Tab. 25 figs. 4—6.

Occurrence: 71°25′ N., 15°41′ E. clay 1134 m. Bott. temp. 1·0. Norw.-North Atl. Ex. 1877 19.7 B. M. R. M.

Dimensions. The polyps reach a length of up to 15 mm. (Danielssen). In the preserved state the length of the largest polyp was about 1·1 cm., largest diameter a little under the tentacles 0·5 cm., smallest diameter 0·3 cm.

Colour. "The sarcosoma is semi-transparent, grayish. The polyp is grayish-yellow owing to the incrusted sand, but the rose-red integument shines through. The oral disc is rose-red with lighter-coloured radii. The tentacles are, upon their lowest broad part rose-red like the oral disc, but upon their superior half are paler in colour and almost white at the point" (Danielssen). In the preserved state they are dirty sand-coloured.

External appearance. The polyps are connected with each other by a flat cœnenchyma of moderate size. The single polyps are placed quite close to each other. With regard to shape the

polyps according to Danielssen are "almost piriform." The small contracted polyps with quite retracted tentacles are somewhat narrower in the proximal than in the distal part, which is somewhat rounded. The expanded polyp was narrowest a little above the base, then gradually becoming wider and reaching its greatest breadth some way below the tentacles, afterwards tapering a little towards the base of the tentacles. The distal part is provided with capitular furrows, which Danielssen states to be 12 in number. This is too few, as far as I can see. The ridges and furrows are certainly not so distinct in the preserved polyp, but I have found 16—18. The polyps are incrusted with sand-grains, especially in the proximal part and in the cœnenchyme.

The number of tentacles probably agrees with the number of mesenteries.

The œsophagus has a very distinct siphonoglyphe.

Anatomical description. The ectoderm of the body-wall is fairly thin, considerably thinner than in *E. glacialis*, continuous and provided with a thin cuticle. In the ectoderm are fairly many spirocysts (normal shape?) and large nematocysts with greatly twisted thread. The latter have a length of 29—31 μ and a breadth of 12 μ (the lower part being broader than the upper). Small cells occur in great numbers, but no lacunae or groups of cells seem to be present in the mesoglœa, at least not in the distal part (Pl. 5, fig. 6). The incrustation is fairly strong and consists of comparatively large sand-grains, here and there a sponge-needle and exceptionally foraminifera. The entoderm is well-developed and thicker than the ectoderm.

The sphincter is mesoglœal but not so strong as in the other Epizoanthus-species examined by me (Pl. 3, fig. 4). In the distal part the meshes are considerably larger than in the proximal and extend horizontally, i. e. in the direction from the ectoderm to the entoderm. The bridges of connective tissue between the muscle-meshes were broad.

The tentacles have the usual structure. The ectoderm is very high with numerous large spirocysts; further, it contains the same kind of large nematocysts as occur in the body-wall and typical thick-walled capsules (length 17 μ). The mesoglœa is thin, the longitudinal musculature moderately developed.

The ectoderm of the œsophagus is fairly thick and contains large capsules, almost of the same kind and size as those in the body-wall, besides not a few typical thick-walled capsules (length 24—26 μ) The mesoglœa is thin, being however considerably thickened in the siphonoglyphe.

The single specimen examined by me had 32 regularly arranged mesenteries. Danielssen's statements on this matter cannot be correct, as it is quite evident from his figure, that he has not seen the macro-type arrangement but has supposed the macro and micro-mesenteries to be alternating everywhere. The mesoglœa of the macro-mesenteries is fairly thick, the micro-mesenteries rather long but narrow and not much developed. The musculature is comparatively weak.

The filaments seem to have the usual structure. The glandular tract contains the same kind of nematocysts as occur in the œsophagus. The thick-walled capsules may sometimes be a little smaller (22—24 μ).

The sexual organs were not developed in the polyp closely examined by me.

Epizoanthus beeren-islandicus n. sp.

Pl. 2, fig. 10, Pl. 3, fig. 2, Pl. 4, fig. 1.

Occurrence: 73° 3′ N., 18° 30′ E. Beeren Island-Norway 410 m. Bott. temp. 2°. Gray clay. Spitzbergen Exp. 1898 4/9. No. 42 3 sp. R. M.

Dimensions of the largest polyp: height and breadth about 1 cm.

Colour in alcohol: yellowish.

External appearance. The three specimens of this species formed no colonies. One was attached to a stone, one other to a Retepora. The cœnenchyme was very thin, disc-shaped. The polyps are cylindrical, almost as high as broad — the animals however were very contracted — and the distal part was a little broader than the proximal. The upper margin was truncate on the contracted polyps. The capitular region has some fairly distinct furrows. In the large specimens I counted 21 capitular furrows with distinct, incrusted ridges between them. The incrustation, which is comparatively inconsiderable, consists of small light sand-grains, now and then interspersed with a few small black sand-grains.

The œsophagus is short with distinct siphonoglyphe and hyposulcus of almost the same length as the œsophagus.

Anatomical description based on two specimens. The ectoderm of the body-wall is continuous and provided with a distinct cuticle. It is fairly high and contains nematocysts with greatly twisted thread, which are uniformly broad, 31—37 μ long and 11—12 μ broad, and fairly common except in the capitular region. The mesogloea is always thicker than the ectoderm, double as thick at the most. It contains fairly many small cells with long thread-shaped outshoots, here and there cell-islets and lacunae. The latter often, though not always, lie at the base of the mesenteries, so that in certain sections (Pl. 4, fig. 1) the lacunae are very characteristic in appearance. The entoderm is almost of the same size as the ectoderm. The incrustation is rather inconsiderable in the ectoderm; the greater part of the mesogloea has no incrustation, this is mostly found near the mesenteries from which it often penetrates into the above-mentioned lacunae.

The sphincter is strong and long (Pl. 3, fig. 2) and lies nearer the ecto- than the entoderm, so that in the capitular furrows it is only separated from the ectoderm, by a thin mesogloeal lamella. The muscle-meshes are drawn out crosswise and the mesogloeal meshes are thin.

The ectoderm of the tentacles contains as usual numerous spirocysts, whereas the thick-walled nematocysts (length 17 μ) are very scarce. Further, there is a very sparse occurrence of the same large nematocysts as found in the filaments. The ectodermal musculature is fairly strong.

The ectoderm of the œsophagus contains fairly many large nematocysts (length 34—41 μ) and numerous typical, thick-walled capsules (length 22—25 μ). The structure of the siphonoglyphe agrees with that in other species of Zoanthidae described here.

The number of mesenteries in the three specimens was 44, 40 and 39 respectively. In the first specimen, which was regularly developed, the 6th proto-mesentery on the one side of the sagittal plane was a micro instead of a macro-mesentery. In the second specimen the one side was more developed and had one pair of mesenteries more than the other. The micro-mesenteries in the lower part of

the œsophageal region were fairly well developed. The longitudinal muscles on the macro-mesenteries are fairly strong but form few folds. The parieto-basilar muscles are very weak and narrow. The distribution of the longitudinal and parieto-basilar muscles on the body-wall is quite distinct.

The filaments have the usual structure. The nematocysts of the glandular tract are 34—41 μ long and 10—12 μ broad (very seldom only 9 μ broad). They are uniformly broad and very common and there is also a frequent occurrence of thick-walled capsules with distinct basal part to the spiral thread (length 22—26 μ).

The sexual organs were undeveloped in the two specimens sectioned in the sexual region.

Epizoanthus glacialis Dan.

Pl. 2 fig. 1—5, Pl. 4 fig. 2, 6, 7.

Epizoanthus glacialis n. sp. Danielssen Norw. Atl. Exp. Actinida p. 129, Tab. 6 figs. 7—9, Tab. 24 figs. 5—8, Tab. 25 figs. 1—3 pro parte.

Palythoa norvegica Kor. & Dan. Marenzeller K. Acad. Wiss. Wien 3 1886. IV p. 16 var *jan. mayeni.*

Occurrence: 68° 21′ N., 10° 40′ E. 836 m. Sabulous clay. Bott. temp. — 0·7°. Norw. North Atl. Ex. 1876, 29. 6. St. 164. many specimens Bergen M.

71° 25′ N., 15° 41′ E. 1134 m. Clay. Bott. temp. — 1·0°. North Atl. Ex. 1877. 17. 7 St. 200. a few specimens B. M.

Altenfjord 80 fms. clay. June 1890. Jägerskiöld. some colonies Upsala M., R. M.

Öxfjord Finmarken. Loven 1 sp. R. M.

Greenland Umanak 250 fms. clay Amundsen 15. 8. 1860. several specimens R. M.

Greenland Umanak 397 fms. light clay. Ingegerd and Gladans Ex. J. Lindahl 13. 7. 1871. 2 specimens R. M.

Greenland off Umanakfjord 122 fms. hard light grayish clay. Ingegerd and Gladans Ex. J. Lindahl 14. 7. 1871. several large colonies R. M.

Greenland 70° 53′ N., 52° 18′ W. 397 fms. light clay. Bott. temp. — 2·8° (27° F.) C. Nyström Upsala M.

Jan Mayen 200 m. Austrian polar stations 1882—1883. 1 colony: var *jan mayeni.*

Dimensions. The column measures about 2·0 cm. in height, 0·6 cm. in breadth at the base, 0·6—0·7 cm. broad at the uppermost extremity and 0·4 cm. broad at the middle (Danielssen). Specimens from Umanak fjord, which were considerably larger than the specimens of *E. glacialis* I have seen from the Norwegian North Atlantic Expedition, had in the preserved state a length of about 1·8 cm. and a breadth of 0·6 cm., the smallest breadth being 0·4 cm.

Colour. The incrusted portion of the body is greenish-yellow but when the animal is extended almost yellow, having a somewhat greenish play of colour at the base only. The oral disc is faint brick-red with darker folds round the oral aperture. The tentacles are more intensely red than the oral disc, but are somewhat paler in colour at the extremities (Danielssen). In alcohol dirty yellowish.

External appearance. This species forms larger or smaller colonies, sometimes almost of the size of a hand (the colonies dredged off Umenak Fjord). The polyps are connected with each other by a flat, rather thick cœnenchyme with a fairly well developed net-work of entodermal canals. The polyps are either placed close to each other as in the Umenak material or emerge from the cœnenchyme at greater intervals. They are cylindrical in shape especially in the longitudinally expanded specimens, in the more contracted the middle part becomes somewhat narrower than the capitular region especially. The length is generally at least double the breadth. On contracted polyps the distal margin is rounded not truncate. Danielssen states however that "when the polyp is retracted the uppermost extremity appears truncated but with a little depression in the middle." As far as I can see, this is not the case but a specimen of *E. danielsseni* found in the same sample as *E. glacialis* had this shape, so that Danielssen's description was probably in this regard taken from that species (cf. *E. danielsseni*). The capitular furrows are distinct and vary in number. The greatest number observed by me was 28 the smallest 16, the latter in a small specimen. The polyps taken near the coast of Greenland, which generally were considerably larger than the Norwegian ones, had also as a rule a larger number of capitular furrows. In 15 of the first named specimens I counted the following number of capitular furrows 20, 20, 20, 20, 20, 21, 21, 22, 23, 23, 23, 25, 27, 28. Five type specimens had 16, 18, 18, 20, 20. Specimens from Altenfjord have 17, 17, 18, 18, 20, 20, 20, capitular furrows. That the number of furrows may also be high in the Norwegian forms may be seen from the fact, that I found among them a specimen with no less than 52 mesenteries. The incrustation, which consists almost exclusively of sand interspersed with a few sponge-needles, is not very strong and restricted to the ectoderm and the outer part of the mesoglœa. The œsophagus has the usual appearance lengthwise. The siphonoglyphe is distinct with a well-marked, though not very long hyposulcus.

Anatomical description. The ectoderm of the body-wall is high and sometimes as thick as the mesoglœa; it is continuous, but may at times show a slight tendency to become discontinuous, and is provided with a thin cuticle. The nematocysts of the ectoderm consist partly of large nematocysts with greatly twisted thread (length 26—34 μ, breadth 10—12 μ) partly of thick-walled capsules (length 19 μ), which however occur in small quantities.

The mesoglœa is thick, sometimes thicker on one side than on the other. In the distal part it contains fairly many cells, often provided with long outshoots (Pl. 4, fig. 6). Further, there is a sparse occurrence of cell-islets of moderate size, which however are more numerous in the Umanak specimens. In the proximal part both cells and cell-islets occur more frequently (Pl. 4, fig. 7). No muscles are present in the mesoglœa except the sphincter and the mesoglœal muscles of the body-wall which may break through the mesenteries; the structures (muscle-meshes) observed by Danielssen are nothing but breaches in the mesoglœa. Lacunae are absent, except in the sexual region, where some signs of these are seen. The entoderm is remarkably well-developed in comparison with the other layers of the body.

The sphincter (pl. 4 fig. 2) is very strong. Seen in transverse section the muscle-meshes in the proximal part are separated by large portions of mesoglœa, in the distal part they are divided into large meshes, extending in the direction from within outwards and almost filling the whole breadth of the mesoglœa, or even more split up here, though smaller and lying nearer the ectoderm than the entoderm

The tentacles have the usual structure. The spirocysts in the ectoderm are as usual very numerous, the thick-walled ones (17—22, 19—24 μ long) scarce. Further, some large nematocysts of the same kind as in the body-wall occur in very small quantities. The longitudinal musculature is moderately developed.

The ectoderm of the œsophagus is high. It contains fairly great numbers of nematocysts partly large with much coiled thread and uniformly broad, length (26) 29—36 μ, breadth about 12 μ, partly thick-walled 19—24 μ long. The mesogloea is thin but that of the siphonoglyphe on the other hand is considerably thickened. The ectoderm of the siphonoglyphe is as usual thinner than in the œsophageal region.

The number of mesenteries varies according to the size of the polyps, 3 of the examined Umenak specimens had 40, 46 and 50 mesenteries. The arrangement of the mesenteries in the first polyp was typical, both the others had a pair of mesenteries more on the one side of the directive chamber than the other. One of the type specimens (the smallest) had 36, another 40 and a third no less than 52 mesenteries. While the first and last polyp were symmetrical the third one was very asymmetrical, the one side having 22, the other no more than 18 mesenteries. Specimens from Öxfjord Finmarken had 36 mesenteries. Danielssen's statement that the number of micro-mesenteries is the same as the number of macro-mesenteries is of course incorrect, as Zoanthidae-species with the mesenteries arranged according to the macro-type do not have as many micro as macro-mesenteries.

In the œsophageal region the macro-mesenteries are fairly thick with well-developed mesogloea. The longitudinal musculature is strong with fairly many folds (text-fig. 5). The parieto-basilar muscles are weak. Extension of the longitudinal and parieto-basilar muscles onto the body-wall inconsiderable. In the sexual region the macro-mesenteries are thin and the musculature weak. The micro-mesenteries are moderately developed.

The structure of the filaments is as usual. The glandular tract sometimes contains greater sometimes smaller numbers of large, uniformly broad nematocysts with much coiled thread — length (26) 29—36 μ breadth 10—13 μ — and thick-walled capsules 19—26 μ long with distinct basal part to the spiral thread.

The species is dioecious.

Systematic remarks. In the sample from St. 164 Norw. North Atl. Ex., — the only type-specimens of *E. glacialis* which I have had for examination, — there were two species which have undoubtedly been mixed in Danielssen's description. The one is the species described here, which I have considered the type-specimen of Danielssen's species *glacialis*, as his description, at any rate with regard to the external appearance, may in the main be referred to this species. Figures 7 and 8 on Pl. 6 in Danielssen's work evidently represent the above-described species and the same is certainly the case with fig. 5 and probably also with fig. 6 on Pl. 24. On the other hand, fig. 9 Pl. 6 probably represents *E. danielsseni*. With regard to the anatomical figures of *E. glacialis* in Danielssen's work they are so poor that they may represent the one as well as the other of the species, though the weak incrustation seems to indicate the species I have described as *glacialis*. Both species are namely so unlike each other, not only with regard to the nematocysts but also in external

appearance and inner structure, that there can be no doubt that they represent 2 species quite different from each other.

var. *jan mayeni* Pl. 2 fig. 2.

Through the kindness of Prof. Marenzeller, I have had the opportunity of examining the specimens from Jan Mayen which he considered *Palythoa norvegica*. They could not be referred to this species with absolute certainty, but may well be considered as a variety of *E. glacialis*, from which they differ but little, mostly with regard to the nematocysts which are generally somewhat larger than in the main form.

Occurrence. See above under the main form.

Dimensions. Length of the largest polyp 1·2 cm., breadth in the capitular region 0·7 cm.

Colour in alcohol. Ectoderm uncoloured. Mesoglœa interspersed with black sand-grains.

External appearance. 1 colony consisting of 2 polyps, which lie close to each other projecting from a thin cœnenchyme (fig. 2 Pl. 2). In the contracted state the polyps are elongated, cylindrical somewhat broader at the upper end and with rounded capitular region. The capitular furrows are very distinct, in the smaller specimen I counted 21, in the larger 24. The siphonoglyphe is well developed.

Text-fig. 5. Transverse section through the body-wall with adjacent mesenteries and œsophagus of *Epizoanthus glacialis* (specimens dredged by C. Nyström). Mesoglœa and muscles black. Ectoderm not drawn and entoderm only in part. dc directive chamber. In the mesoglœa of the body-wall the incrustations are marked by dots.

Anatomical description. The ectoderm of the body-wall is continuous, very high and thicker than the mesoglœa, in which we frequently find broad nematocysts with greatly twisted thread (length 34—36 μ, breadth 12—13 μ). Incrustation of small sand-grains. Otherwise like the main form.

While the spirocysts in the ectoderm of the tentacles were very numerous, the thick-walled capsules only occurred in small numbers (length 24 μ).

The ectoderm of the œsophagus has the typical appearance. The large nematocysts resembling those in the body-wall are scarce but somewhat larger than usual (length 38—43 μ, breadth 12—13 μ), the thick-walled nematocyst capsules are numerous and longer than in the main form — 26—29 (31) μ long.

The mesenteries. The specimen examined has 42 mesenteries, 12 macro and 10 micro on the one side, 11 macro and 9 micro on the other. Of the latter the 1st proto-mesentery (according to the developmental scheme adopted) was not much developed and very little larger than a micro-mesentery. Otherwise the mesenteries are as in the main form.

In the glandular tract occur some large nematocysts with much coiled thread (length 34—36 μ breadth 13 μ). Further, it contains fairly many thick-walled capsules with distinct basal part to the spiral thread (length 27—30 μ, breadth 6 μ).

Epizoanthus koreni n. sp.

Pl. 2 fig. 23, Pl. 4 fig. 4.

Occurrence: 62°49′ N., 7°12′ W. 276 fms. Bott. temp. 1·6°. Ingolf Ex. St. 144 1 colony of two polyps.

Dimensions: Length of the largest polyp 1·1 cm; smallest breadth 0·35 cm.; largest breadth 0·55 cm.

Colour in alcohol: dirty sand-coloured.

External appearance. The cœnenchyme was large and covered among other things an arm of an Ophiurid. It is fairly thin but has a very robust appearance, probably owing to the imbedded small foreign particles on which it grows. The 2 polyps are not close to each other but separated by a fairly great interval. The largest polyp is elongated, almost double as long as broad, narrow at the base but gradually increasing in breadth upwards. The smaller polyp on the other hand is higher than broad and more cylindrical. The capitular furrows are distinct, in the largest specimen their number was 18, in the smaller probably 15. The upper margin of the polyps is truncate, the tentacles being retracted. The incrustation is inconsiderable and restricted to the outer part of the body-wall.

The œsophagus is short, siphonoglyphe and hyposulcus distinct.

Anatomical description. The ectoderm of the body-wall is fairly high, continuous and incrusted with sand-grains, sponge-needles and foraminifera, though not very strongly. It is also incrusted with detritus particles attached to the cuticle. The ectoderm frequently contains nematocysts with coiled thread, in the capitular region these are scarce. They are uniformly broad 26—29 μ long, about 10 μ broad and rounded at both ends. The mesogloea is thick and considerably thicker than the ectoderm; only the outer part of the mesogloea has a slight incrustation consisting of the above-mentioned particles. The mesogloea contains numerous oval or round cells and fairly many, middle-sized cell-islets, and rarely large cavities filled with round or oval cells, the nature of which I have not been able to determine with certainty (Pl. 4, fig. 4 ml?). The entoderm is fairly large and seems to contain zooxanthellæ, which however are more numerous in the entoderm of the œsophagus and the mesenteries. In the mesogloea of the mesenteries similar cavities filled with cells may also occur as in the mesogloea of the body-wall.

The sphincter is very strong and resembles the sphincter in *E. erdmanni*. It lies considerably nearer to the ectoderm than the entoderm.

The ectoderm of the tentacles contains great numbers of spirocysts but only few thick-walled capsules (length about 19 μ) and nematocysts with much coiled thread (length 26—31 μ, breadth 10 μ).

The œsophagus has the usual structure. I have not been able to make any macerated preparations of the high ectoderm. The siphonoglyphe is deep with thinner ectoderm and considerable thicker mesogloea than in the œsophagus.

In the specimens examined anatomically the number of mesenteries (in the large polyp) was 36, 10 macro and 8 micro on either side of the directive line. The micro-mesenteries are moderately developed, the macro-mesenteries strong. The longitudinal musculature on the macro-mesenteries is fairly strong, but not much folded, the parieto-basilar musculature is weak. The distribution of the longitudinal and parieto-basilar musculature on the body-wall is inconsiderable.

The filaments have the usual structure. The glandular tract contains numerous nematocysts with much coiled thread 26—36 μ long and 10—12 μ broad, sometimes even narrower. Further, some thick-walled capsules are found (length 19—22 μ).

The colony was not sexually ripe.

Genus Isozoanthus Carlgren.

Isozoanthus n. gen. Carlgren in Nordgaard Hydrogr. and Biol. Investig. 1905 p. 159.

Macrocnemic Zoantheae with a diffuse entodermal sphincter musele. The body-wall inerusted. The ectoderm is always continuous. Cell-islets and lacunae in the mesogloea but no encircling sinus. Dioecious polyps. Polyps solitary or in small clusters, as a rule connected with a comparatively thin coenenchyme.

The genus, which has been briefly characterised by me on an earlier occasion (1905 p. 159), forms a link between the genera Epizoanthus and Parazoanthus. With regard to the appearance of the sphincter, Isozoanthus agrees with the latter, but in the structure of the body-wall it agrees with the former. In the genus Isozoanthus the encircling sinus so charaeteristic of Parazoanthus is wanting.

If attention is only paid to the appearance of the sphincter in arranging the genera within the macrocnemic Zoanthidae, the Isozoanthus-species would have to be referred to the older genus Parazoanthus, but if the structure of the mesogloea of the body-wall is considered to be of some importance in the characterisation of the genera, it is most reasonable to let the species, which have no incireling sinus but are otherwise in the main in agreement with Parazoanthus, form a separate genus, i. e. Isozoanthus. In the latter case the diagnosis given by Haddon and Shackleton for the genus Parazoanthus would need no revision, in the first case on the other hand their diagnosis would have to be altered with regard to the encircling sinus, as for example "encircling sinus absent or present." If the species comprised by me under the genus Isozoanthus are referred to the genus Parazoanthus, it would at any rate be advisable to let them form a separate sub-genus named Isozoanthus. Future investigations must decide, whether Isozoanthus should be considered a separate genus or a sub-genus.

The type for the genus Isozoanthus is *Isozoanthus (Epizoanthus) arborescens* (Dan.). Another species, by the way the longest Zoantharia known, has been figure by me in Chun's work: "Aus den Tiefen des Weltmeeres" 2 Aufl. 1905 p. 520. It has been dredged on the Agulhas Bank during the German deep-sea expedition and provisionally named by me *I. giganteus*. The genus thus occurs in northern as well as in southern seas. A revision of the Zoanthidae already described would possibly show, that certain forms described as Parazoanthus should in reality be referred to Isozoanthus.

Of the 9 Isozoanthus-species mentioned here only one, namely the type of the genus, *I. arborescens*, has been described before by Danielssen, who referred it to the genus Epizoanthus. Danielssen's anatomical description leaves much to be desired in many respects. All the species with exception of *I. danicus* have been dredged during the Ingolf Expedition. *I. danicus* has been taken in the Limfjord and determined by Mortensen (1897) as *Z. couchii* (Johnst.).

Synopsis of the *Isozoanthus*-species described here.

A. Single polyps or small colonies of two specimens with tube or groove-shaped cœnenchyme, which is well-developed, but probably unattached. The mesoglœa of the body-wall contains few cells exceptionally cell-islets. Number of mesenteries 28—32 ..... *bulbosus.*

B. Single polyps or small colonies of densely placed polyps connected by an inconsiderable cœnenchyme. The polyps are elongated, slightly attached.

a. Mesoglœa of body-wall contains few small cells. Number of mesenteries 32—36. Specific nematocysts in the filaments 31—38 μ × 11—12 μ ..... *arborescens.*

aa. Mesoglœa of body-wall contains numerous, granular, fairly large cells. Number of mesenteries 34—38. Specific nematocysts in the filaments 36—53 μ × 12 μ ..... *davisi.*

C. Colonies with large, fairly well-developed cœnenchyme.

b. Elongated, small polyps.

c. Number of mesenteries about 34. Specific nematocysts in the filaments partly large 26—34 μ × 10—12 μ partly smaller 14 μ × 5 μ. Well developed cœnenchyme tube-shaped covering needles of Hexactinellidae (always?) ..... *islandicus.*

cc. Number of mesenteries about 30 Specific nematocysts in the filaments partly large 19—26 μ × 10—12 μ, partly smaller 12—14 μ × 5—6 μ. Cœnenchyme band-like (on Cidaris spines, always?) ..... *dubius.*

bb. Polyp of moderate length or short.

d. Number of mesenteries 18—22. Specific nematocysts in the filaments 22—26 μ × 7 μ. Mesoglœa of the body-wall almost homogeneous with very scarce cells. Cœnenchyme band-like, branched ..... *danicus.*

dd. Number of mesenteries about 32. Specific nematocysts in the filaments partly large 31—43 μ × 12 μ, partly smaller 15 μ × 7 μ. Mesoglœa of the body-wall contains numerous small cell-islets and less numerous large cell-islets often fused together to form lacunae. Cœnenchyme band-like, branched ..... *maguinsulosus.*

ddd. Number of mesenteries 38—40. Specific nematocysts in the filaments partly large 41—48 μ × 14—17 μ, partly smaller 17—19 μ × 7 μ. Mesoglœa of body-wall contains numerous small cell-islets and scattered large ones. Lacunae-system slightly developed, cœnenchyme of small dimensions ..... *multinsulosus.*

dddd. Number of mesenteries 38—40. Specific nematocysts in the filaments partly large 31—40 μ × 12—14 (19) μ, partly smaller 17—19 μ × 7 μ. Mesoglœa of body-wall contains numerous, often elongated cells and larger or smaller cell-islets sometimes fused together at the base of the mesenteries. Large, thin cœnenchyme..... *ingolfi.*

Isozoanthus bulbosus n. sp.

Pl. 1, figs. 5, 6. Pl. 2, figs. 14–16. Pl. 6, fig. 1.

Occurrence: 65° 34′ N., 7° 31′ W. 762 Danish fathoms. Bott. temp. —0·8°. St. 105 Ingolf Ex. Several specimens.

66° 23′ N.,	7° 25′ W.	957	Dan. fms.	Bott. temp.	— 1·1°.	St. 104	Ingolf Exp.	several spec.
68° 08′ N.,	16° 02′ W.	729	—	—	—	— 0·8°.	- 125	—	—	2 spec.
69° 13′ N.,	8° 23′ W.	1003	—	—	—	— 1·0°.	- 117	—	—	12 spec.
69° 31′ N.,	7° 06′ W.	1309	—	—	—	— 1°.	- 113	—	—	several spec.
70° 05′ N.,	8° 26′ W.	371	—	—	—	— 0·4°.	- 116	—	—	several spec.
73° 3′ N.,	18° 30′ W.	410 m.		—	—	2°.	- 32	Spitzbergen Ex. 1898	4	9	2 spec. R.M.
81° 20′ N.,	20° 30′ E.	1000 m.					- 41	Römer & Schaudinn.	Berlin M.		
66° 35′ N.,	56° 38′ W.	318	Dan. fms.	—	—	3·9°.	- 32	Ingolf Exp.	several spec.		

Dimensions in the preserved state. The largest breadth of the polyps was about 0·55 cm. The height was about 0·7 cm. excluding the groove-shaped cœnenchyme which may be of variable length (greatest length observed 1·4 cm.).

The colour of living specimens has not been observed. In the preserved state the polyps are dirty coloured, lighter or darker. The polyps which are strongly incrusted with foraminifera look as if they were covered with white grit.

External appearance. The polyps are pear-shaped, in the proximal part often drawn out into a long narrow stalk, which often again increases a little in diameter towards the point and is sometimes somewhat swollen (see fig. 6 Pl. 1 showing the most typical appearance of the polyps). This stalk which often had a groove-shaped appearance (fig. 15—16 Pl. 2) does not however belong to the polyp itself but to the cœnenchyme. The cavity of the polyp namely is continued in the stalk part only as large canals, in contrast to what is found in *I. arborescens*. As the polyp, also in contrast to *I. arborescens*, is always unattached, this part which is strongly incrusted probably serves as a sort of anchor for the polyp. The groove-shaped part may possibly have surrounded some object, though the large material collected affords no evidence of this. The polyps are nearly always single, and only very seldom (observed in a few cases only, fig. 5, 6, Pl. 1) does the stalk-shaped part send out another polyp. The body-wall is richly incrusted, probably mostly with foraminifera densely placed, further, with a smaller number of sand-grains and sponge-needles, the latter found mostly in the upper part. In the specimens from St. 116 the sand-grains predominate and these polyps are darker; in specimens from St. 32 the incrustation consisted exclusively of lighter or darker sand-grains interspersed with a few sponge-needles. In the specimens collected at St. 105 as also in those dredged by Römer & Schaudinn, the capitular region was well-marked, owing to the main incrustation being made up of sponge-needles, while the lower part was richly beset with foraminifera. In another specimen I was able to remove large pieces of a sponge, and it is possible that this is symbiotic with the polyp. In two specimens collected during the Spitzbergen Expedition of 1898 the incrustation consisted mainly of sand-grains and sponge-needles, while the foraminifera were scarce. The capitular furrows were indistinct and generally not to be seen in the contracted, preserved polyps. In a half expanded specimen (fig. 5 Pl. 1) on the other hand faint capitular furrows could be observed. In a specimen from St. 32 I counted 13 capitular furrows with well-marked sand-grain ridges in the distal part. The whole polyp is of a more vigorous appearance than *I. arborescens*.

The œsophagus is very short, the siphonoglyphe broad, the hyposulcus almost of the same length as the œsophagus.

Anatomical description. The ectoderm of the body-wall is large, continuous and richly incrusted. It contains sparse, uniformly broad nematocysts with greatly twisted thread (length 31—36 μ, breadth 12 μ). The mesoglœa is fairly thick, mostly incrusted and contains a few large cell-islets and now and then cell-groups, surrounded by inconsiderable protoplasm (Pl. 6, fig. 1). The entoderm is thin. In the capitular region the ecto- and entoderm become thicker, especially the former, while the mesoglœa gets thinner.

The sphincter is straight with few folds, the musculature strong.

The longitudinal musculature of the tentacles is strong. The spirocysts of the ectoderm very numerous, whereas the thick-walled nematocysts are scarce, about 22 μ long sometimes smaller.

The œsophagus is almost without longitudinal folds, probably because it is very much expanded. The ectoderm contains numerous thick-walled capsules (length 17—24 $\mu \times 6\ \mu$) and is several times thicker than the mesoglœa. In the distinct siphonoglyphe the mesoglœa is considerably thickened, especially where the directive mesenteries are attached. The ectoderm of the siphonoglyphe is thinner than in the œsophagus.

The number of mesenteries is 28—32, i. e. less than in *I. arborescens* though the latter has a much smaller diameter than *I. bulbosus*. 9 specimens examined had 28 mesenteries, 1 had 32 and 3 had 30, 9 macro and 7 micro on the one side and 8 macro and 6 micro on the other. In one case at least the right side was the most developed. The mesenteries are thin, somewhat thickened inwards and extending below the œsophagus a long way into the gastrovascular cavity, the micro-mesenteries are thin but become broader below the œsophagus. The lamella of the longitudinal muscle is fairly well-developed especially just below the œsophagus, where it is provided with some closely-lying folds. The parieto-basilar muscles are weak. The longitudinal and parieto-basilar muscles extend some distance out onto the body-wall.

The structure of the filaments is typical. The glandular tract contains sparse thick-walled nematocysts broader at the one end and with distinct basal part to the spiral thread (length 19—22 (24) μ, breadth 6 μ), further there are also granular thick-walled capsules (length 26—31 μ, breadth 5 μ, sometimes smaller). In a specimen from St. 32 I found some very few small egg-shaped capsules (length 10—11 μ, breadth 4 μ). These may possibly also be present in other specimens but owing to their small size and scarce occurrence may easily have escaped notice. The large nematocysts with greatly twisted thread are very seldom observed (length about 36 μ, breadth 12 μ) and are generally absent altogether. I have examined these nematocysts of the filaments in various specimens from different localities and found them in the main to be in agreement with each other. It seems characteristic, that the nematocysts with greatly twisted thread are extremely scarce if present at all. Nor do smaller nematocysts of the same kind as the preceding seem to occur, in contrast to what we find in many other Isozoanthus-species, or if occurring are extremely scarce. In their place thick-walled nematocysts of a somewhat granular appearance may be observed.

The polyps are dioecious.

Isozoanthus arborescens (Dan) Carlgr.

Pl. 1 figs. 1—2, Pl. 2 fig. 27, Pl. 3. fig. 5, Pl. 6, fig. 2.

Epizoanthus arborescens n. sp. Danielssen Norw. North Atl. Ex. Actinida. 1890. Tab. 6 fig. 6 Tab. 24 figs. 1—4.

Isozoanthus arborescens (Dan) Carlgren in Nordgaard 1905 Investig. in Norwegian fjords p. 159.

Occurrence: 60° 37′ N., 27° 52′ W., 799 Dan. fms. Bott. temp. 4·5°. Ingolf Ex. 1 spec.

65° 28′ N., 27° 39′ W. 450 Dan. fms. Bott. temp. 5·5°. Ingolf Ex. St. 97 5 spec.

67° 52′ N., 13° 58′ E. 247 m. clay Bott. temp. 4·9°. Norw. North Atl. Ex. 23/6 1877. St. 149. Bergen M. R. M.

S. E. of Mortsund 200 m. Bott. temp. 6·6°. 22/2 1899 Nordgaard. 1 colony.

12 miles E. by S. of Reine 150 m. 3/3 1899 Nordgaard. 2 spec.

68° 15′ 5″ N., 15° 49′ E. Tranödybet 607—640 m. Bott. temp. 6·3°. 16/3 1899 Nordgaard.

Dimensions in the expanded state, probably measured on living specimens: "up to 3·5 cm. in length with a basal part only 0·5—0·6 cm., the uppermost extremity 1·2 cm. in breadth." Danielssen. The largest specimen from the Ingolf Expedition had in preserved state a length of 2·8 cm., a breadth at the base of 0·2 cm. and at the apex of 0·35 cm.

Colour according to Danielssen. "The incrusted portion of the body is grey with a play of a slightly greenish colour. The oral disc is almost white with a reddish tinge. The tentacles pale rosy-red."

External appearance. Danielssen has given a good description thereof. The polyps are solitary and connected with each other by a very small cœnenchyme attached to stones (or Serpula-tubes or similar objects, see Danielssen fig. 6, Tab. 6, fig. 1, Tab. 24). The colonies are often attached by means of a thin membranous part, from which an inconsiderable tube-shaped cœnenchyme extends sending out numbers of polyps which make the colony look like a plant branching off at the base. Though not a little incrusted the polyps are rather slender and very elongated with a narrow, long basal part, which gradually becomes broader towards the distal part. In the contracted polyps the broadest part lies a little way from the distal end. The polyps from Mortsund (fig. 1 Pl. 1) were strongly contracted and consequently very firm, and the basal part of the polyps did not project so much as in the other, more developed polyps from other localities. Danielssen states that they have 16 capitular furrows. On the preserved specimens these are however very indistinct and only in the Mortsund specimens have I been able to trace them. The body-wall is incrusted with sand-grains, though not in very great quantities, so that "when the animal is extended and in full vigour, they permit the white-red integument to shine through it." (Danielssen).

The number of tentacles agrees in all probability with the number of mesenteries, in which case it is 32—36. The innermost row of tentacles are according to Danielssen very long. The same author also states that the oral disc is "rather flat and finely folded, the oral aperture is almost circular."

The œsophagus is short with well-marked siphonoglyphe and distinct hyposulcus.

Anatomical description. Danielssen has described the anatomy of this species but as usual very unsatisfactorily, especially with regard to the musculature, which according to his work

does not differ from that of the other Zoanthidae. He has even made a mistake with regard to the arrangement of the mesenteries, as can be seen from his figure showing the grouping of the mesenteries where he has not observed the couple of mesenteries forming the macro-type. This is for example seen from the fact, that fig. 4 Tab. 24 shows 18 macro-mesenteries, whereas fig. 3 only has 16, which according to the later number of macro-mesenteries is in agreement with the description. As I think it superfluous to point out Danielssen's mistakes in detail, I shall in the following pay no attention to his anatomical description of this species, but only describe the structure as I found it in a type-specimen from Bergens Museum, supplemented by examination of the material collected by Nordgaard and during the Ingolf Expedition.

The body-wall is more or less incrusted with sand-particles, here and there sponge-needles occur and sometimes also foraminifera. The incrustation reaches a longer or shorter distance into the mesoglœa, which however is not so much filled with the incrustation that its structure cannot be seen. The ectoderm is continuous with a generally thin but sometimes thicker cuticle on which are fixed particles of detritus. Though comparatively broad the ectoderm is considerably thinner than the mesoglœa and is, as usual, most developed in the capitular region. In the greater part of the body-wall there is a fairly frequent occurrence of nematocysts with greatly twisted thread (length 31—41 μ, breadth 12 μ). The mesoglœa is thick and contains small cells of more or less frequent occurrence Pl. 6 fig. 2). Ectodermal canals are also found though very seldom. On certain sections of one of the type-specimens I observed some elongated cells, the long outshoots of which were parallel to the margin of the mesoglœa. They lay either very far into the mesoglœa or near its inner margin. If the position of these cells were not variable, they might possibly be considered as the remnants of a ring-sinus, which however can hardly be the case, as these elongated cells are not of constant occurrence. An encircling sinus is absent. The entoderm is not large and several times thinner than the ectoderm.

The sphincter is entodermal and in transverse sections deep semicircular folds may be seen (fig. 5, Pl. 3). Where the sphincter breaks though the mesenteries one may, as in all Parazoanthus-species, obtain sections which if viewed externally give the impression that the sphincter is mesoglœal, but this is not the case.

The structure of the tentacles and the oral disc is in agreement with other Zoanthidae. The ectoderm of the tentacles contains numerous spirocysts and many 14—17 μ long, typical thick-walled capsules. The longitudinal musculature of the tentacles is fairly strong. The mesoglœa of the tentacles is also incrusted.

According to the more or less contracted state, the œsophagus is rounded, oval-shaped or more flattened. The siphonoglyphe is fairly distinct, but the mesoglœa is only somewhat thicker than in the other parts of the œsophagus. The ectoderm of the œsophagus is considerably larger than the thin mesoglœa. The difference in height between the ectoderm of the œsophagus and the siphonoglyphe is on the other hand quite inconsiderable. Owing to the small development of the œsophagus I have not been able to make glycerine-preparations.

Mesenteries. Of 4 specimens examined 2 had 32, 1 had 36 typically arranged mesenteries. The 4th specimen with 34 mesenteries had 9 macro and 7 micro-mesenteries on the one side, while on the other side there were 18 mesenteries irregularly arranged. This side namely was partly arranged

according to the micro-type, and the 12th mesentery from the endocoele of the micro-directive mesenteries was a macro-mesentery instead of a micro-mesentery.

In the sexual region the macro-mesenteries are short and reach only a little way into the gastrovascular cavity. Their mesoglœa is fairly well-developed. The longitudinal musculature forms few but fairly deep folds. The parieto-basilar muscles are weak and unfolded. The micro-mesenteries are moderately developed with muscles as on the macro-mesenteries.

The filaments have the typical structure. The glandular tract contains many uniformly broad nematocysts with greatly twisted thread (length 32—38 μ, breadth 11—12 μ). In the type-specimen I found also some very small oval nematocysts (length 17 μ, breadth 7 μ). Further, the glandular tract contains fairly many thick-walled nematocysts with distinct basal part to the spiral thread, which are broader at the one end (length 17—22 μ).

The animals are diœcious. The macro-mesenteries bear as usual the sexual organs. On the 1st couple of macro-mesenteries reckoned from the directive micro-mesenteries these are weaker than on the other proto-mesenteries, and the same applies to the youngest meta-macro-mesenteries.

Isozoanthus davisi n. sp.

Pl. 2, fig. 17. Pl, 7, fig. 1.

Occurrence: Davis Straits 66° 35′ N., 56° 38′ W. 318 Dan. fms. Bott. temp. 3·9°. Ingolf Expedition St. 32 several specimens (together with *I. bulbosus* and *Epizoanthus lindahli*).

Dimensions: The length of the polyps reached up to 1·4 cm., largest breadth about 0·4 cm. in the contracted state.

Colour in alcohol: light or dark sand-coloured.

External appearance. The majority of the specimens formed small colonies consisting of a few polyps connected with each other by a small, generally thin cœnenchyme and attached to small yellowish, sometimes branching sand-tubes (of Rhizammina?). All the polyps were probably attached to such objects, though in one case it looks as if the colony was free, probably arising from the fact that a piece of the cœnenchyme is worn off. The polyp is narrowest at the base, from which part it becomes more or less wide upwards, according to the more or less state of contraction. The capitular furrows are very indistinct. The whole body-wall and cœnenchyme of the polyps is richly incrusted with sand-grains, here and there also sponge-needles occur, especially in the uppermost part.

The tentacles are short.

The œsophagus is short, the siphonoglyphe distinct with well-marked hyposulcus of almost the same length as the œsophagus.

Anatomical description. The ectoderm of the body-wall does not seem to be very high except in the capitular region. It is mostly absent and if present filled with detritus and incrusted. Nematocysts with greatly twisted thread 38—48 μ long and 11—12 μ broad are fairly common in the proximal part, but very scarce distally. Further, the ectoderm of the body-wall contains egg-shaped nematocysts resembling those in the filaments (length 22—26 μ, breadth 5—7 μ). The mesoglœa is thick, several times thicker than the ectoderm and contains numerous, scattered large cells, generally

oval-shaped and with granular contents of close-lying grains (Pl. 7. fig. 1). The whole mesoglœa with exception of the very innermost part is incrusted. The entoderm is moderately developed, sometimes darkly pigmented.

The sphincter is long and strong, in the distal part it forms a few deep folds, in the proximal numerous but small folds.

The ectoderm of the tentacles contains numerous spirocysts, whereas the thick-walled capsules (length about 22 μ), are very scarce. The mesoglœa is richly incrusted.

The ectoderm of the œsophagus is very high and contains numerous nematocysts 24—26 μ long and thick-walled; further, there is a sparse occurrence of larger or smaller nematocysts with coiled thread as in the filaments. The mesoglœa is thin though however thickened in the siphonoglyphe.

Text-fig. 6. Transverse section through a portion of the body-wall with mesenteries and œsophagus of *Isozoanthus davisi*. Mesoglœa and muscles black, ectoderm of the œsophagus shaded, entoderm dotted. The light parts in and outside the mesoglœa of the body-wall represent incrustations. Ectoderm of the body-wall absent.

The number of mesenteries varied in the two specimens examined between 34 and 38. In both specimens the one side had one mesentery more than the other.

The macro-mesenteries are rather thick even in specimens with expanded mesenteries, whereas the micro-mesenteries are weak and in the lower part of the œsophageal region extend a little over the main part of the entoderm of the body-wall. In specimens having the mesenteries contracted broadwise the longitudinal musculature lies in deep folds even extending below the œsophagus (Text-fig. 6). The parieto-basilar muscles are very weak. The distribution of the longitudinal musculature on the body-wall is fairly considerable, whereas hardly any parieto-basilar muscles occur. Below the œsophagus extend the mesenteries, which contain the undeveloped sexual organs reaching some way into the gastrovascular cavity.

The filaments have the usual structure. Two kinds of nematocysts with greatly twisted thread and often of a somewhat curved shape occur, the one kind larger 37—53 μ long and 10—12 μ broad, the other smaller elongated, egg-shaped, somewhat broader at the one end (length 15—22 μ, largest breadth 6—7 μ). Further, the filaments contain thick-walled nematocysts broader at the one end than at the other (length 22—24 μ, breadth 5—6 μ).

One of the specimens investigated had undeveloped testes.

Isozoanthus islandicus.

Pl. 2. fig. 20. Pl. 7 fig. 2.

Occurrence: 64°45′ N., 29°06′ W. 568 Dan. fms. Bott. temp. 4·4°. Ingolf Exp. St. 90. 1 colony.

Dimensions: Length of the largest polyp 0·9 cm., greatest breadth about 0·2 cm.

Colour in alcohol: dark.

External appearance. The only colony of this species was attached to a couple of spicules of a Hexactinellida. The thin cœnenchyme was very large encircling the spicules almost entirely, so that it formed a tube round these. In fig. 20 Pl. 2 we see very little of the spicules. The polyps,

which in the full-grown specimens especially are very elongated in shape, lie very far from each other. They are narrowest at the base but expand somewhat towards the distal part. The capitular furrows are very indistinct. The upper margin of the polyps is somewhat rounded. The polyps as well as the cœnenchyme are richly though not very conspicuously incrusted.

The œsophagus is short, the siphonoglyphe distinct. Hyposulcus?

Anatomical description. The ectoderm of the body-wall is high and reaches almost the same size as the mesoglœa. Except in the capitular region it contains fairly many nematocysts with greatly twisted thread, length 29—34 μ, breadth 10—12 μ. Particles of detritus are found in and on the ectoderm. The mesoglœa is moderately developed, and very much incrusted with foraminifera (dissolved in the section on Pl. 7, fig. 2), sand and sponge-needles, the latter heaped up especially in the capitular region. Scattered granular cells of moderate size, sometimes also larger, occur fairly commonly here (Pl. 7, fig. 2). The entoderm is considerably thinner than the ectoderm.

The sphincter is long and strong, of the same appearance as in other Isozoanthus-species.

Regarding the tentacles I am unable to give any other information than that their ectoderm as usual contains numerous spirocysts.

In the œsophagus the ectoderm is high, the mesoglœa thin, whereas in the siphonoglyphe the conditions are reversed.

In the single specimen sectioned, the number of mesenteries, as far as I was able to see on the somewhat torn sections, was 34, 10 macro and 8 micro on the one side and 9 macro and 7 micro on the other. The micro-mesenteries are moderately developed. The longitudinal musculature is but moderately developed, forms few or no folds at all, the parieto-basilar muscles weak. So far as I was able to see on the not well-fixed material the longitudinal and parieto-basilar muscles extended only a moderate distance on the body-wall.

The filaments have the usual structure. The glandular tract region contains large nematocysts with coiled thread (length 26—34 μ, breadth 10—12 μ), but they only occur sparsely as is also the case with some smaller, similar capsules (length 14 μ, breadth 5 μ) and some thick-walled capsules broader at the one end (length 22 μ). Inside the filaments in the entoderm of the mesenteries we also find many nematocysts (length 14—17 μ, breadth 10—11 μ) and numerous elongated, generally curved nematocysts (length 22—26 μ, breadth 5 μ). These capsules probably do not belong to the animal, but are foreign nematocysts taken up by the ectoderm (2 specimens examined).

The animals were not sexually ripe.

Remarks. The above-mentioned species is undoubtedly closely related to *Isozoanthus dubius* from St. 45, but differs from the latter mainly in the larger nematocysts, and the stronger sphincter. Later examination of a larger material may possibly show that they can be thrown together to form one species, but till then I think it best to separate them.

Isozoanthus dubius n. sp.

Pl. 2, fig. 19. Pl. 7, fig. 3.

Occurrence: 61° 32′ N., 9° 43′ W. 643 Dan. fms. Bott. temp. 4·17°. Ingolf Exp. St. 45 1 colony.

Dimensions: Length of the largest polyp 0·8 cm., greatest breadth 0·3 cm.

Colour in alcohol: tawny sand-coloured.

External appearance. The only colony of this species was attached to a fragment of a Cidaris spine. The colony had a thin, disc-like cœnenchyme from which two polyps emerged at a long distance from each other. The polyps are elongated, narrow at the base and broader upwards. The distal margin, which completely covered the tentacles, was truncate. The capitular furrows were very indistinct. The incrustation of the polyps and the cœnenchyme consisted of sand-grains, foraminifera and sponge-needles. The œsophagus is short, the siphonoglyphe distinct. Hyposulcus?

Anatomical structure. The ectoderm of the body-wall is high, slightly incrusted with the above mentioned foreign bodies and detritus particles. In the distal part the nematocysts are very scarce, in the proximal part on the other hand nematocysts with coiled thread are common (length 22—29 μ, breadth 12 μ). The mesoglœa is thicker than the ectoderm, richly incrusted and contains scattered, fairly numerous, often oval-shaped, granular cells of moderate size (Pl. 7, fig. 3). In the section figured, the foraminifera have been dissolved by means of nitric acid, so that only the cavities in which they were lying can be seen. The ectoderm is thin.

The sphincter is considerably shorter than in *I. islandicus* and has in the distal part some large folds, which soon pass over into the ring-muscle layer of the body-wall.

The tentacles, of which I made no macerated preparation, contained in the ectoderm numerous spirocysts. Whether also thick-walled nematocyst capsules occur, I am unable to tell from the material sectioned.

The œsophagus is as in *I. islandicus*.

In the examined specimen the number of mesenteries was 30, 9 macro- and 7 micro-mesenteries on the one side, 8 macro- and 6 micro-mesenteries on the other. In the lowest part of the œsophageal region the micro-mesenterics are weak and only reach a little beyond the main lamella of the entoderm. The macro-mesenteries are thin, the longitudinal and parieto-basilar muscles weak, but reach a long way on the body-wall. The macro-mesenteries below the œsophagus seem to be longer than in *I. islandicus*.

The glandular tract of the filaments contains a few, large nematocysts with coiled thread (length 19—26 (29) μ generally 24, breadth 10—12 generally 10—11 μ) with rounded ends and fairly many, smaller, similar capsules (length 12—14 μ, breadth 5—6 μ). Further, there is a common occurrence of thick-walled capsules, broader at the one end (length 14—17 μ).

The sexual organs were not developed in the specimen sectioned.

Remarks. See under *I. islandicus*.

Isozoanthus danicus n. sp.

Pl. 1, fig. 3—4. Pl. 7, fig. 4.

Zoanthus couchii Gosse, Mortensen. Smaa biol. o. Faun. lagttagelser, Videnskab. Medd. 1897. p. 316.

Occurrence: Denmark, Limfjord. Mortensen; R. Hörring Sept. 1902. Copenh. Museum R. M.

Dimensions. Height of the retracted polyps 0·25—0·4 cm., breadth about 0·2 cm.

Colour in alcohol. The cœnenchyme and the majority of the polyps dark or dirty-coloured,

capitular region light. In the living condition: cœnenchyme and the proximal part of the polyps brown, disc brown frequently with white radial stripes (Mortensen).

External appearance. The cœnenchyme consists of an irregularly branched network with a thin attachment to dead oyster-shells. The polyps emerge from the cœnenchyme sometimes at smaller, sometimes greater intervals. They are small, cylindrical and when much contracted almost as high as broad or the breadth is a little larger (Pl. 1, fig. 4), in less contracted state (Pl. 1, fig. 3) they are twice as high as broad. In the contracted state the distal part is rounded. The capitular furrows are indistinct on the not very well preserved material, so that their number cannot be given.

The œsophagus is short, the siphonoglyphe distinct, but the hyposulcus seems to be short.

Anatomical description. The ectoderm of the body-wall is moderately developed and as far as I am able to see continuous (owing to the strong contraction and the folding resulting therefrom it is difficult to determine this with certainty). It is incrusted with coarse sand-grains, some sponge-needles and detritus, in which numerous diatoms occur. The ectoderm contains uniformly broad nematocysts with greatly twisted thread (length 22—26 μ, breadth generally 7 sometimes 10 μ). Whether they are numerous or not I am unable to say for certain. The mesogloea is moderately developed, the outer part incrusted, it has no lacunae and very few cells (cell-islets) which sometimes lie in groups close to each other. The cells are however so scarce that the mesogloea looks almost as if it was homogeneous and cell-free, this being fairly characteristic of the species (Pl. 7, fig. 4). The entoderm is of moderate thickness and contains fairly many zooxanthellae, which besides occur everywhere in the entodermal layer of the polyp.

The sphincter is entodermal, somewhat folded at the upper part and fairly long in consideration of the small size of the animal. The musculature is strong so that the capitular region is very much retracted in the contracted state.

The structure of the œsophagus seems to be the same as in the other Zoanthidae. The ectoderm is high, the mesogloea thin. I have not been able to make any macerated preparations of the œsophagus, because this is so short and folded and badly preserved. The siphonoglyphe has a somewhat lower ectoderm than the œsophagus, and the mesogloea is a little thicker than in the œsophagus.

In 7 specimens examined the number of mesenteries were 18, 20, 20, 20, 22, 24, 24; the specimens with 18 and 22 mesenteries had 1 couple of mesenteries more on the one side of the body than on the other. It is difficult to see the arrangement, as the specimens especially in the œsophageal region were badly preserved. It is worth noticing especially, that the sixth couple of proto-mesenteries, i. e. the proto-mesenteries lying nearest to the meta-mesenteries, as also the macro-meta-mesenteries, have not yet grown out to the œsophagus and had no filament (at least not in the specimen with 18 mesenteries). The sixth couple of proto-mesenteries, the micro-proto-mesenteries and all meta-mesenteries seem to be almost equally developed. Though it might be supposed, that the polyps were brachycnemic, it is however probable, that they are macrocnemic, though the 6th couple of proto-mesenteries have not yet reached the œsophagus. This is also indicated by the small development of the macro-meta-mesenteries. The micro-mesenteries at any rate are well-developed. The longitudinal musculature is strong on the complete mesenteries, especially on the directive mesenteries, where it forms deep folds.

The parieto-basilar muscles are weak, and as far as I have been able to see the longitudinal and parieto-basilar musculature does not extend onto the body-wall or only very little.

The filaments have the usual structure. The glandular tract contains fairly many, often curved, uniformly broad nematocysts with greatly twisted thread (length 22—26 μ, breadth about 7 μ). Further, it contains numerous thick-walled capsules about 17 μ long.

The species is diœcious. In most of the polyps ovaries or testes were found though at a fairly early stage.

Isozoanthus magninsulosus n. sp.

Pl. 1, fig. 7. Pl. 6, figs. 4—5.

Occurrence: 64° 24′ N., 28° 50′ W. 788 m. Bott. temp. 3·5°. Ingolf Ex. St. 10. 1 colony.

Dimensions in the contracted state. Length of the largest polyp 0·6 cm., breadth 0·3 cm.

Colour in alcohol: dirty yellowish-brown. It may possibly have absorbed this colour from a brown piece of paper covering the stone on which the colony was fixed, and which coloured the alcohol.

External appearance. The only colony of this species in the collection consisted of 8 larger and smaller polyps placed fairly close to each other and separated by a large flat and very thin, band-like cœnenchyme (Pl. 1 fig. 7), attached to a stone. The polyps are cylindrical not elongated, with distinct capitular forrows. All the polyps were retracted so that no tentacles were visible, the upper margin was rounded. The polyps as well as the cœnenchyme were incrusted with numerous foraminifera, giving the colony a granulated appearance. The œsophagus is very short, the siphonoglyphe distinct with well-marked hyposulcus.

Anatomical description. The ectoderm of the body-wall is fairly high, continuous and in the lower part of the polyp provided with fairly numerous and uniformly broad nematocysts about 34 μ long and 13 μ broad with greatly twisted thread. In the capitular region they seem to be wanting but are replaced by small egg-shaped capsules like those in the filaments (length 12—14 μ, breadth 6 μ). The mesoglœa is more than twice as thick as the ectoderm and like this incrusted with numerous foraminifera and some few sponge-needles. The incrustation is mostly present in the outer half of the mesoglœa but may often reach further into this. The part of the mesoglœa which is not incrusted contains numerous cell-islets of larger or smaller size (Pl. 6, fig. 5). The smaller as well as the larger of these are often in connection with each other, thus forming a lacunae-system which is mostly observed in the lower part of the body (Pl. 6, fig. 4). A section through the mesoglœa of the body-wall has therefore quite a different appearance from *I. multinsulosus*, where such lacunae-systems are only seldom found. In sections of *I. multinsulosus* the cell-islets are consequently as a rule round or oval whereas in *I. magninsulosus* they have a more irregular appearance owing to their connection with each other. The large islets (the lacunae) are also considerably larger in *I. magninsulosus* than in *I. multinsulosus*. In spite of the presence of a fairly well-developed lacunae-system one cannot speak here of any defined encircling sinus. The entoderm is thin and slightly pigmented.

The sphincter has the same structure as the other Isozoanthus species described.

The ectoderm of the tentacles contains numerous spirocysts and fairly many thick-walled nematocysts (length 17—19 μ). The mesoglœa of the tentacles is often incrustated.

The ectoderm of the œsophagus has the usual structure. Nematocysts probably also occur there, but as parts of the filaments are connected with the ectoderm of the œsophagus the macerated preparation has given no certain information regarding the occurrence and appearance of the nematocysts. The mesogloea is thin and considerably weaker than in the siphonoglyphe.

Mesenteries. Of 3 specimens sectioned only one was so well fixed that I could determine the number of mesenteries. This polyp has 32 typically arranged mesenteries. The mesenteries are thin, the longitudinal as well as the parieto-basilar musculature weak. These muscles extend a long way onto the body-wall. The micro-mesenteries are fairly well-developed even below the œsophagus.

The filaments have the usual structure. The nematocysts are partly large, uniformly broad capsules with greatly twisted thread (length 31—43 μ, breadth 12 μ), partly smaller often somewhat curved (length about 15 μ, breadth 7 μ). The latter are common. Further, the filaments contain fairly many, thick-walled capsules with distinct basal part to the spiral thread and somewhat broader at the one end (length 22—24 μ, breadth 7 μ). The species is dioecious. The best preserved specimen had well-developed testes on the macro-mesenteries.

Systematic remarks. In some respects this species resembles *I. multinsulosus*, from which it differs however in a number of features. In *I. magninsulosus* the large cell-islets (the lacunae) in the mesogloea of the body-wall are, for example, more numerous and larger than in *I. multinsulosus* (cf. above), in this species the incrustation consists of foraminifera, in *I. magninsulosus* of sand-grains, and in this the ectoderm is less pigmented than there. In *I. magninsulosus* the number of mesenteries is 32, in *I. multinsulosus* 38—40. Also the large nematocysts are somewhat shorter and especially narrower here than in *I. multinsulosus*, though otherwise they resemble each other with regard to the nematocysts.

Isozoanthus multinsulosus n. sp.

Pl. 1, fig. 18. Pl. 6, fig. 3.

Occurrence: 64° 15′ N., 14° 22′ W. 68 m. Bott. temp. 7·07°. Ingolf Ex. St. 51. 1 colony.

65° 43′ N., 14° 34′ W. 90 m. Bott. temp. 7°. Ingolf Ex. St. 6. 1 colony.

Dimensions. The polyps were strongly contracted. Largest polyp about 0·45 cm. broad and 1 cm. high.

Colour. The polyps are black owing to the incrustation of black sand-grains. It is probable, however, that the polyps are dark in themselves as the ectoderm and especially the entoderm are darkly pigmented.

External appearance. One of the colonies consisting of 4 polyps was attached to a stone, the other colony with 3 polyps to a Dentalium-tube. The greatly contracted polyps were connected with each other by a very thin, spread cœnenchyme from which the polyps emerge, sometimes at smaller, sometimes larger intervals. The polyps are short, the upper margin of the polyps retracted in the distal end, not truncate but rounded. Capitular furrows present but so indistinct that I am unable to state their number. The tentacles have the usual structure. The œsophagus is short, siphonoglyphe deep, hyposulcus distinct.

Anatomical description. The ectoderm of the body-wall is continuous, fairly high and contains fairly many, uniformly broad nematocysts with greatly twisted thread — length (38) 41—48 μ, breadth 14—17 μ. The ectoderm and outer part of the mesogloea are strongly incrusted, almost exclusively with black sand-grains interspersed with a few sponge-needles. The mesogloea is thick, the inner half and probably also the outer one (owing to the strong incrustation it has been rather difficult to study the structure of the mesogloea) contains cells and numerous cell-islets (Pl. 6, fig. 3), the majority of which are small but others reach quite a considerable size though not so large as in *I. magninsulosus*. More seldom the cell-islets fuse together to form elongated lacunae but not so great as in *I. magninsulosus*. An encircling sinus however is not found. The entoderm is thin, with black pigmentation.

The sphincter is entodermal, long and in the upper end has some fairly deep, often large folds.

The ectoderm of the tentacles is high and contains numerous spirocysts, besides many thick-walled nematocysts (length 19—24 μ) and a few large capsules with greatly twisted thread of the same kind as in the body-wall, but somewhat small (34 μ long).

The ectoderm of the œsophagus is fairly high and contains numerous thick-walled capsules (length 22—24 μ), and the same kind of large nematocysts as found in the body-wall though somewhat smaller (38—41 μ long). The mesogloea is thin and considerably weaker than in the siphonoglyphe, whose ectoderm as usual is lower than that of the œsophagus.

In the two specimens examined the number of mesenteries was 38 and 40. The second polyp was typical, the first had 1 couple of mesenteries more on the one side than on the other. The micro-mesenteries are moderately developed even below the œsophagus and several times broader than the entoderm of the body-wall. The mesogloea of the mesenteries is thin, the longitudinal musculature weak and partly folded, the parieto-basilar muscles weak. The extension of the longitudinal and parieto-basilar muscles on the body-wall is distinct though not considerable. Below the œsophagus the mesenteries are narrow, so that the gastrovascular cavity is large.

The filaments have the usual structure. In the glandular tract there is a rich occurrence of large capsules of the same kind as in the body-wall (length 41—48 μ, breadth 14—17 μ) and a sparse occurrence of similar smaller capsules (length 17—19 μ, breadth 7 μ); further, it contains fairly many thick-walled capsules with distinct basal part to the spiral thread and somewhat broader at the one end (length 22—24 μ, largest breadth 6 μ).

The sexual organs were not developed in the specimens examined.

Isozoanthus ingolfi n. sp.

Pl. 2, fig. 25. Pl. 6, fig. 6.

Occurrence. 64° 54′ N., 55° 10′ W. 393 fms. Bott. temp. 3·8°. Ingolf Ex. St. 27 several specimens (type).

Finmarken Ögsfjord Loven, 1 colony with 2 polyps.

Dimensions. Largest polyp (from Davis Straits) 1 cm. long and 0·55 cm. broad.

Colour in alcohol: light sand-coloured, the specimen from Finmarken containing small, scattered black sand-grains.

External appearance. Small colonies consisting of some polyps connected by a thin, fairly extensive cœnenchyme attached to small stones, mollusc-shells or worm-tubes. The polyps are cylindrical and sometimes, owing to contraction, a little thicker in the distal part, and longer than broad. In the retracted state the distal part is almost truncate with a depression in the middle. Capitular furrows present but very indistinct, in the best preserved specimen 20 were observed. The polyps as well as the cœnenchyme were incrusted with sand, now and then with sponge-needles; near the ectoderm mud-particles are fixed. The incrustation is not very strong and restricted to the ectoderm and especially the outer part of the mesoglœa.

The œsophagus is short with a very distinct deep siphonoglyphe and well-developed hyposulcus, which is somewhat longer than the œsophagus.

Anatomical description. The ectoderm of the body-wall is moderately developed, yet several times thinner than the mesoglœa. In the proximal part of the body-wall large nematocysts with coiled thread are found, sometimes sparsely (specimens from the Ingolf Expedition), sometimes more commonly (length 31—36 μ, breadth 12—14 μ). In the Finmarken specimen some smaller capsules of the same appearance as the smaller egg-shaped capsules of the filaments are also found. The mesoglœa is thick and contains numerous cells with long outshoots, sometimes running in the direction from ecto- to entoderm (Pl. 6, fig. 6) and sometimes even more irregularly arranged. Further, there is a sparse occurrence of small cell-islets and large cells. The latter sometimes fuse together to form (ectodermal?) lacunae. The large cell-islets lie often near the insertions of the mesenteries. As the cell-islets fuse together forming lacunae, it may sometimes on certain parts of the proximal part of the polyps look as if traces of an encircling sinus might be present. As the cell-islets lie fairly irregularly and are generally separated from each other by large portions of mesoglœa, especially in the distal end of the polyp, the lacunae cannot however be considered as an encircling sinus. The entoderm is thinner than the ectoderm.

The sphincter resembles that of *I. arborescens* and forms large folds.

The ectoderm of the tentacles has the usual structure and contains numerous spirocysts and fairly thick-walled nematocysts (length 19—20 μ). Besides there are very sparsely large capsules of the same kind as in the ectoderm of the body-wall. In the specimen from Finmarken I observed small capsules with coiled thread (length 19 μ, breadth 7 μ). The mesoglœa of the tentacles is incrusted though only inconsiderably.

The ectoderm of the œsophagus is high and contains fairly many thick-walled nematocysts (length 17—22 μ). Further, there also occur, though only very sparsely, some larger or smaller capsules with coiled thread of the same appearance as in the filaments. The ectoderm of the siphonoglyphe is as usual considerably lower than in the œsophagus, whereas with regard to the mesoglœa the condition here is reversed.

In the two specimens taking during the Ingolf Expedition the number of mesenteries was 40 and 38; the first of them had the mesenteries arranged typically, whereas the second had a pair of mesenteries less on the one side than on the other. Of the specimens from Finmarken one had 46 mesenteries, 13 macro and 11 micro on one side and 12 macro and 10 micro on the other. Another specimen probably had 44 mesenteries — 11 being observed in one fourth part of the polyp.

The longitudinal musculature is fairly well-developed but forms large folds. The parieto-basilar muscles are moderately developed but in transverse section no folds are seen. The parieto-basilar and longitudinal musculature extend a long way onto the body-wall. The micro-mesenteries are not very well-developed.

The filaments have the usual structure. The glandular tract contains larger and smaller nematocysts with greatly twisted thread, the larger are uniformly broad 31—43 μ long and 12—14 μ, sometimes even 17 broad, and scarce to not seldom, the smaller are egg-shaped 17—19 μ long and 7 μ broad and not seldom. Further, it contains thick-walled capsules with distinct basal part to the spiral thread and broader at the one end than at the other (length 17—19 μ long, largest breadth 5 μ). Sometimes also typical thick-walled capsules are present (length 24 μ).

The sexual organs were not developed in the specimens examined by me.

Besides the above-mentioned Isozoanthus-species a specimen of an Isozoanthus type which I could not refer with certainty to any of the above-described was dredged at St. 27 during the Ingolf Expedition. The polyp has a length of 2 cm. and a breadth in the capitular region of 0·4 cm., at the base it measured 0·3 cm. and was of a dark colour. The polyp was attached to a stone by an inconsiderable, irregularly triangle-shaped cœnenchyme on which a faint indication of another polyp was visible. The large polyp gradually increased in breadth towards the capitular region which is somewhat rounded. The capitular furrows are indistinct. The œsophagus is short, the hyposulcus well-developed. The body-wall at least in the upper part is greatly expanded and consequently thin. The ectoderm is almost half as thick as the mesoglœa, continuous and incrusted with mud and detritus particles, which partly at least give the animal its dark colour. The mesoglœa is quite filled with sand-grains and a few sponge-needles. It also contains numerous cell-islets and cells, but owing to the strong incrustations it is very difficult to get a true idea of the nature of the mesoglœa.

The sphincter resembles that of the other Isozoanthus-species. The œsophagus has the usual structure. The ectoderm contains thick-walled capsules 19—22 μ long. There are 36 mesenteries which are very much expanded so that the mesoglœa becomes very thin. The musculature seems to be weak; the micro-mesenteries are well-developed. The filaments contain a few specific, uniformly broad nematocysts (length 29—38, breadth 10—11 μ) besides some more frequently occurring egg-shaped capsules 13—15 μ and thick-walled capsules with distinct basal part to the spiral thread and somewhat broader at the one end (length 19 μ). The sexual organs were undeveloped.

Owing to the small amount of material I have not named this form.

Genus **Parazoanthus** Haddon and Shackleton.

Macrocnemic Zoanthidae with a diffuse entodermal sphincter muscle. The body wall is incrusted, the ectoderm is continuous. Encircling sinus as well as ectodermal canals, lacunae and cell-islets in the mesogloea. Dioecious. Polyps connected by thin coenenchyme, (coenenchyme without cylindric horny skeleton).

I have given the diagnosis of Haddon and Shackleton, which seems to me good, and have added the information, for the Genus Gerardia, that a true cylindric horny skeleton is wanting. I have placed this however in brackets, as I consider further examination of the Gerardia skeleton desirable, in order to ascertain how much of the skeleton actually belongs to the polyp, a determination that can hardly be made without fresh or at least well-preserved material. Though I consider the cylindric, connecting tissue of horn between the branches of the skeleton as being secreted by the polyps themselves, it is not quite excluded, that the other part of the skeleton belongs to another Anthozoon, — a condition undoubtedly existing as regards the basal part of the branched skeleton (cf. Lacaze-Duthiers 1864). If it should be the case, that only the peripheral branches of the so-called Gerardia skeleton have been secreted by the Zoanthid, the genus Gerardia approaches still more to the genus Parazoanthus and comes so near to this, that the question is, whether the two genera could not be thrown together, especially as the inner structure of the Gerardia polyp agrees completely with that of the Parazoanthus polyp even in such details as the presence of a well-developed encircling sinus. In this case the only difference would lie in the skeleton, certain parts of which are tube-shaped in Gerardia, while in Parazoanthus it is only present as a thin flat layer under the cœnenchyme, a difference which is not essential but gradual and certainly is only dependent on the somewhat unequal growth of the colonies. According to the rule of priority the genus name Gerardia would in such a case have to be changed to Parazoanthus — an alteration which cannot be made, however, until the question of the Gerardia skeleton has been definitely settled. Haddon has for the rest already in 1898 p. 408 expressed some doubt as to whether the skeleton in Gerardia was actually secreted by the polyps themselves, though without making any further investigation into the matter himself.

The Parazoanthus species described here are two in number, one of which has already (1889) been described in detail by Haddon and Shackleton, the other is new, named *P. Haddoni*. Further, I give here some supplementary details regarding the anatomy of *P. dixoni* Hadd. & Shackl.

No species of Parazoanthus were dredged by the Ingolf Expedition.

Synopsis of the *Parazoanthus* species described here.

A. Capitular region in the contracted state not or very little swollen. Number of mesenteries 36—46 ..... *P. haddoni.*

B. Capitular region in the contracted state swollen. Number of mesenteries 36—38.. *P. anguicomus.*

Parazoanthus haddoni n. sp.

Pl. 1, figs. 9—11. Pl. 7, fig. 5.

Jutland Reef 100—200 fm. G. Pettersson 1881 R. M.

Jæderen 100—170 fm. Tob. Andersson & Westergren 1877 R. M.

N. W. of Egersund 100 fm. N. Olsson & M. Uddström R. M.

Haugesund and Bergen in S. E. 15—21 miles from land 100—170 fm. Ol. Johansson R. M.

Stora Fiskebanken, Bergen in S. E. 100—180 fm. T. Andersson R. M.

N. W. of Bergen 30—200 fm. M. Olsson 1873, 1878; 90—200 fm. O. Mattson 1880; 100—150 fm. M. Uddström 1880 R. M.

N. N. W. of Bergen 90—200 fm. M. Uddström, G. Nilsson, M. Olsson 1880 R. M.

North Sea M. Uddström 1880 R. M.

North Sea north edge of the Fisher Bank 100—160 fm. B. Olsson R. M.

Size: The colonies form large aggregates sometimes of the size of a clenched fist and almost always fixed on sponges (1 spec. on an Ascidian). In the contracted state the polyps of the largest colonies (Pl. I. fig. 16) reach a length of 1·9 cm. and a breadth at the base of 1 cm. In most of the colonies the polyps are however considerably smaller.

Colour. In alcohol the colour varies from dirty yellowish (Pl. I fig. 10) to dirty grayish or pure white (Pl. I fig. 9—11). The dirty gray colour is generally predominant.

External appearance. The polyps form colonies often of large dimensions, which are attached to large sponges. The cœnenchyme is fairly thin and extensive and sometimes forms narrow outshoots, on the end of which new polyps are formed (Pl. I, fig. 9). A single colony, which by the way was not quite typical, was found on an Ascidian. The polyps generally sit quite close to each other, but sometimes the intervals between may be larger, especially when the cœnenchyme forms string-like outshoots. Even when the tentacles are completely covered by the body-wall, the polyps are generally considerably higher than broad. The breadth is however very considerable, greatest at the base and tapering upwards; sometimes the distal part may be somewhat swollen, especially in greatly contracted polyps, though never so much as in *P. dixoni* and *anguicomus*. Otherwise, the polyps vary much in size, as can be seen from figs. 9—11 on Pl. I, but there is no doubt that we are only dealing with one and the same species. The body-wall is more or less wrinkled especially in the larger specimens. The capitular furrows are generally distinct and reach up to 18—21 in number. The œsophagus is of moderate length. The siphonoglyphe is distinctly marked, the hyposulcus developed but rather short and does not attain to half the length of the œsophagus.

The cœnenchyme as well as the polyps is incrusted with sand-grains and sponge needles, to which are sometimes added a few foraminifera. The sand-grains are generally predominant, but in some cases the sponge-needles occur in quantities. The incrustation is not so strong as in *P. anguicomus* but is very variable. Sometimes polyps are also found which are very little incrusted.

Anatomical structure. The ectoderm of the body-wall is very high and continuous and contains nematocysts with greatly twisted thread of two different kinds, either large 41—46 μ long and 17—18 μ broad or small 24 μ long and 12—13 μ broad. The number of capsules is variable but the smaller ones are always more numerous than the larger and the proportional occurrence of both kinds of capsules seems to be always the same. When the polyps are not strongly expanded, the mesoglœa is somewhat thicker than the ectoderm. It is provided with numerous cells, cell-islets and lacunae and a well-developed encircling sinus. The cell-islets and lacunae are generally numerous (Pl. 7, fig. 5), sometimes however scarce. The lacunae are here and there in distinct connection with the ectoderm and encircling sinus. As a rule the latter is interrupted at a few places by mesoglœal parts and narrow. Sometimes, however, I have found fairly strong mesoglœal bridges together with a broader encircling sinus at the bases of the mesenteries, while the connecting canals between

these broader canal parts are narrow. This variation in structure of the encircling sinus is however probably due to different states of contraction in the polyps, which may be concluded from the fact, that the more abnormal encircling sinuses had a thicker mesoglœa and were more contracted, while the polyps with a more typical encircling sinus were expanded. But the fact also, that both kinds of encircling sinus may be found in the same colony, goes to show, that we are not dealing with a variety. The encircling sinus contains the same kind of nematocysts as the ectoderm of the body-wall.

The sphincter is more developed than in *P. anguicomus* and *dixoni*. While the muscular furrows in the distal part are large and semicircular, they lie on the other hand closer to each other in the proximal part (Pl. 3, fig. 6), though this cannot always be quite distinctly seen. The bases of the mesenteries are broken through by the sphincter, a condition that seems always to be present in the Zoanthidae with entodermal sphincter. In this region the sphincter has thus the appearance of being mesoglœal.

The ectoderm of the tentacles has the usual structure. The spirocysts are very numerous; further, there are numerous thick-walled capsules (length 22 μ) and very few capsules of the same kind as in the body-wall.

The ectoderm of the œsophagus is fairly high and deeply furrowed or smooth according to the varying state of contraction and provided with numerous, ca. 24 μ long, nematocysts. The ectoderm of the sulcus is somewhat thicker than in the œsophagus, while the mesoglœa is thicker.

The number of mesenteries varies between 36 (34?) and 46, but the latter is only seldom found and even specimens with 42 mesenteries seem to be scarce. Of the 14 specimens closely examined one (a small yellowish specimen from the same locality as the colony figured on Pl. I, fig. 10), has 34, possibly 36 mesenteries, 3 had 36, 4 had 38, 3 had 40, 2 had 42 and 1 had 46 mesenteries. Below the œsophagus the macro-mesenteries reach only a short way into the cœlenteron (in specimens not sexually mature). The longitudinal muscles are distinctly marked but form no or very faint furrows; the parieto-basilar muscles are weak. The distribution on the body-wall of both kind of muscles is fairly considerable. The micro-mesenteries are fairly well-developed, in the aboral part of the œsophagus several times longer than the entoderm of the body-wall is high.

The glandular tract contains numerous thick-walled capsules with distinct basal part to the spiral thread. They are somewhat broader at the one end and 17—22 μ long and 5 μ broad. Further, it contains capsules with spiral thread of the same appearance as in the body-wall; they seem always to be scarce and have a length of 36—43 μ and a breadth of 17—18 μ; smaller capsules are also found. Sometimes I have not found any of the large capsules in the filaments.

The polyps are dicœcious.

In the cœnenchyme, which is more or less incrusted, the canals lie nearer to the under than the upper side.

For systematic remarks see under *P. anguicomus*.

Parazoanthus anguicomus (Norm.) Haddon & Shackl.

Pl. I, fig. 19; Pl. II, fig. 21.

Zoanthus sulcatus Bowerbank 1867. Proc. Zool. Soc. p. 351.

— *anguicomus* Norman 1868. Shetland Report. Rep. Brit. Assoc. p. 310.

Polythoa (Taeniothoa) anguicoma Andres, Le Attinie 1883 532, 1884. p. 317.
Epizoanthus americanus var. Verrill, Report Blake. Bull. Harvard. Coll. 1883—85. Pl. 8, fig. 6.
Polythoa sp. Ridley, 1886. Proc. Roy. Irish Acad. (2) 4. Ser. p. 617.
Parazoanthus anguicomus (Norm.) Haddon. Trans. Dubl. Soc. 4 (2) 1891. Pl. 58, figs. 34—36, Pl. 59 figs. 11—12.

Localities: 35° 45′ 30″ N., 74° 48′ W. Verrill 1883—85.

40° 01′ N., 70° 22′ W. 98 fm. U. S. F. C. St. 2245. 1 colony of 4 specimens together with the typical *Epizoanthus incrustatus (americanus)*. Fig. 19, Pl. 1. R. M.

50° 57′ N., 10° 46′ W. 184 m. Michael Sars Exp. 1910. St. 96. 3 single spec. and 2 small colonies on Ascidians and Serpula tubes.

Shetland 1899. 1 colony.

Ireland; various specimens from Dublin Museum.

Formerly known localities: Shetlands. W. and S. W. of Ireland. See Haddon 1891.

Dimensions: Column 3—5 times as high as broad (Norman). Height of column, when fairly expanded (in spirit) 13 mm. The specimens from U. S. F. C. Height of column 0·7 cm., diameter of capitulum 0·4 cm.

Colour: Pinkish-white (Norman); preserved specimens sand-coloured.

External appearance. This species has been well described by Haddon and Shackleton (1891). Characteristic are the very deep furrows and the coarse ridges between these in the capitular region. The number of furrows and ridges seems to be about 18, as stated by Haddon. 6 of the polyps examined by me had 18 furrows, 1 had 17 and another 19. On small polyps the capitular furrows are less distinctly seen, but the future appearance of the furrows and ridges may be discerned. Haddon mentions, that the capitular region is swollen, when contracted. This is easily seen on some specimens, on others it is less distinct, as was the case with the specimens from the American coast (fig. 19, Pl. I). The œsophagus as well as the hyposulcus is of moderate length. The incrustations mainly consist of sand-grains but also of foraminifera and sponge-needles. The specimens dredged on the Michael Sars Expedition were very strongly incrusted and foraminifera also occurred in quantities.

Anatomical description. In 1891 Haddon described the anatomy of this species, but I am able to supplement his description on some points. The fairly numerous nematocysts with greatly twisted thread are almost double as long as broad (length ca. 24 μ, breadth ca. 12 μ). Very seldom large capsules also occur with slightly twisted thread, length 41—48 by 17—22, which are equally broad, rounded in the ends, but somewhat broader at the one end. In the sphincter region the encircling sinus is weak but otherwise it is very well-developed and has the appearance described by Haddon.

The sphincter has the appearance described by Haddon.

The ectoderm of the tentacles contains numerous spirocysts and some few, ca. 19 μ long, thick-walled capsules. The ectodermal musculature is moderately developed. Incrustations are also found in the tentacles.

The ectoderm of the œsophagus contains numerous thick-walled, narrow capsules with distinct basal part to the spiral thread; these are generally 19 μ, sometimes even 24 μ long. If present at all,

the nematocysts with twisted thread are very scarce. The mesoglœa is generally thick, so that the difference in thickness between this and the mesoglœa of the siphonoglyphe, which is somewhat thickened, is not so great as is usual among the Zoanthidae. The entoderm is thin and several times thinner than the ectoderm.

I have examined the arrangement of the mesenteries in 3 specimens, namely, 2 of those represented in fig. 19, Pl. I, and 1 from the Michael Sars Expedition. The first had 36 mesenteries, 19 on the one side, 17 on the other, otherwise the arrangement was typical according to the macrotype, the two mesenteries lying nearest the sulcus, one on each side, being micro-mesenteries. The second specimen had 38 mesenteries, 18 on the one side, 20 on the other, the third 36 mesenteries, 18 on each side; in the last two cases the mesenteries lying nearest the sulcus were macromesenteries. As the œsophagus in the aboral part is very wide, the mesenteries there become short, so that in the glandular tract and genital region they only occupy a small part of the gastrovascular cavity; the micromesenteries are moderately developed. The longitudinal muscles were strong but no folds were seen on my specimens; the parieto-basilar muscles were neither broad nor furrowed, they reach a long way on to the body-wall.

The filaments are very large and strong. The mesoglœa in the glandular region is very thick both in the intermediate tract and the glandular tract. This is undoubtedly in connection with the fact, that the mesoglœa of the œsophagus is so thick. The filaments thereby assume a very robust appearance. The ectoderm of the intermediate and the glandular tracts contains numerous thick-walled nematocysts, the spiral thread of which is plainly visible. They are much longer than in the œsophagus (length ca. 26—29 μ, in the North American form they are in greater agreement with the capsules in the œsophagus, breadth ca. 5 μ). Further, I have even observed some few large capsules of the same appearance as those in the body-wall but larger (length about 31 μ, breadth half the length).

Both the North American specimens sectioned by me were sexually mature and in both cases also ovaries were present.

Systematic remarks. As indicated by me in the synomymy list, the variety of *C. americanus* figured by Verrill in the Report on the Blake Expedition was no other than Norman's *Parazoanthus anguicomus*.

The three species *P. haddoni*, *dixoni* and *anguicomus* are evidently so closely related to each other, that in many cases it seems difficult to separate them, and especially *P. haddoni* and *dixoni* are very much alike in outer appearance. As Prof. Haddon, who had at his disposal a larger material of *P. haddoni* and *P. dixoni* than I have had for investigation and who also several years ago was so kind as to examine a colony (a coloured one with large polyps) of *P. haddoni* sent him by me, is of opinion, however, that they differ, I think I ought to consider them as two different species, though it is difficult to find really good distinguishing characteristics, especially in material which is not well preserved. The nematocysts agree quite well in *haddoni* and *anguicomus*, whereas they are somewhat but not very much larger in *P. dixoni*. In a colony of *P. dixoni* sent me by Prof. Haddon I found the following series of capsules. The large nematocysts of the body-wall with greatly twisted thread were 46—53 μ long and 19—20 μ broad, the smaller ones found in the capitular region were 26—29 μ long and 13—15 μ broad and occurred in quantities. The thick-walled capsules in the

œsophagus were 24—26 μ long. The filaments contained very few capsules 41 μ long and 18 μ broad like those in the body-wall and fairly many 19—22 μ long and thick-walled. In a polyp closely examined by me the number of mesenteries was 42 (20 on the one side and 22 on the other).

In the collections of the Riksmuseum there is a small colony of a Parazoanthus species from the Faeroes, but badly preserved. The nematocysts mostly resemble those of *P. haddoni*, but might quite well belong to *P. anguicomus* though not to *P. dixoni*, as they agree with the shortest ones in *P. haddoni* and *anguicomus*, while those of *dixoni* agree better with the longest ones. A transverse section of the body-wall of this form is given in fig. 6, Pl. VII, of this paper.

Appendix.

During the printing of this work a paper has appeared dealing with the genus Epizoanthus (Lwowsky: Revision der Gattung Sidisia Gray (Epizoanthus Auct.), Zool. Jahrb. Abt. Systematik Bd. 34, pp. 557—614, 1913). As this paper among other things sets up a new diagnosis for the genus I wish to discuss here the extent of this genus.

With regard first of all to the name, the author has replaced Epizoanthus with Sidisia, a change that would be justifiable according to modern rules of priority, if the type of Sidisia, *S. barlesi*, were in reality identical with *E. incrustatus*. Haddon and Shackleton (1891) certainly state, that this is the case, but they nowhere indicate, that they have had type specimens of *S. barlesi* for investigation. For this reason, as also that the Zoanthidae are difficult to determine from outer characteristics, I have above used the name Epizoanthus instead of Sidisia. Moreover I am in agreement with Haddon (1891, p. 634): "We do not propose to keep the name Sidisia for the genus, although it has priority and for this reason; it was solely erected for a species which is only a variety of an older form; and the name has only been occasionally retained for this variety of that particular species, whilst Epizoanthus has been universally adopted for the more typical forms of this genus. Both names were originated by Gray and we have therefore less hesitation in keeping to the latter".

In his diagnosis of the genus Sidisia Lwowsky states, that the sphincter in its proximal part may be entodermal as also that an encircling sinus may occasionally be present; he relies here on his investigation of *S. gracilis*. But in my opinion *S. gracilis* is in all probability not a Sidisia but a Parazoanthus species. So far as I can find, namely, the sphincter figured of *E. gracilis* is not a mesoglœal but an entodermal structure. That it seems mesoglœal in the distal part is due to this, that the section has cut through not only the body-wall but also a mesentery. And since the entodermal sphincter in the genus Parazoanthus becomes mesoglœal from cutting through the mesoglœa of the mesenteries, a great part of the sphincter in sections which just meet the mesenteries may have the appearance of being a weak mesoglœal sphincter. Such figures, like that drawn by Lwowsky for

S. gracilis, I have often obtained both in Isozoanthus and Parazoanthus species. It is difficult especially to obtain good figures of the entodermal sphincter in those polyps where the mesenteries lie very close together, for in such cases the section cuts not only the body-wall but also at the same time a mesentery. As *E. gracilis* is a form with small polyps and with numerous mesenteries, the section has certainly at one and the same time cut through the body-wall and mesenteries. I thus believe, that *S. gracilis* is a Parazoanthus species (a fact that Lwowsky in a letter to me seems willing to accept). Under such circumstances the additions in the diagnosis which Lwowsky makes with regard to the sphincter and encircling sinus must be dropped, for the indication of an encircling sinus, which the ectodermal canals are said to form in *S. balanorum*, has little resemblance to a true encircling sinus especially in the upper part of the polyp.

Thus the assumption, that an encircling sinus occurs in Epizoanthus, must also be rejected, though it is not inconceivable theoretically, that such may occur there. When we see, namely, that the macrocnemic Zoanthidae with entodermal sphincter may have (Parazoanthus) or lack (Isozoanthus) an encircling sinus, it is quite possible, that the same condition may be present in the macrocnemic Zoanthidae with mesoglœal sphincter. In this case it might be advisable to set up a new genus for forms with encircling sinus, distinct from Epizoanthus. Nevertheless *S. gracilis* cannot be taken as a type for this conceivable genus and just as little, it seems to me, *S. balanorum*.

Lwowsky states, that a specimen of *Epizoanthus norvegicus* examined by him had a brachycnemic arrangement of the mesenteries (l. c. p. 608) and thinks it probable, that Haddon and Shackleton (1891), just on account of the external habitus and the appearance of the sphincter, had concluded that this species was an Epizoanthus. Since Haddon and Shackleton in their short notice on this species remark upon the appearance of the incomplete mesenteries, they have certainly also examined the arrangement of the mesenteries. The specimens I have examined here above show a macrocnemic arrangement; 2 other specimens, of which I made sections, had the same arrangement. Lwowsky's specimen has thus — unless some mistake of locality has taken place — been a malformation, which sometimes occurs both in brachycnemic and macrocnemic Zoanthidae, the brachycnemic showing a macrocnemic type and the macrocnemic a brachycnemic, but only exceptionally, so far as I know (*Polythoa caribæa*), on more than on side of the body (Carlgren: Beobachtungen über die Mesenterienstellung der Zoantharien etc. Festskrift for Lilljeborg 1896, fig. 6a Pl. 8; Duerden: Jamaican Actiniaria Pl. 1, Zoantheae Sc. Trans. R. Dublin Soc. 6 (2) 1898 p. 331; this work p. 34). Further, disarrangement of the mesenteries sometimes occurs (Carlgren 1896 l. c. Pl. 8, fig. 5 a, 7). That a brachycnemic species should occur in Trondhjem Fjord is indeed little conceivable, since we know of no brachycnemic forms from European seas; these belong to tropical and subtropical seas. In any case Lwowsky's colony of *E. norvegicus* certainly merits closer examination.

Finally, I wish to point out an oversight of Lwowsky, which may possibly be misleading for his readers. On p. 568 he identifies "the reflected entoderm" with the cnido-glandular region instead of with the ciliated tract of the filaments (cf. Haddon & Shackleton's figs. 1, 6, Pl. 60. 1891).

I cannot conclude this appendix without emphasizing, that our investigations on the various Zoanthidae species require to be extended, if we are to reach more accurate knowledge as to whether

a form has to be regarded as a special species or as a growth form or variety. It is very probable indeed, that the Zoanthidae display great variation during growth, though the extent of this variation cannot be judged without exact investigation (it can hardly be more than supposed), but it also seems to me, that the number of species of Zoanthidae is large. I emphasize this especially with regard to Lwowsky's combining Zoanthidae described as separate species into one species Sidisia fatua. It is certain, that this requires revision. Even if the nematocysts in the body-wall are difficult to find or are lacking, yet the nematocysts in the filament especially would give valuable information.

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EXPLANATION OF LETTERS.

c. cuticula.
d. detritus.
di. diatoms.
eb. ectodermal bay.
ek. ectoderm.
en. entoderm.
enc. encircling sinus.
i. incrustations.
if. incrustations of foraminifera.
is. incrustations of sand.
iss. incrustations of spicula.
m. mesoglœa.
mc. mesoglœal-cells.
me. mesenteries.
mi. cell-islets in the mesoglœa.
ml. lacunae in the mesoglœa.
mu. muscles.
n. nematocysts.
rm. transverse muscles.
z. zooxanthellae.

ABBREVIATIONS IN THE TEXT.

N. N. A. E.: Norwegian North-Atlantic Expedition.
R. M.: Riksmuseum of Stockholm.
U. S. F. C.: United States Fish Commission.
Ups. M., U. U. Z. M.: Zoological Museum of the university Upsala.

Plate I.

Plate I.

Fig. 1. *Isozoanthus arborescens* $^{2}/_{1}$ (from Mortsund).
— 2. — — $^{1}/_{1}$ (from Tranödybet).
— 3, 4. — *danicus* $^{2}/_{1}$ on oyster shells. In fig. 3 also on the right side an Ascidian.
— 5. — *bulbosus* $^{2}/_{1}$ (Römer & Schaudinn).
— 6. — — $^{2}/_{1}$ (from Ingolf Exp. St. 104).
— 7. — *magninsulosus* $^{1}/_{1}$ (from Ingolf Exp. St. 10).
— 8. *Epizoanthus paguriphilus* $^{1}/_{1}$ (from Michael Sars Exp. 1900).
— 9. *Parazoanthus haddoni* on sponges $^{1}/_{1}$ (from N. N. W. of Bergen. Uddström R. M. No. 270).
— 10. — — $^{1}/_{1}$ (from N. W. of Bergen. Mattsson 1880 R. M. No. 740).
— 11. — — on sponges $^{1}/_{1}$ (from N. N. W. of Bergen. Uddström R. M. No. 270).
— 12. *Epizoanthus norvegicus* (from Trondhjem Fjord).
— 13. — *danielsseni* $^{2}/_{1}$ (from Sophia Exp.).
— 14. — *erdmanni* $^{1}/_{1}$ (from Spitzbergen Exp. St. 42).
— 15. — *danielsseni* a little magnified (from Spitzb. Exp. St. 42).
— 16. — *erdmanni* $^{4}/_{1}$ capitulum from the oral side.
— 17. — *erdmanni* $^{1}/_{1}$ (from Greenland Exp. 1899).
— 18. *Isozoanthus multinsulosus* $^{2}/_{1}$ (from Ingolf Exp. St. 51).
— 19. *Parazoanthus anguicomus* $^{2}/_{1}$ (= *E. americanus* var. Verrill U. S. F. C. St. 2245).


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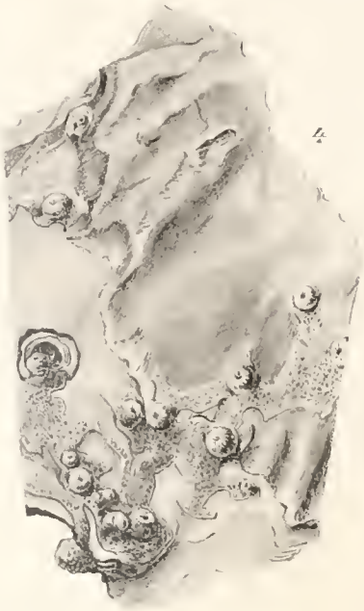
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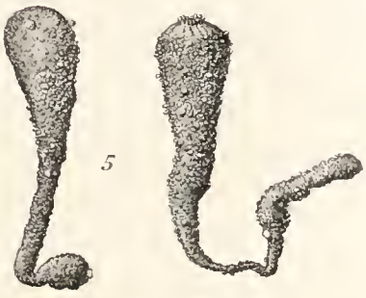
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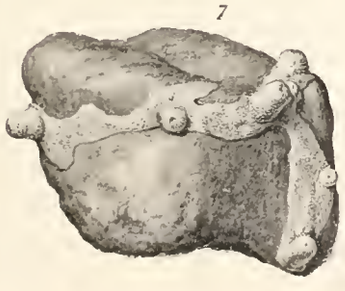
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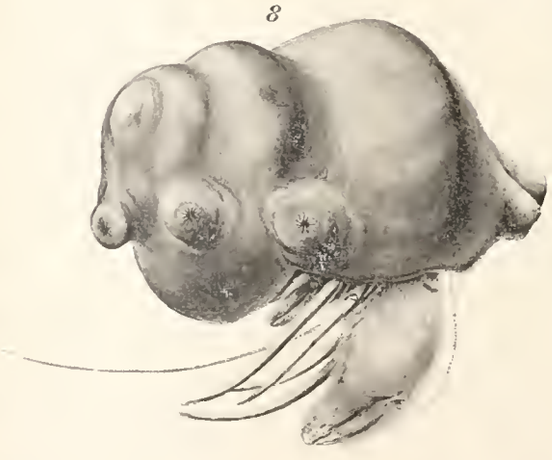
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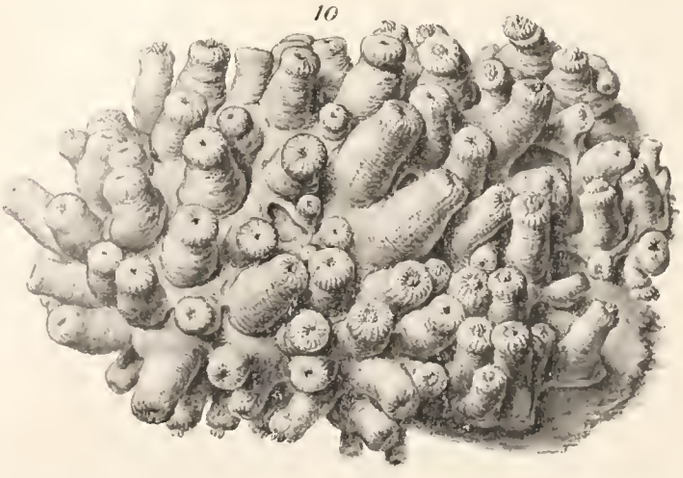
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Ljustr. A.B. Lagrelius & Westphal. Stockholm

Plate II.

Plate II.

Fig. 1—5. *Epizoanthus glacialis* (fig. 1 from Umenak $^{1.5}/_{1}$; fig. 2 from Jan Mayen $^{2}/_{1}$; fig. 3 from Norw. Nord. Atl. Exp. St. 164 (type) $^{2}/_{1}$; fig. 4 from Ogsfjord, Lovén $^{2}/_{1}$; fig. 5 from Umenak 25 fms. $^{2.5}/_{1}$.

— 6. *Epizoanthus danielsseni* (from Norw. N. Atl. Exp. St. 164) about $^{2}/_{1}$.

— 7. — *tindahli* var. nordgaardi about $^{2}/_{1}$.

— 8. — *abyssorum* about $^{2}/_{1}$.

— 9. — *danielsseni* var. loveni $^{2}/_{1}$.

— 10. — *beercnislandicus* $^{2}/_{1}$.

— 11. — *tindahli* (from Baffins Bay, Lindahl) enlarged somewhat more than 2 times.

— 12. — — (from Michael Sars Exp.) $^{2}/_{1}$.

— 13. — — (from Ingolf Exp. St. 32) about $^{2}/_{1}$.

— 14. — *bulbosus* dissected specimen showing the mesenteries (from Ingolf Exp. St. 104 about $^{2}/_{1}$).

— 15. *Epizoanthus bulbosus* (from Ingolf Exp. St. 104 about $^{2}/_{1}$).

— 16. — — (from Ingolf Exp. St. 32 about $^{2}/_{1}$).

Fig. 17. *Epizoanthus davisi* (from Ingolf Exp. St. 32 about $^{2.5}/_{1}$).

— 18. — *erdmanni* var. *aurivillii* (from Kvenangen) about $^{2.5}/_{1}$.

— 19. *Isozoanthus dubius* (from Ingolf Exp. St. 45) about $^{2}/_{1}$.

— 20. — *islandicus* (from Ingolf Exp. St. 90) about $^{2}/_{1}$.

— 21. *Parazoanthus anguicomus* (from Dublin Museum) about $^{1.75}/_{1}$.

— 22. *Epizoanthus norvegicus* (from Trondhjem Fjord, Bergen Museum) $^{1.5}/_{1}$, on the left a large double polyp.

— 23. *Epizoanthus koreni* (from Ingolf Exp. St. 144) $^{2}/_{1}$.

— 24. — *erdmanni* (from Iceland Ofjord) about $^{2}/_{1}$.

— 25. *Isozoanthus ingolfi* (from Ingolf Exp. St. 27) about $^{2}/_{1}$.

— 26. *Epizoanthus incrustatus* (R. M. 23. 5. 1888) about $^{1.75}/_{1}$.

— 27. *Isozoanthus arborescens* (from Ingolf Exp. St. 97) about $^{1.75}/_{1}$.

— 28—29. *Epizoanthus erdmanni* var. *aurivillii* (from Kvenangen) $^{2.25}/_{1}$.

N. Holmgren phot.

Ljustr. A.B. Lagrelius & Westphal, Stockholm

Plate III.

Plate III.

Vertical sections through the sphincter muscles. In the figs. 1—3, 5 the distal part of the sphincter is turned upwards, in the figs. 4 and 6 downwards.

Fig. 1 of *Epizoanthus abyssorum* $^2/_3$ [1].
— 2 - — *beerenislandicus* $^4/_3$.
— 3 - — *norvegicus* (from Skarnsound) $^2/_3$.
— 4 - — *roseus* $^2/_3$.
— 5 - *Isozoanthus arborescens* (from Ingolf Exp. St. 97) $^4/_3$.
— 6 - *Parazoanthus haddoni* (from N. W. of Bergen, Mattson 1880 $^2/_3$).

[1] Magnifications refer to Reichert's system "Austria". Figures drawn on the level of the microscope's foot.

Plate IV.

Plate IV.

Fig. 1. *Epizoanthus boreoislandicus*. Transverse section through the body-wall $^4/_3$ [1].

— 2. — *glacialis*. Vertical section through the sphincter (from Norw.. N. Atl. Exp.) $^2/_3$.

— 3. — *erdmanni* — — — — — (from Lyngen, Nordgaard) $^4/_0$.

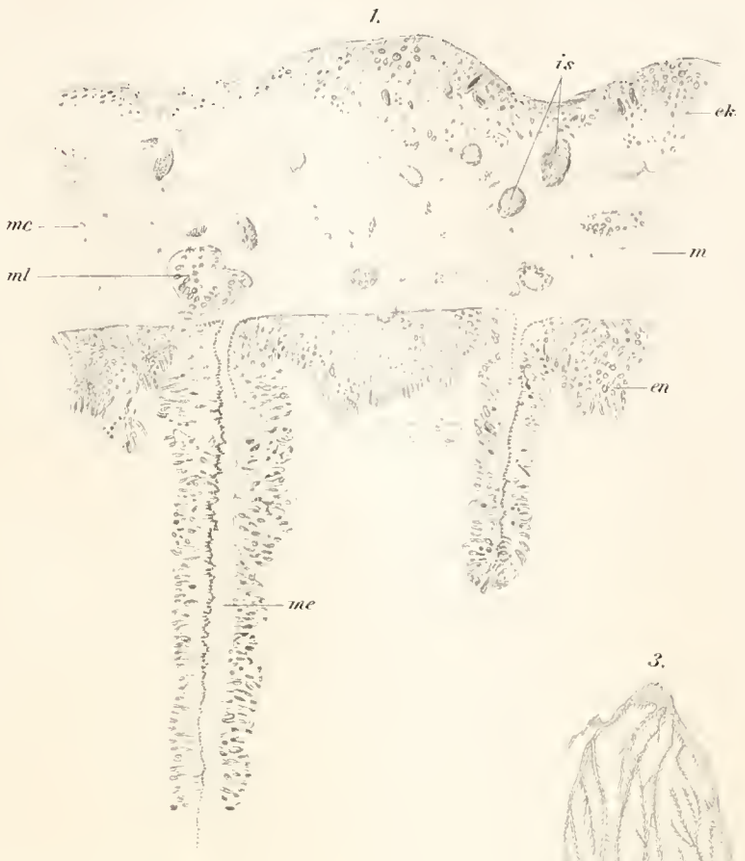
— 4. — *koreni*. Transverse sections through the body-wall $^4/_3$.

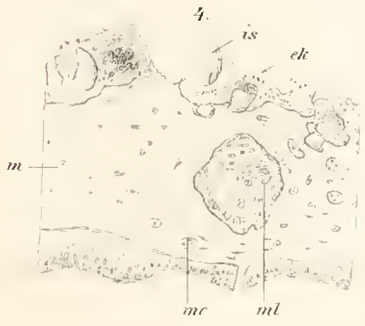
— 5. — *lindahli*. — — — — — (from Baffins Bay) $^4/_3$.

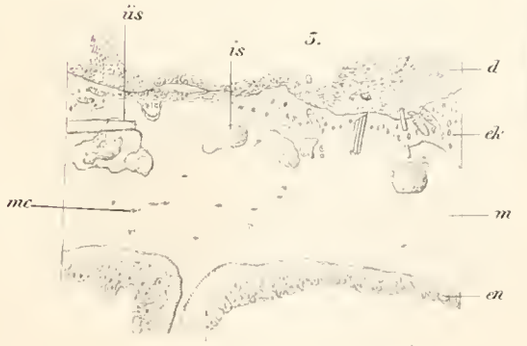
— 6. — *glacialis* — — — — — upper part. $^4/_3$.

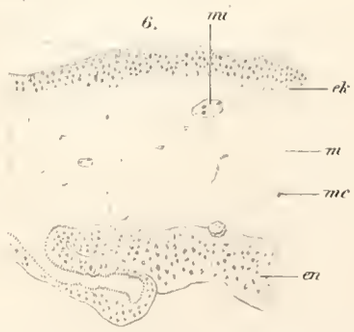
— 7. — *glacialis* — — — — — lower part. $^4/_3$.

[1] Cf. Pl. III.









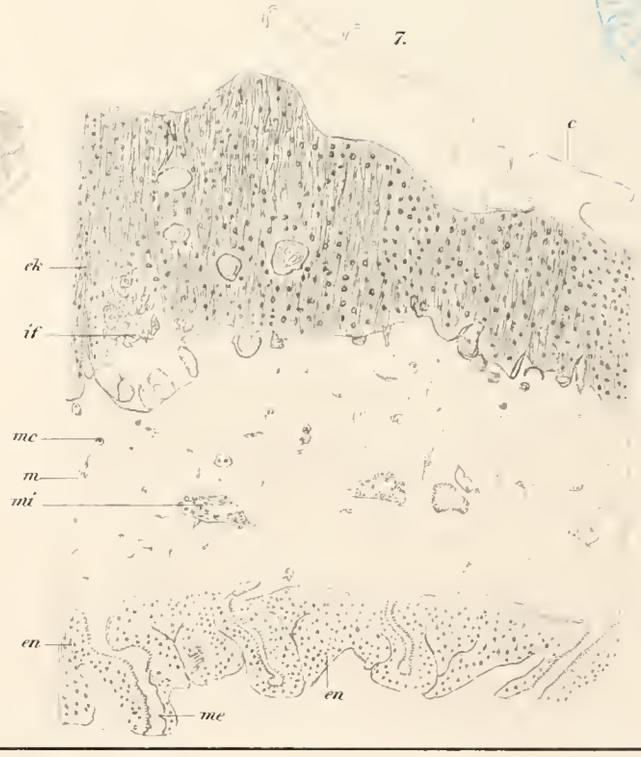


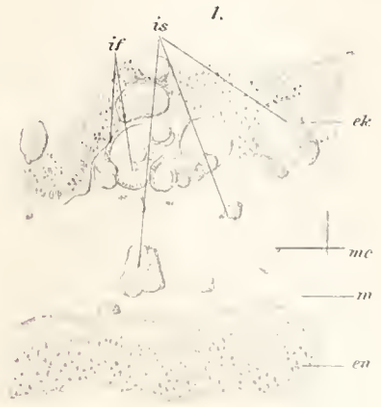
Plate V.

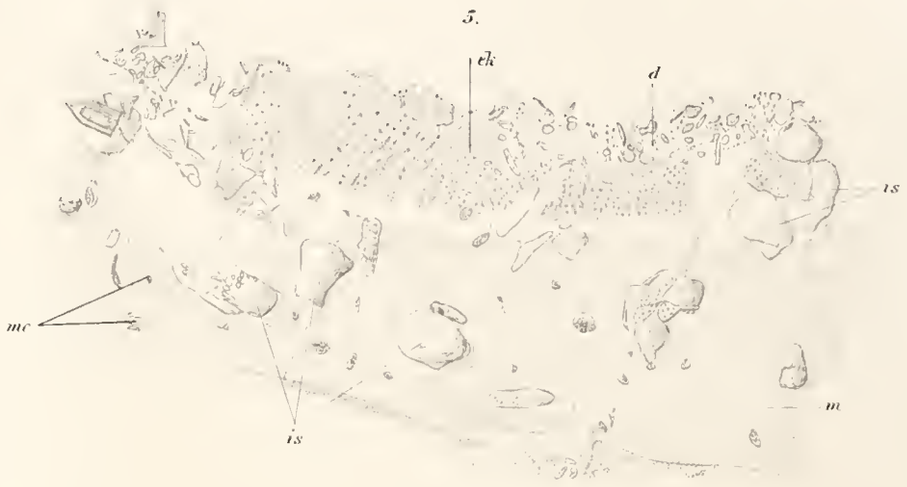
Plate V.

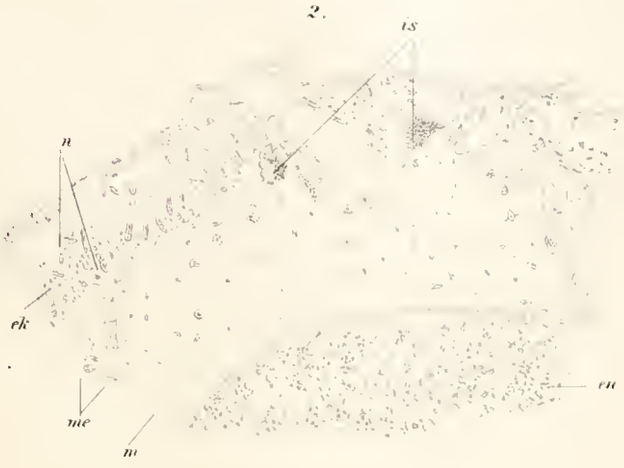
Transverse sections through the body-wall, figs. 1, 3—7 in the region of the œsophagus. Entoderm not drawn in figs. 3, 5, 6.

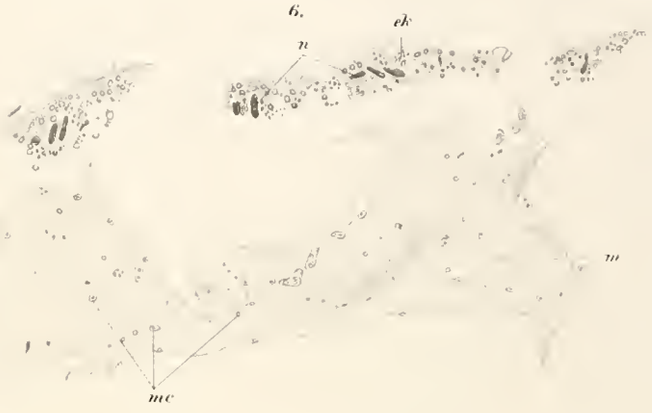
Fig. 1 of *Epizoanthus danielsseni* (from Spitsb. Exp. St. 42) $^4/_3$ [1].
— 2 - — *norvegicus*, capitular region (Trondhjem Fjord, Östergren) $^4/_3$.
— 3 - — — (— — —) $^4/_3$.
— 4 of *Epizoanthus erdmanni* (Lyngen, Nordgaard) $^4/_3$.
— 5 - — — var. *aurivilli* (Finmarken, Goës & Malmgren) $^4/_3$.
— 6 - — *roseus* $^4/_3$.
— 7 - — *abyssorum* $^4/_3$.

[1] Cf. Pl. III.









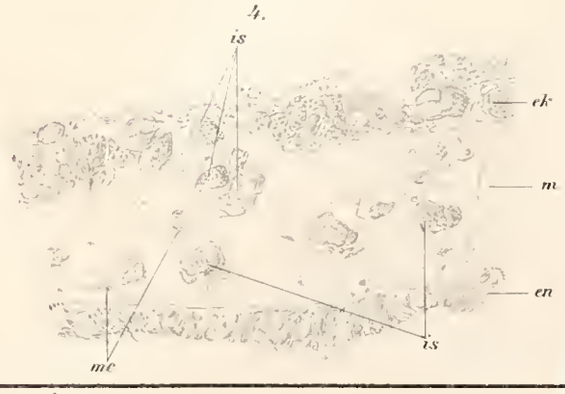


Plate VI.

Plate VI.

Transverse sections of the body-wall figs. 1, 3, 5 in the region of the œsophagus; figs. 2, 4 in the cnido-glandular tract of the filaments, fig. 6 in the hyposulcus region (Magnification $^4/_3$ Reichert's "Austria"; the figures drawn on the level of the microscope's foot; fig. 1 same magnification but with drawn out tube. Entoderm not drawn in figs. 1—4).

Fig. 1 of *Isozoanthus bulbosus* (from Ingolf Exp. St. 104).
— 2 - — *arborescens* (from Mortsund, Nordgaard).
— 3 - — *multinsulosus* (from Ingolf Exp. St. 51).
— 4 - — *magninsulosus.*
— 5 - — —
— 6 - — *ingolfi* (from Ingolf Exp. St. 27).

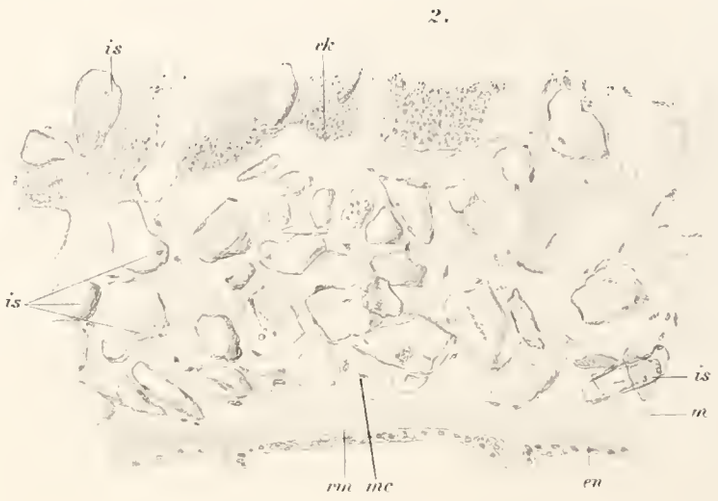


Plate VII.

Plate VII.

Transverse sections through the body-wall in the region of the œsophagus; fig. 5 in the region of the cnido-glandular tract of the filaments, figs. 1—4 magnification $^2/_7$ Reichert's "Austria". Figures drawn on a level with the stage of the microscope.

Fig. 1 of *Isozoanthus davisi.*
— 2 - — *islandicus.*
— 3 - — *dubius.*
— 4 - — *danicus.*
— 5 - *Parazoanthus haddoni* (from N. W. of Bergen, Mattson 1880) $^2/_3$ with drawn out tube.
— 6 - — ? (from the Færoes) $^2/_3$ with drawn out tube.

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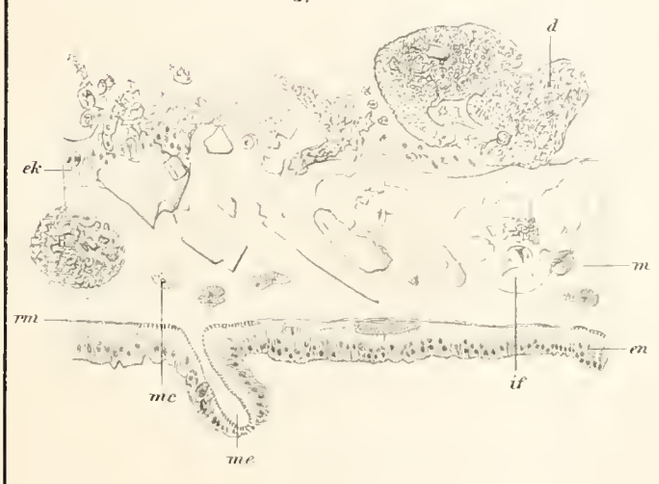
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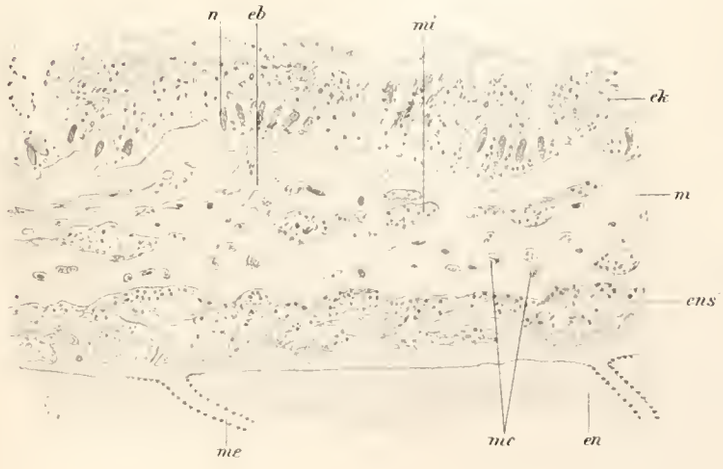
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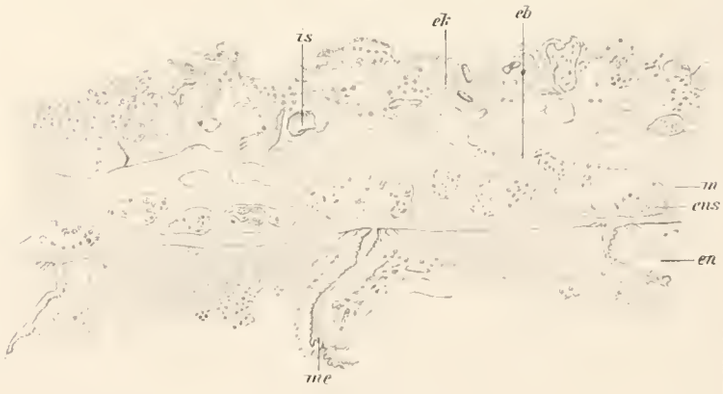
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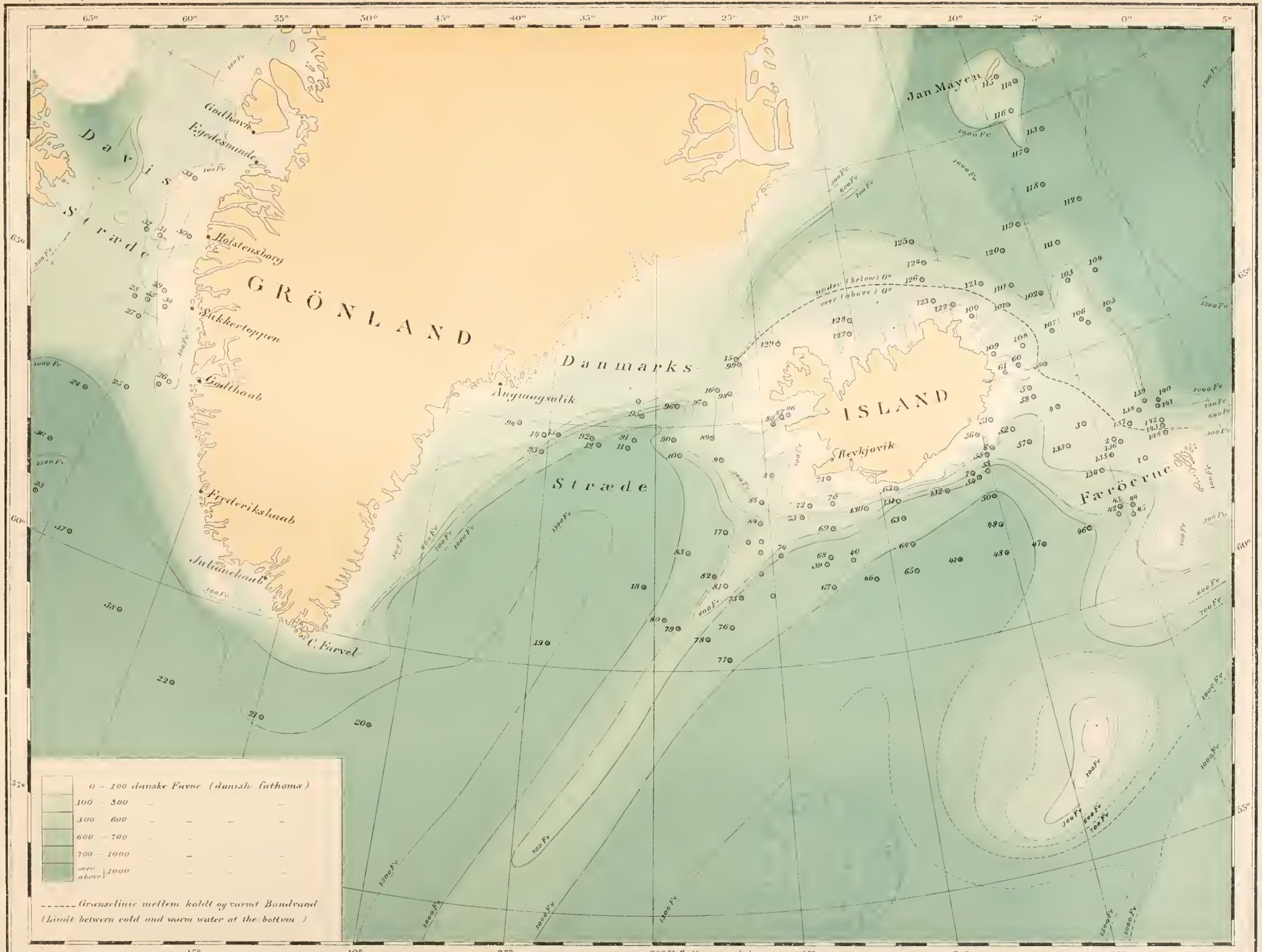
THE INGOLF-EXPEDITION

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					


Davis Strædet
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Godthaab
Frederikshaab
Julianehaab
C. Farvel
Danmarks Strædet
Angmagssalik
ISLAND
Reykjavik
Færöerne
Jan Mayen
0 - 100 danske Favne (danish fathoms)
100 - 300
300 - 600
600 - 700
700 - 1000
over 1000
Grænselinie mellem koldt og varmt Bundvand
(Limit between cold and warm water at the bottom)
30° V f Greenwich

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