

# THE DANISH INGOLF-EXPEDITION.

VOL. IV, PART 13.

CONTENTS:

*S. G. HEDING*: HOLOTHURIOIDEA. II

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H. HAGERUP.

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# THE DANISH INGOLF-EXPEDITION

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VOLUME IV

13

## HOLOTHURIOIDEA

PART II

ASPIDOCHIROTA—ELASIPODA—DENDROCHIROTA

BY

S. G. HEDING

D 2352

WITH 2 PLATES AND 43 FIGURES IN THE TEXT

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## Introduction.

The present paper is the second and last part of the report on the Holothurians collected by the Danish "Ingolf"-Expedition. The first part appeared in 1935, and contained the Synaptids—the Molpadids and the Molpadid-like forms. As in the case of the first part this was also worked out in correspondence with the description of the collection of the German "Valdivia"-Expedition, a method which has among others given the specially valuable result that the real place of the "Molpadid-like" forms described in 1935, is now verified, i. e. within the *Aspidochirota*, close to *Pseudostichopus* (cfr. pag. 4).

Beside the "Ingolf" material, this paper also includes the collections made by the Danish research steamers "Thor" and "Dana", as well as some collections made by AD. S. JENSEN on board the Norwegian research steamer "Michael Sars", and the North Atlantic material from the collections of the Zoological Museum, Copenhagen. As, however, the first part of this report included all this material, this second part only deals with the material collected at depths greater than 300 m.

This material includes 22 genera and 35 species.

Of these forms three genera, five species and two varieties are new to science, and besides, the detailed study of these large collections has cleared up more of the intricate problems of the classification of the Atlantic Holothurians, as well as throwing light on the variation within some of the species.

The abyssal Holothurian fauna of the Atlantic is mainly to be regarded as a branch of the Indo-Pacific abyssal fauna, which, however, shows clear trace of developing into an endemic fauna, especially in the northern part of the ocean. Several of the species found in the Atlantic can only with difficulty be separated from the corresponding Indo-Pacific species, but as they are in reality

different I have supposed it the better, as a rule to maintain or establish such forms as independent species or where sufficient material shows the limits more clearly and the differences are but faint, to describe subspecies, and for the same reason some few cases are described as subgenera. Some authors, it is true, are as a matter of principle against such a dividing up into minor classificatory groups, and state with right that future material in many cases will show that many species or varieties are identical. This may be, but as long as we are left to work with more or less scattered collections, all possible differences must be recorded and classified. Only in this way we are able to see the faint variations which correspond to different localities and conditions.

Though the greater part of the abyssal Atlantic Holothurian fauna appears to be of Indo-Pacific origin, there is a little group which must be regarded as being of Arctic origin. This latter consists, however, mainly of species which are not so pronouncedly abyssal, and especially the "Ingolf"-Expedition has shown how the real abyssal species are unable to cross the ridge between the Faroes, Iceland, and Greenland, e. g. species such as *Elpidia glacialis* and the three closely related species of *Trochostoma thompsoni*, *boreale* and *arctica* (cf. Ingolf Holothurioidea I p. 57).

The present material considered in connection with that of the "Godthaab" Expedition gives further an interesting distribution for some of these species, as they are found in the Norwegian Sea and in Baffin Bay, but not south of the ridges from the Faroes-Iceland-Greenland-Baffin Land. As there is apparently no deeper connection between the Baffin Bay and the Norwegian Sea north of Greenland, these species either would be expected south of the ridges, but are not found there, or they may have been distributed along the north coast of Greenland in a former geological period, being then survivors in Baffin Bay.

## Ordo Aspidochirota.

### Family Holothuriidae.

#### Subfamily Stichopodinae.

The subfamily *Stichopodinae* is, in the "Ingolf" collections, represented by two species, *Stichopus regalis* (Cuvier), and *Parastichopus tremulus* (Gunnerus). Of these *Pa. tremulus* is fairly common in the northeastern Atlantic, whereas *Stichopus regalis*, which is a Mediterranean species, was taken only a single time in the northern Atlantic by the "Helga". At first I was inclined to regard the two small specimens from "Thor" St. 3 as juvenile specimens of *Parastichopus tremulus*, in which the deposits other than tables were not developed, but the large specimen from the "Thor" St. 213, shows definitely that these specimens cannot be referred to the genus *Parastichopus*, but should be regarded as true *Stichopus*.

The examination of the collections of these two species shows

that the variation of the tables is not nearly so great as within the genus *Bathyplores*, the only difference being that the tables of the ventral side are slightly smaller than those from the other areas of the body wall.

As to the distinction between the two genera *Parastichopus* and *Stichopus* I agree with H. L. CLARK, though MORTENSEN, in 1927, does not find the genus *Parastichopus* "sufficiently warranted". The presence of large spinous, often branched rods in the body wall and the very characteristic "star-shaped" spicules separate *tremulus* from the real *Stichopus* species, so that I have no doubt that it is a valid genus, a supposition which is also adopted by DEICHMANN (1937 and 1938).

Genus *Stichopus*.

*Stichopus regalis* (Cuvier).

Mortensen 1927: British Echinoderms p. 391, figs. 232-233.  
Mayer 1937: Die Holothurien der Adria, p. 22, figs. 12 & 13.

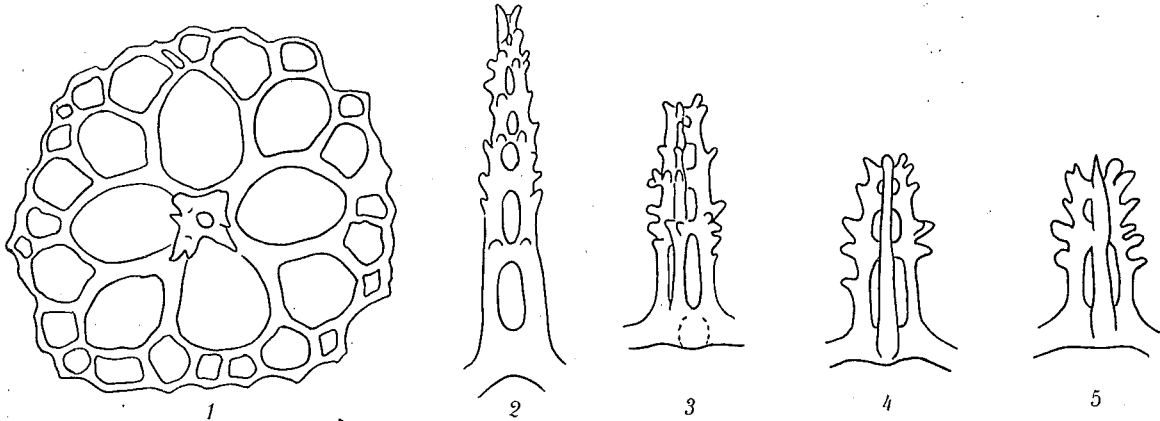
Localities:

- 58°32' N. 4°18' E. "Thor" St. 3, 30/4-03, 280 m. . . . . 2 spec.
- 58°18' N. 10°08' E. "Thor" St. 213, 10/3-04. 470 m. . . . . 1 -

- 61°07' N. 9°30' W. "Thor" St. 78, 12/5-04, 835 m. . . . . 2 spec.
- 61°15' N. 9°35' W. "Thor" St. 99, 22/5-04, 900 m. . . . . 1 -
- Skagerrak "Thor" 1911 . . . . . 4 -
- 61°08' N. 8°47' W. "Dana" St. 3026, 23/6-27 . . . . . 1 -

The specimens quite agree with the descriptions, except that the ventral tables are a little smaller than those of the dorsal side.

The shape of the tables (textfig. 2 1-2) is very constant and quite different from that of the tables in the specimens referred to *Stichopus regalis* above (cf. textfig. 1 1-5). Besides the tables,



Textfig. 1. *Stichopus regalis*, tables from the dorsal side. × 300.

As stated above I supposed at the preliminary examination of the two specimens from St. 3 that they were but young specimens of *Parastichopus tremulus*. A closer examination of them as well as of the specimen from St. 213 definitely showed that the real genus *Stichopus* was represented, and as there are no clear differences between the specimens present and *regalis* they should be referred to that species.

*Stichopus regalis* is previously recorded from the west coast of Ireland; and there is no doubt that the "Helga" specimens are the same species as those collected by the "Thor". Whether these specimens are in reality the Mediterranean *regalis* is not quite certain, but as said above there are no clear differences.

there are numerous more or less spiny rods in the body wall as also in the water vascular appendages. In the body wall there are numerous "star shaped" deposits.

*Parastichopus tremulus* does not seem to be widely distributed.

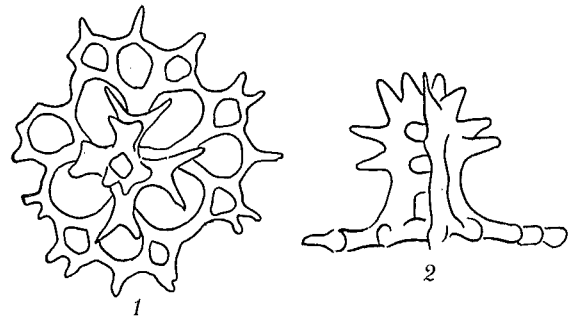
Genus *Parastichopus* Clark 1922.

*Parastichopus tremulus* (Gunnerus).

Mortensen 1927: British Echinoderms p. 389, figs. 228 1 & 231.

Localities:

- 58°32' N. 4°18' E. "Thor" St. 3, 30/4-03, 280 m. . . . . 3 spec.
- Skagerrak "Thor" St. 24, 10/3-04, 835 m. . . . . 1 -



Textfig. 2. *Parastichopus tremulus*, tables from the dorsal side. × 300.

It is recorded from the Bay of Biscay and the Canaries, but in spite of this it should be regarded as a Scandinavian and English species.

Family *Gephyrothuriidae* KOEHLER & VANEY.

Heding 1935: Holothurioidea of the "Ingolf" Expedition I pag. 77.  
Heding 1940: Holothurien der Deutsche Tiefsee Expedition II pag. 142.

The family *Gephyrothuriidae* is represented in the collections of the "Ingolf" Expedition by only a few specimens belonging to the two species *Molpadiodemas acaudum* Heding and *Plicastichopus ingolfi* n. sp., the first of which was described in the "Ingolf" Holothurioidea I pag. 78 as a member of the order *Gephyrothurioidae* Heding, which cannot be maintained.

As shown in my report on the Holothurians of the German Deep-Sea Expedition, the family *Gephyrothuriidae* must be placed within the *Aspidochirota* of equal standing with the *Holothuriidae*

and the *Synallactidae*. Further some of the genera hitherto regarded as Synallactids must be removed from that family and placed in the family *Gephyrothuriidae* viz. the genera *Pseudostichopus* and *Benthothuria*.

Genus *Molpadiodemas* Heding 1935.

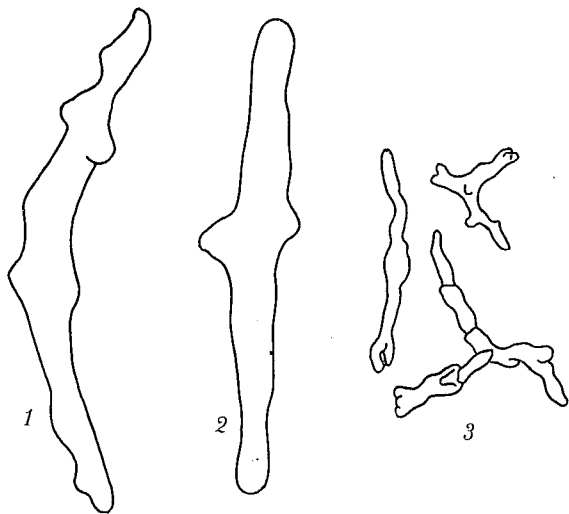
*Molpadiodemas acaudum* Heding.

Heding 1935: Holothurioidea I, the Ingolf Expedition. p. 78.

As shown in my report on the German Deep-Sea Expedition and as stated above, the order *Gephyrothurioidae* cannot hold

good, and the family *Gephyrothuriidae* must be placed among the aspidochirote Holothurians where it includes the genus *Pseudostichopus* and allied forms.

To my former description of this species I have little to add, but it is of the greatest value for the classification of these specimens that they have in reality a vertical pygal furrow, though



Textfig. 3. *Molpadiodemus acaudum*. 1-2, rods from the tentacles. 3, rods from the gonads. 1-3  $\times 300$ .

it is not very distinct on account of the shape of the body. Further they have some few calcareous deposits in the tentacles and in the gonads (textfig. 3 1-3) though deposits, as stated, do not occur in the body wall nor in the rudimentary tube-feet. Also repeated examination did not reveal any deposits in the pygal furrow and the respiratory trees.

Not only the presence of the pygal furrow but also that of deposits in the tentacles and the gonads, though such are lacking in the body wall, places this species within the *Pseudostichopus* group. I have no doubt as to the validity of the genus *Molpadiodemus* but as to that of the species there may be some doubt, as in reality *acaudum* in several respects resembles *atlanticus* Perrier. How far these two species are in reality synonyms cannot for the present be ascertained.

#### Genus *Plicastichopus* Heding 1940.

##### *Plicastichopus ingolfi* n. sp.

Plate I, figs. 4-5.

##### Localities:

61°44' N. 30°29' W. "Ingolf" St. 18, 2137 m, temp. 3° 0 C. 2 spec.  
58°20' N. 40°48' W. "Ingolf" St. 20, 3192 m, temp. 1° 5 C. 1 -

Diagnosis: *Pseudostichopus*-like Holothurians with a distinct pygal furrow and large lateral papillae each with one terminal and several lateral tubefeet. There are also tubefeet scattered all over the dorsal side, those along the dorsal ambulacra being

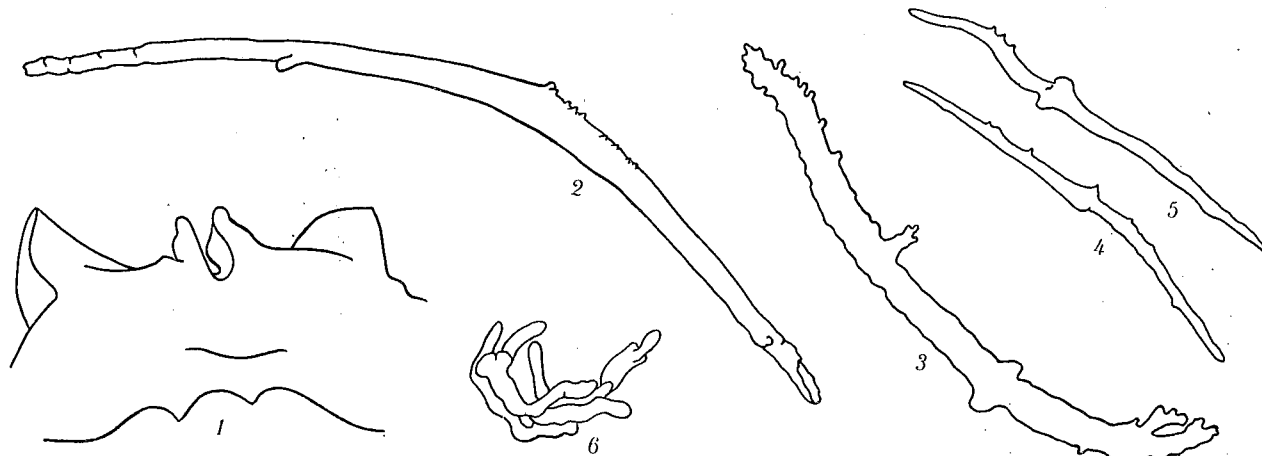


Textfig. 4. *Plicastichopus ingolfi*, a part of the left dorsal ambulacrum with three lateral papillae, showing small scattered tube-feet.

larger than the others. On the ventral side there are either no or very few and rudimentary tube-feet. Tentacles twenty. Polian vesicles one or two, and stonecanal quite lacking or very rudimentary, with faint traces of a madraporite. Respiratory trees paired but with a common origin. Calcareous deposits lacking in the body wall but present in the tentacles and in the terminal ends of the tube-feet.

Description: The specimens measure from 4 to 7 cm in length and are in shape (Plate I, fig. 4) fusiform with a fairly flat ventral side. Along the ventrolateral ambulacra there are about twenty large conical papillae, each with a large terminal and a number of smaller lateral tubefeet (cf. Plate I, fig. 5, textfig. 4). Along the dorsal ambulacra there are two rows of alternating large tubefeet or small papillae with a terminate large tubefeet.

The mouth is ventral, and the anal opening is situated in a fairly deep vertical pygal furrow. There are twenty tentacles; directly counted there are but 17, the shape of the calcareous ring, however, indicates twenty. In the type specimen there is but one polian vesicle. In the other specimens there are, however, two polian vesicles. The stone-canal is faintly developed or quite rudimentary. The respiratory trees are fairly large but with a common origin.



Textfig. 5. *Plicastichopus ingolfi*. 1, right ventral radial  $\times 15$ . 2 and 3, rods from the tentacles, 4 and 5, rods from the gonads. 6, spicules from the end of a minor tube-foot. 2-6  $\times 300$ .

Calcareous deposits are lacking in the body wall but present in the tentacles, the gonads, and in the tips of the tube-feet (text-fig. 5 2-6). *Plicastichopus ingolfi* appears to be a well limited species; it resembles only *Pseudostichopus plicatus* Koehler & Vaney, and there are indeed some reasons for thinking that they are synonymous, but as for the present we do not know *plicatus* sufficiently well it would be unsafe to refer this very characteristic Atlantic species to the Indo-Pacific form.

### Genus *Benthothuria* Perrier.

Cf. Heding 1940: Die Holothurien der Deutschen Tiefsee-Expedition p. 363.

#### *Benthothuria funebris* Perrier.

R. Perrier 1902: Holothuries, "Travailleur" et "Talisman", p. 365.

Locality: 61°50' N. 56°21' W., Ingolf St. 36, 2700 m, 1°5 C. — 1 specimen. The single 140 mm long specimen is rather badly preserved, and especially exteriorly it is not possible to ascertain

other features than the ventrally bent mouth with its twenty tentacles. There are two large polian vesicles and two large free respiratory trees. The intestine is fairly well preserved, and only a small part is disturbed, but as this part is the oesophagus, the possible presence of a coecum cannot be ascertained. The longitudinal muscles are unpaired, consisting as in *B. valdiviae* of numerous longitudinal portions.

I have no doubt that this specimen is in reality *Benthothuria funebris* Perrier, only the two polian vesicles and the shape of the longitudinal muscles justify its reference to *B. valdiviae* Heding. This latter species is however so closely related to *B. funebris* that it is fairly difficult to separate them by other features than the general appearance. Of the two main differences that of the polian vesicles cannot, as seen from this "Ingolf" specimen, be maintained.

As to the difference in the arrangement of the papillae I have already stated in the "Valdivia" report that this arrangement cannot be used for identification, owing to the usually badly preserved specimens.

Thus it might be supposed that these two species are synonyms, but the very different localities and the differences in the general appearance (*valdiviae* is the more flat) are against such a supposition.

## Family Synallactidae.

### Genus *Mesothuria* Ludwig.

Heding 1940: Die Holothurien der Deutschen Tiefsee Expedition II p. 117.

In the Handbook of British Echinoderms, MORTENSEN records three species of *Mesothuria* from the British Isles, viz. *intestinalis*, *lactea*, and *verrilli*, and suggests that six other species may be found in the deeper waters of the northern Atlantic.

Of these species the "Ingolf" Expedition collected but three, *intestinalis*, *lactea*, and *maroccana*, and beside these two others, *bifurcata* Hérouard and *cathedralis* Heding. It is surprising that *verrilli* was not found by the "Ingolf", and still more so that *bifurcata* was taken in the northern Atlantic, as it was previously taken only by the "Belgica" in 77°14' S. 89°14' W. It seems possible that the specimen is erroneously determined, a supposition which is the more likely because the type specimen is but a juvenile measuring 8 mm in length, and that HÉROUARD has not figured the calcareous deposits (only their bifurcate arms). In spite of this I have, however, little doubt that the "Ingolf" specimen is in reality HÉROUARD's species, and I cannot find any good reason for establishing a new one. Thus the question arises, how far the presence of *bifurcata* in the northern Atlantic indicates any bipolarity, but as I do not find evidence for bipolarity in Holothurians I think that we have here a further proof of the conformity of the abyssal faunas of the Atlantic and the Indopacific (at any rate the southern part).

As to *verrilli*, this species is by some authors regarded as a synonym of *intestinalis*, but PERRIER and DEICHMANN have definitely shown that it differs clearly and must be regarded as a valid species. According to DEICHMANN one of the characters which most distinctly separates *verrilli* from *intestinalis* is the presence of the so-called "reduced tables" in the tube-feet, and in this I am willing to follow her, as I regard the absence of reduced tables in the tube-feet of *intestinalis* as a character useful for separating the subgenus *Allantis* from the other subgenera of the genus *Mesothuria*.

As *M. verrilli* was not taken by the "Ingolf" Expedition the supposition is possible that the "Helga" record from S.W. of Ireland is not reliable. Owing to PERRIER's, and especially DEICH-

MANN's, descriptions, it is not easy to suppose that *verrilli* can have been confused with any of the other species found in the northern Atlantic, so I think that the record of *verrilli* from S.W. of Ireland must be regarded as valid.

As one of the synonyms of *verrilli*, MORTENSEN in British Echinoderms, mentions *H. rouli* Koehler. In the collections of the Zoological Museum of Copenhagen there is, however, a specimen of *rouli* (a cotype), the examination of which shows definitely that *rouli* is not only specifically different from *verrilli*, but that it should be referred to another subgenus.

The study of the "Ingolf" collections of *Mesothuria* in connection with the collections of the Zoological Museum of Copenhagen gives an excellent opportunity to confirm my division of the genus *Mesothuria* given in the report of the German "Valdivia" Expedition, it only appears that the subgenus *Allantis* is not so numerous in species as was previously supposed. The presence or absence of "reduced tables" must be regarded as a character which gives clear limits for the subgenus *Allantis*. Of the species which, owing to the presence of "reduced tables" in the tube-feet, must be removed from *Allantis* as strictly defined, species such as *rouli* Koehler and *carnose* Fisher make a group of their own, characterized by the presence of two layers of deposits in the body wall, an outer layer of normal tables, and an inner layer of irregular rods and bodies.

This group which may be regarded as of equal rank with the subgenera *Mesothuria*-*Allantis*-*Zygothuria* may be named *Diplasiothuria* subg. nov. from the two layers of deposits, and the group including species as *cathedralis* and *verrilli* may be named *Pentochrothuria* subg. nov. from their single layer of deposits.

Thus for the present I prefer to divide the genus *Mesothuria* into the following six subgenera, which are easily separated by the key.

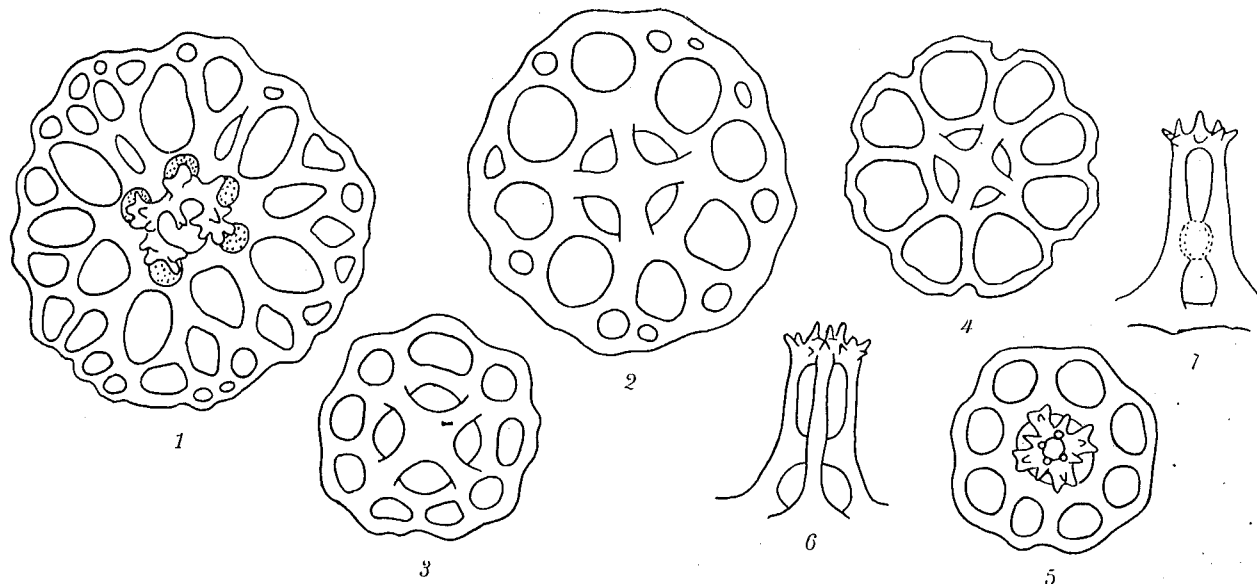
#### Key to the subgenera of *Mesothuria*.

- 1) Body cylindrical or subcylindrical, with pedicells all over 2  
Body flat, with the pedicells arranged exclusively in a single  
or double row along the paired ambulacra, those of the  
dorsal side often minute. A marginal fringe often present 1
- 2) Deposits of the tube-feet normal tables though often

- somewhat irregular in shape. "Reduced tables" totally lacking ..... *Allantis*  
 Deposits of tube-feet "reduced tables" ..... 3  
 3) Exclusively triradiate tables ..... *Mesothuria*  
 Tables normally quadriradiate, though triradiate to septem-  
 radiate tables may occur ..... 4  
 4) Two layers of deposits in the body wall, an outer layer  
 of normal tables and an inner layer of rods and irregular  
 bodies ..... *Diplasiothuria*

small tertiary and quaternary ones (textfig. 6 1-2). A comparison with other specimens of *intestinalis* shows that this is a normal feature, though the variation of the dorsal plates in a specimen from Gullmar Fjord is somewhat greater, being 130-170  $\mu$ .

A specimen from "Michael Sars" St. 134 differs from the other specimens of *intestinalis* in having exceedingly regularly shaped deposits (textfig. 6 4-5), but since it agrees in all other features with the other specimens of *intestinalis* (the specimen is poorly preserved) I regard it as a specimen of this species.



Textfig. 6. *Mesothuria (Allantis) intestinalis*. 1, Dorsal table of a specimen from the Gullmarfjord. 2, Dorsal table of specimen from the "Ingolf", St. 85. 3, ventral table of the same specimen. 4 and 5 tables from a specimen collected by "Michael Sars". 6 and 7, spires of the tables of the same specimen.  $\times 300$ .

- Only one layer of deposits in the body wall, all normal tables ..... *Penichrothuria*  
 5) All the tables of the body wall supplied with only one terminal point with lateral spines (cf. "Valdivia" Holoth. II p. 128, text fig. 8) ..... *Monothuria*  
 Tables of the body wall with normally three long spines, only occasionally one or two spines ..... *Zygothuria*

On basis of these collections from varying localities including the "Ingolf" St. 85, Bergen, and Gullmar Fjord and of sizes varying from 1 cm to 15 cm, it appears that the real characteristics of *intestinalis* are:

Tube-feet scattered all over the body, those ventrally quite minute to microscopic, but always present, issuing from the unpaired radial canal. Those along the paired ambulacra larger than the others notably along the ventro-lateral ambulacra which form a real fringe along the sides of the body.

Calcareous deposits of the body wall only tables in one layer, those of the dorsal side being the largest and often supplied with several circles of perforations. Spire relatively low with one transverse beam and a very regularly shaped crown (textfig. 6 6-7).

Calcareous deposits of tube-feet normal tables, often of somewhat varying shape, but never "reduced tables".

Remarks: *Mesothuria intestinalis* is recorded from widely separated localities, but as DEICHMANN also states in 1930, many of the older records are not reliable, since *intestinalis* is often confounded with other species, especially *verrilli*. *M. intestinalis*, sensu stricto, is at present known from the Scandinavian coasts where it lives in fairly shallow water (abt. 40 m) to the deep water around northern Gr. Britain and the Faroes. Further, PERRIER records *intestinalis* from deep-water off the Açores, and according to his description and figures there is no reason to doubt his determination. In 1930 DEICHMANN recorded *intestinalis* from the West Indies, and I quite agree with her that it is not easy to believe that the typical Scandinavian *intestinalis* really occurs in the West Indies. DEICHMANN's description and figures agree, however, so well with Scandinavian specimens that, like DEICHMANN, I am quite unable to see any difference.

On the other hand, the fact that *intestinalis* is able to live in quite littoral as well as in abyssal depths enables it to have a wide distribution.

***Mesothuria (Allantis) intestinalis* (Asc. & Ratke).**

- Östergren 1896: Zur Kenntniss der Synallactinae p. 347-351.  
 Perrier 1902: Holothuries, Travailleur et Talisman, p. 304-307, textfigs. 1-2, Pl. XVI, figs. 19-21.  
 Mortensen 1927: British Echinoderms p. 381, figs. 225 & 228 3.  
 ?Deichmann 1930: Holothurians of the Atlantic Ocean p. 94-95, Pl. 6, figs. 9-10.

**Locality:**

63°21' N. 25°25' W. "Ingolf" St. 85, 320 m ..... 1 spec.

The specimen is a fairly typical *intestinalis*, which differs from the common specimens only in having two polian vesicles. The examination of the large collection of *intestinalis* in the museum shows, however, that no other specimen has more than one polian vesicle, so the presence of two in the "Ingolf" specimen is an individual abnormality.

The examination of the calcareous deposits shows that the ventral tables are rather small, measuring but 70-100  $\mu$  in diameter (cf. textfig. 6 3-5) and supplied with only a single circle of large perforations, usually 8. The dorsal plates are, however, double the size, measuring 150-170  $\mu$  in diameter, and they are supplied with many more perforations, as besides the eight large primary and secondary holes they have a number of

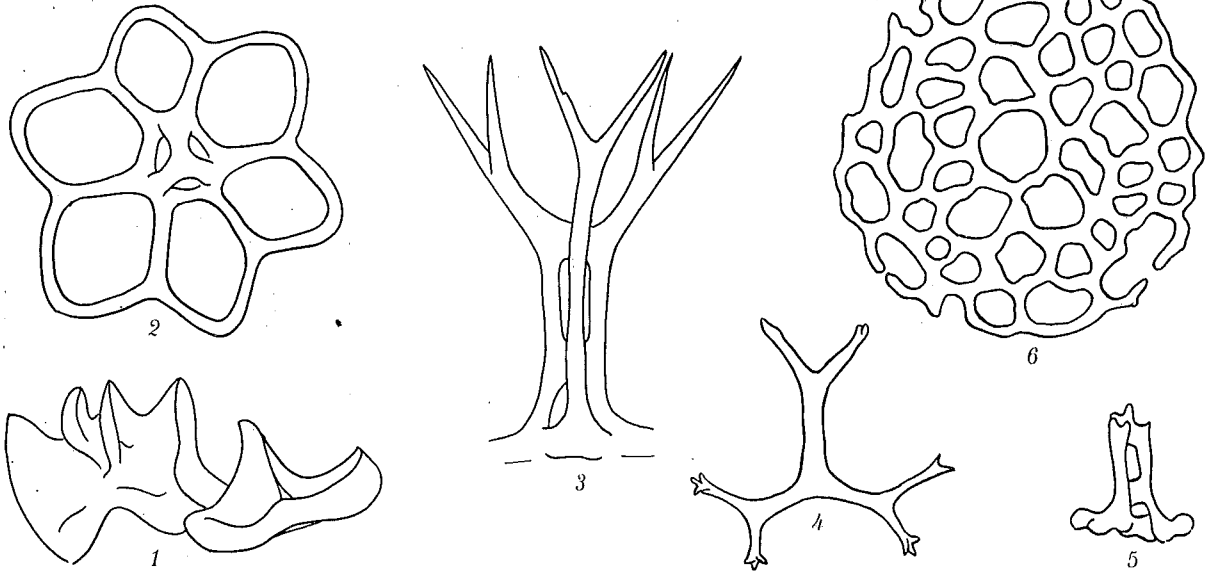
**Mesothuria (Mesothuria) maroccana** Perrier.

Perrier 1902: Holothurians, Travailleur et Talisman, p. 312-317, Pl. XVI, figs. 32-35.

Deichmann 1930: Holothurians of the Atlantic Ocean p. 97-98, textfigs. 1-2, Pl. VII, figs. 2-7.

## Localities:

61°44' N. 30°29' W. "Ingolf" St. 18, 2137 m, temp. 3°0 1 spec.  
 61°32' N. 13°40' W. "Ingolf" St. 47, 1789 m, temp. 3°23 1 -  
 61°33' N. 19°00' W. "Ingolf" St. 65, 2051 m, temp. 3°0 15 -  
 60°50' N. 26°50' W. "Ingolf" St. 76, 1518 m, temp. 4°1 1 -



Textfig. 7. *Mesothuria (Mesothuria) bifurcata*. 1, calcareous ring.  $\times 10$ . 2, table of the body wall. 3, spire of table. 4, crown of a peculiar spire, seen from above. 5, reduced table. 6, terminal plate. 2-6  $\times 300$ .

All these specimens are so characteristic that there can be no doubt as to their determination. The shape of the tables, which is quite constant, the very large lateral tube-feet and the constantly brown color, make it easy to recognise this species.

*Mesothuria maroccana* was originally described from off Morocco, and DEICHMANN showed that it is fairly common in West Indian waters. The present "Ingolf" records further show that it is not confined to the warm area of the Atlantic for which reason it may be supposed to have a wide distribution in the abyssal Atlantic, and most likely also in the southern part of the Indo-Pacific. Here it meets THÉL's *Holothuria murrayi* with which it agrees so well that I am not able to see any difference between the two species. I should certainly prefer to refer PERRIER'S *M. maroccana* to THÉL'S *M. murrayi*, but since DEICHMANN, who had both species for comparison, maintains that they are really different it will be better for the present to keep them separate.

**Mesothuria (Mesothuria?) bifurcata** Hérourard.

Hérourard 1906: Holothurians, "Belgica", p. 4, Pl. II, fig. 3.

## Locality:

61°44' N. 30°29' W. "Ingolf" St. 18, 2337 m, temp. 3°0. 1 spec.

The single specimen collected measures 5.8 cm in length and 1.0 cm in diameter. It is nearly cylindrical, and its color is grey.

The tube-feet are well developed and are scattered over the greater part of the body wall, only the ventral side is quite without any ambulacral appendages. Those along the ventro-lateral am-

bulacra are fairly large and are placed in two double rows along each side.

There are 20 tentacles (directly counted), one polian vesicle and a single stone canal. The calcareous ring is well developed, but the connection between the single pieces is very loose (textfig. 7 1).

The calcareous deposits of the body wall (textfig. 7) are exclusively triradiate tables with six large meshes and a high spire which is supplied with three long bifurcate teeth. In a number of tables the points of these ramifications bear a few other minute points.

The deposits of the tube-feet (text fig. 7 5) are partly normal

tables (in the proximal part) and partly very reduced ones, placed more distally.

In the sucking discs there are large polypore terminal plates, and in the tentacles there are simple, curved, faintly spiny, rods.

The specimen differs in the shape of the tables from all known species of *Mesothuria* except *M. bifurcata* Hérourard, with which species it agrees strikingly well. However, HÉROUARD has not described the type-specimen (which is very small) quite satisfactorily, so there may be some faint doubt as to the determination.

The presence of this species in the "Ingolf" collections is very interesting since only one specimen has hitherto been found from 71°14' S. 89°14' W., i. e. the antarctic area of the Pacific.

**Mesothuria (Penichrothuria) cathedralis** Heding.

*Mesothuria (Allantis) cathedralis* Heding 1940: Deutsche Tiefsee-Expedition p. 338-340, textfig. 5.

*Mesothuria (Allantis) candelabri* Heding 1940: Op. cit. p. 334-335, textfig. 3.

## Locality:

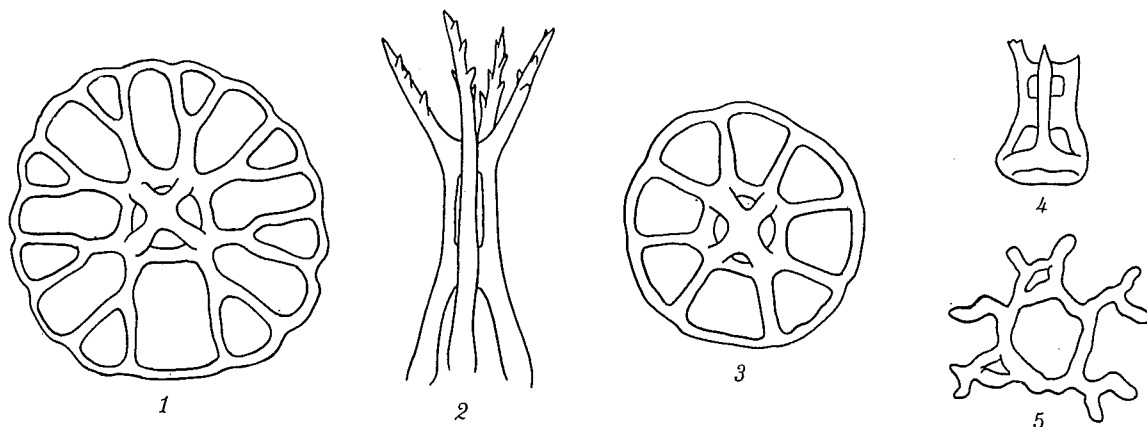
61°44' N. 30°29' W. "Ingolf" St. 18, 2137 m, temp. 3°0 2 fragm.

The two fragments present, which most likely are of the same specimen, measure 3 cm and 1.8 cm in length i. e. about 5 cm for the whole specimen. The color is a pale yellow, the mouth is subventral, and the anus is terminal. The tube feet are distributed all over the body, with the large lateral ones in a broad row. The ventral tube-feet are very small.



The deposits are fairly regular tables measuring from 100–150  $\mu$  in diameter (textfig. 8). The smaller plates (i. e. by far the greater part of them) have but eight perforations, others have a second circle of smaller holes, and a few are fully developed with

*M. cathedralis* has a fairly wide distribution in the Atlantic being found in 3° N. 5° E., 24° N. 17° W. and 61° N. 29° W. in really deep water, in all localities at temperatures of abt. 3°C.



Textfig. 8. *Mesothuria (Penichrothuria) cathedralis*. 1, polypore plate. 2, spire. 3, normal plate. 4, reduced table. 5, terminal plate.  $\times 300$ .

8 inner and 8 outer large holes of which the primary ones (the inner) are almost angular. The spires (textfig. 8 2) are like the plates fairly regularly built, and measure about 150  $\mu$ , on a plate with a diameter of about 100  $\mu$ . The crown is supplied with four (in triradiate plates three) long spiny arms. In the tube-feet there are "reduced tables" (textfig. 8 4).

It seems at first sight that the present specimen may represent a new species, but the large plates resemble so closely those of *M. cathedralis* Heding, that I am convinced that it is a juvenile specimen of this latter.

This further shows that the "Valdivia" specimens which I

### *Mesothuria (Zygothuria) lactea lactea* (Théel).

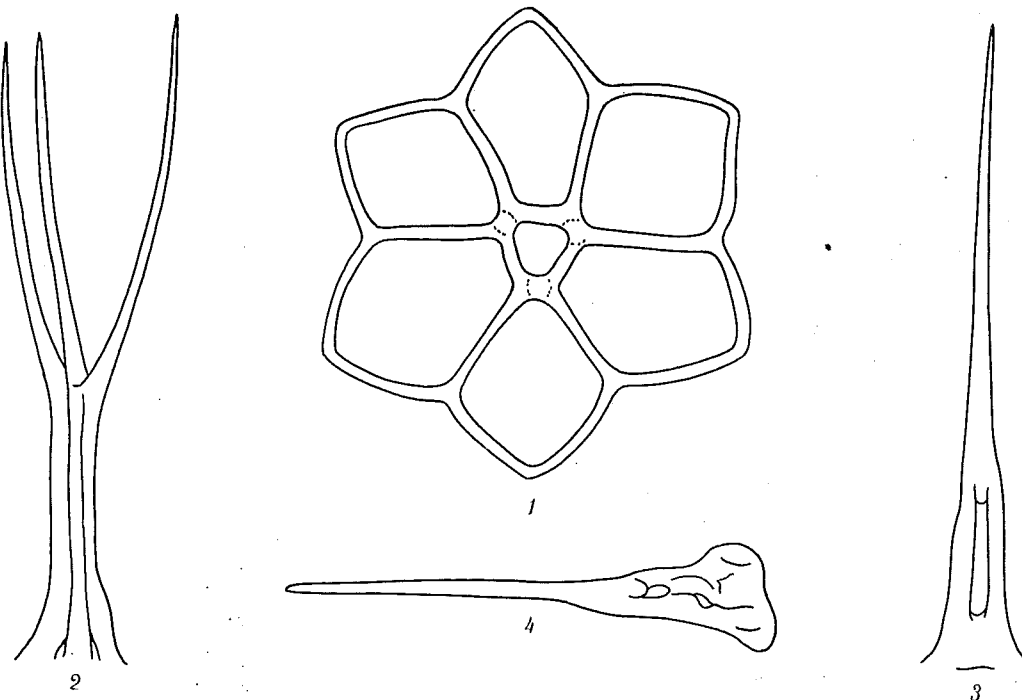
*Zygothuria lactea* Perrier 1902: *Holothuries*, Travailleur et Talisman, p. 322–327, Pl. XVII, figs. 1–10.

*Zygothuria lactea* v. *oxysclera* Perrier 1902: *Op. cit.* p. 323.

*Mesothuria lactea* Hérouard 1923: *Holothuries prov. des camp. des Yachts Pr. Alice & Hirondelle II* p. 13–15.

*Mesothuria lactea* Mortensen 1927: *British Echinoderms* p. 382–83, fig. 227.

*Zygothuria lactea* Deichmann 1930: *Holothurians of the Atlantic Ocean* p. 108–111, Pl. VIII, figs. 8–9.



Textfig. 9. *Mesothuria (Zygothuria) lactea*. 1, normal plate. 2, normal spire. 3, single-spined spire. 4, reduced table  $\times 300$ .

determined as *M. candelabri* Hérouard in 1940 cannot be that species, but must also be specimens of *cathedralis*.

As the specimen at hand has a quite regular crown we may suppose that the characteristic appearance of the spires in the type specimens of *cathedralis* is due to a variation in the shape of the spicules in correlation with the age of the specimen.

*Mesothuria (Zygothuria) lactea lactea* Heding 1940: *Holothurien der Deutschen Tiefsee-Expedition II* p. 126–127, textfig. 7 3.

#### Localities:

62° N. 21°36' W. "Ingolf" St. 40, 1591 m, 3°3 C. . . . . 14 spec.  
62°40' N. 19°05' W. "Ingolf" St. 63, 1506 m, 4°0 C. . . . . 3 "

The specimens are all rather large, measuring abt.  $10 \times 5$  cm, and are unusually well preserved. They are not so flat as is usually stated, being more like a loose sac with a flat underside. The marginal fringe though not very distinct, is, however, present in the posterior third of all the specimens.

It is often stated that *lactea* normally has the dorsal side devoid of tube-feet, only now and then a single one being found; the examination of these specimens shows that they all have a row of small tube-feet along each of the dorsal ambulacra with the tube-feet placed about one cm from each other. As these tube-feet are rather small, and the specimens of *lactea* are usually rather poorly preserved, I think that the presence of dorsal tube-feet along the ambulacra may be regarded as a characteristic feature of the species.

Along each of the ventro-lateral ambulacra, ventrally to the marginal fringe, there are some large tube-feet arranged in a row. Except for these lateral tube-feet the ventral side is totally devoid of any water vascular appendages.

The calcareous deposits of the body wall are large slender tables with six meshes and three very long arms on the crown (textfig. 9). These tables vary much in shape, since the normal hexagonal plates may be nearly circular and supplied with some additional pores, and the length of the spines or arms on the crown may vary from half to more than double the length of the spire itself. Further in the same specimen the number of spines varies from three to one, and in the latter case the spine may be either somewhat laterally directed or terminal.

In the tube-feet there are some few short and thick staves, a rather rudimentary terminal plate, and a great number of more or less reduced tables, of which those from the terminal third of the tube-feet are but slender rods with a blunt and irregular base (textfig. 9 4). Contrary to the arrangement of the real rods which lie parallel to the surface, these reduced tables are placed vertically to the surface of the tube-feet.

*M. (Zygothuria) lactea lactea* is distributed throughout the deeper waters of the Atlantic and is recorded by THÉEL from the eastern part of the Pacific. In my report on the "Valdivia" holothurians, I have shown that the specimens of *lactea* found in the Indian Ocean represent a separate form, described as *lactea spinosa*. It may be supposed that THÉEL's specimens from the Pacific would be *spinosa* or another independent form, which agrees fairly well with the fact that THÉEL's Pacific specimens apparently have somewhat larger tables. As is seen from the present specimens, the size of THÉEL's tables lies within the limits of variation of the tables in a single specimen, and I have no doubt that they are really *lactea lactea*.

In 1930 DEICHMANN described a *Zygothuria* sp. which she regards as a separate species. I have compared her description carefully with my specimens and am convinced that it is the same species. Also PERRIER's var. *oxyclera* must be regarded as a typical *lactea lactea*, as single-spined tables, as seen from my specimens, are a common feature, which does not, within this subgenus, justify any classificatory distinction.

### Genus *Bathyplores* Östergren.

Östergren 1896: Zur Kenntnis der Subfamilie Synallactinae etc. p. 351.

Heding 1940: Die Holothurien der Deutschen Tiefsee-Expedition II p. 342.

When ÖSTERGREN established the genus *Bathyplores* in 1896 with the genotype *Stichopus natans* Sars, he referred a further two species to it, viz. *Stichopus tizardi* Théel, and the new species *Bathyplores fallax*. Since then a fairly large number of species have been referred to the genus *Bathyplores*, in the description of which the characters used by ÖSTERGREN in 1896 for separating

his three species, i. e. the distribution of the ventral tube-feet and the shape of the calcareous deposits, are regarded as the main specific characters within the genus *Bathyplores*.

When MORTENSEN, as the result of his examinations of a large collection of *Bathyplores* from Bergen, showed that there were good reasons for regarding the named three species as synonyms, DEICHMANN could partly follow him in this, as she, in 1930, (Atlantic Holothurians p. 100) referred *tizardi* and *fallax* to *natans*, and stated that they were both good varieties of that species. The present collections, in connection with those of *Bathyplores* in the Zoological Museum (including the material used by Dr. MORTENSEN), have afforded a good opportunity for taking up this problem again for a critical revision.

The result of these studies is to confirm Dr. MORTENSEN in regarding ÖSTERGREN's three species as synonyms, and also that the shape of the calcareous deposits is certainly a valid character for separating species within the genus, but that the greatest attention must be paid to the part of the body wall from which the deposits to be described are taken. There seems to be, in *natans*, as well in the new form described below, one typical form of table in the body wall proper, in the area which I name the "shoulder"; this is nearly identical with that found in the real dorsal side i. e. the unpaired interambulacrum. Quite another and much more robust form is found in the posterior part of the dorsal side, and in the descriptions I shall mention these deposits as the "posterior". Usually the deposits of the ventral side are quite different from the others, but also here there are two areas with different deposits, the marginal part, in which the deposits often, even in the anteriormost part, perfectly resemble the "posterior" ones, and the medial part, where the deposits are usually specific, or in other cases fairly like the "shoulder" deposits. Beside these different forms of tables there are some very high and slender ones in the ambulacral appendages, of which those from the large dorsal papillae are the most characteristic. Further there are numerous C-shaped deposits in the cartilaginous-like layers of the body wall. In the tentacles as well as in the tube-feet and the papillae there are spiny staves more or less bent, but these, as well as the C-shaped deposits, do not seem to be of any use in classification. It is stated that terminal plates are lacking in the genus *Bathyplores* and real terminal plates I have never seen, but generally there are some large polypore plates in the sucking discs.

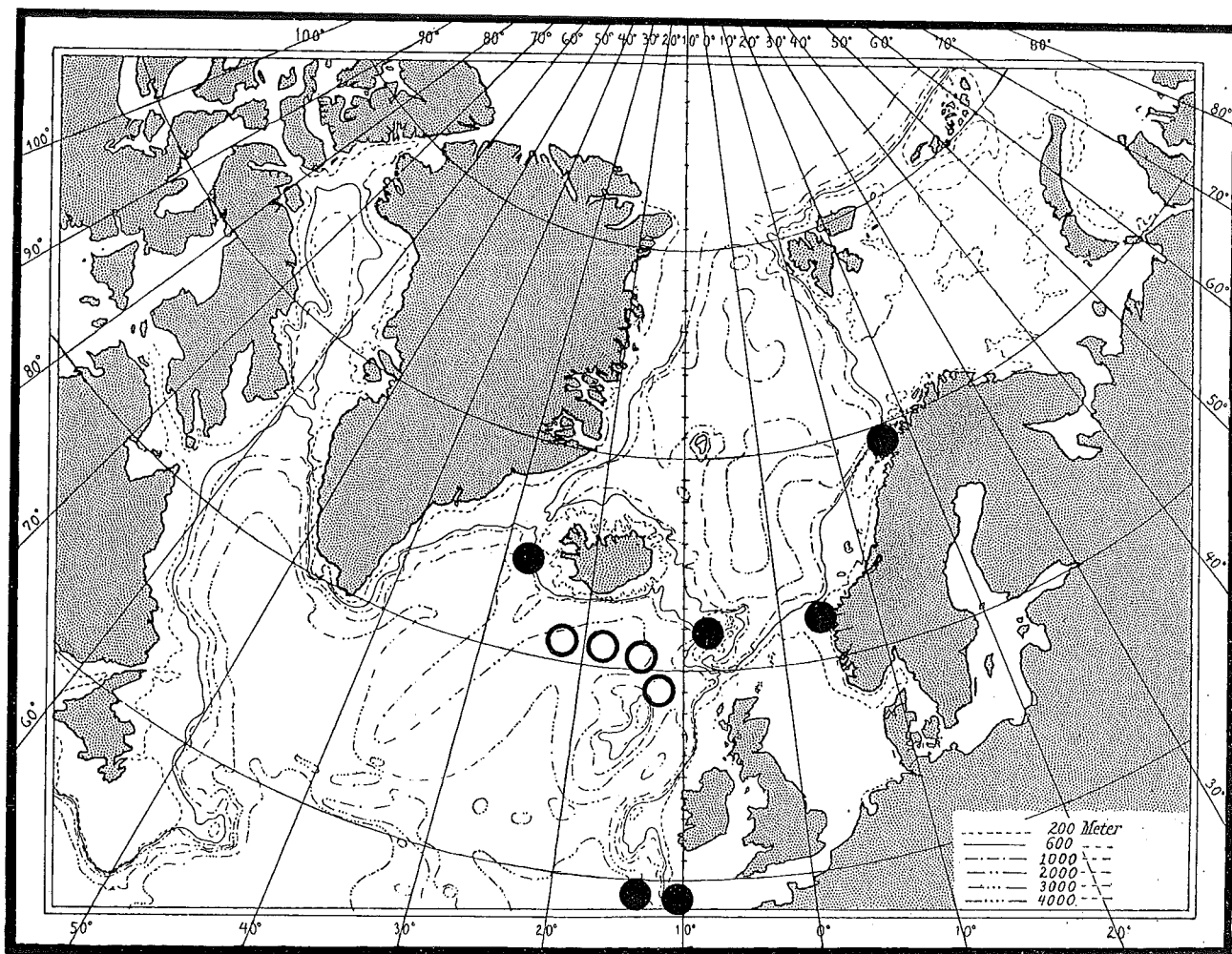
In brief, a description which shows only some few or a single deposit without stating exactly from where it originates, is of no use. A good description must show tables from at least three different parts of the body; for the comparison of such descriptions I prefer always to describe and figure tables from 1) the "shoulder" 2) the dorsal pygal area i. e. the "posterior" tables 3) the ventral midline and 4) from one of the anterior dorsal papillae, though this last group does not, at present, seem to be of much classificatory use.

MORTENSEN certainly is right in stating that the distribution of the ventral tube-feet cannot be of much use in classification, since it may vary much in specimens from a single locality, and the exact shape of the deposits in nearly all the older descriptions is always doubtful. Thus one must regard with much doubt the validity of many species which were hitherto described as *Bathyplores*.

Of these 27 species (listed in my report on the German Deep-Sea Expedition Op. cit.) 16 cannot in reality be separated from *natans*, and only 10 can be separated from it with certainty, though at present it cannot be said how many of these are synonyms.

This is of course of interest in any discussion of the distribution of these species, and therefore that of *natans*.

*Bathyplores natans* is frequently recorded from the North Atlantic, especially along the Norwegian coast. DEICHMANN records it in 1930 from the West Indies, and under the name *tizardi* it is even recorded from Japan (MITSUKURI: Studies in Actinopodous Holothurians p. 35-40). I conclude that we must, at present,

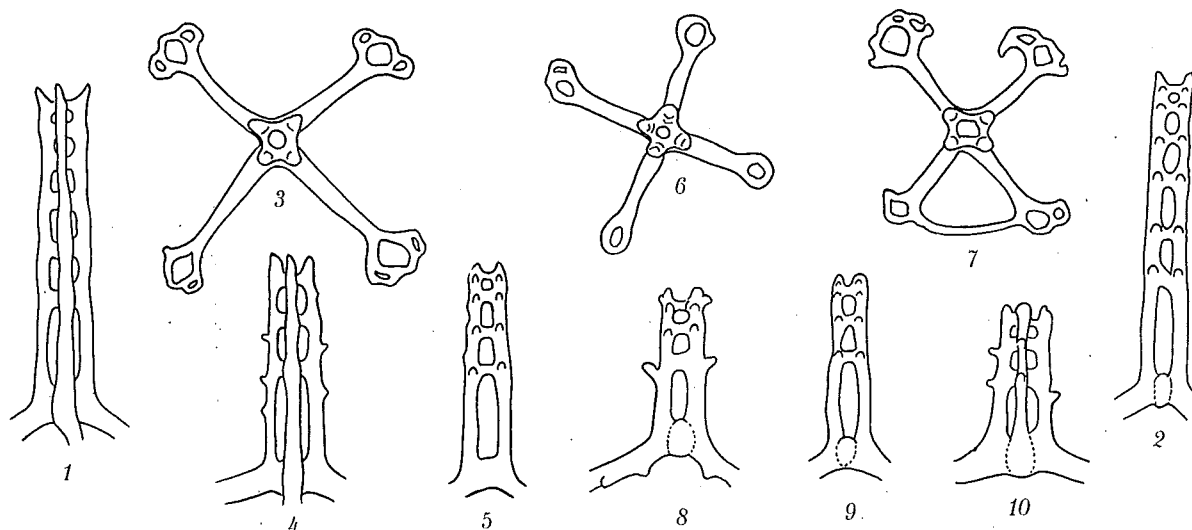


Textfig. 10. ● *Bathyplores natans* (Sars). ○ *Bathyplores heteroactylides* n. sp.

disregard all these foreign records, even those of KOEHLER and PERRIER from the south-eastern Atlantic, and only state that *natans* is distributed with certainty along the coasts of England, Iceland, and Norway in fairly deep waters, (textfig. 10). I have however no doubt that many of the different species of *Bathyplores* described from foreign localities are, in reality, true *natans*, which species certainly will prove to have a world wide distribution, as in the case of *Laetmogone violacea*.

**Bathyplores natans** (Sars).

*Bathyplores natans* Östergren 1896: Zur Kenntniss der Subfam Synallactinae p. 352.  
*Bathyplores tizardi* (Théel) Östergren 1896: Op. cit. p. 354.  
*Bathyplores fallax* n. sp. Östergren 1896: Op. cit. p. 355.  
 Cf. Mortensen 1927: British Echinoderms p. 384.  
 Deichmann 1930: Atlantic Holothurians p. 100.



Textfig. 11. *Bathyplores natans*, calcareous deposits. × 300. 1 and 2, from the papillae. 3-5, from the anterior part of the dorsal side ("shoulder"). 6-10, from the mid-line of the ventral side.

## Localities:

- 64°45' N. 27°20' W. "Ingolf" St. 89, 584 m, 8°.4 C. . . . . 1 spec.  
 49°23' N. 9°35' W. "Thor" St. 74, 9/6-06, 1200 m. . . . . 1 -  
 61°15' N. 9°35' W. "Thor" St. 99, 22/5-04, 900 m. . . . . 4 -  
 62°57' N. 19°58' W. "Thor" St. 166, 14/7-03, 957 m. . . . . 4 -  
 Besides these, several specimens from Bergen and Lofoten are examined.

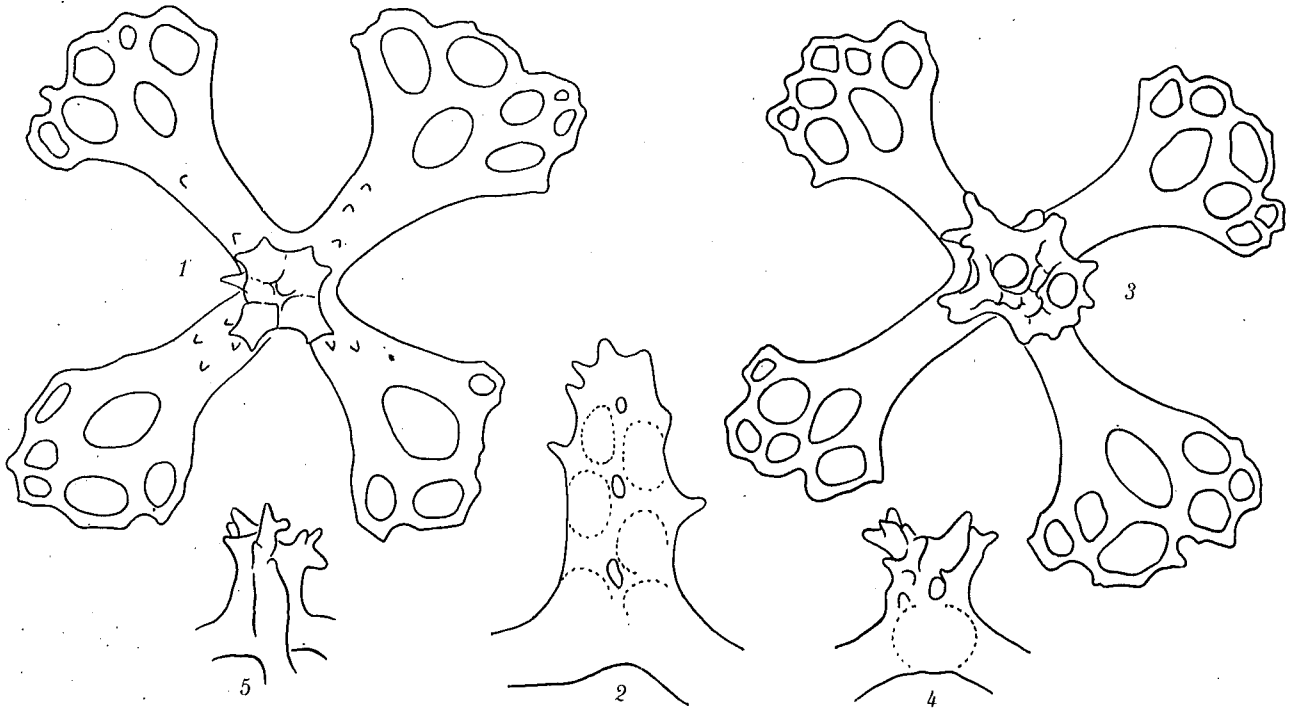
The specimens before me are all fairly large, measuring 10-15 cm in length, but only the specimens from Bergen are satisfactorily preserved.

The others have the exterior layer of the body wall more or

Diagnosis: Synallactide Holothurians with paired gonads and strongly reduced, even lacking, calcareous ring. Tentacles 18. Calcareous deposits resembling those of *B. natans* but usually having the spires supplied with six or more columns instead of the four usual in the genus.

Type specimen: The large specimen from "Ingolf" St. 73, in the Zoological Museum of Copenhagen.

Description: The type specimen measures 10 cm in length, 3 cm in width and 2 cm in height. The mouth is ventral and the anus is dorsal. It is pale greyish yellow, and has dorsally, besides two rows of large ambulacral papillae, some few smaller papillae irregularly scattered. Along the sides there are two rows of lateral



Textfig. 12. Socalled "large tables" from the posterior end of the dorsal side.  $\times 300$ . 1 and 2, *Bathyplores natans*. 3-5, *Bathyplores heterostylides*.

less worn off. There are, however, in most of the specimens sufficient portions of skin left for a safe identification.

As stated above the examination of these specimens has thrown light on the variation of the shape of the calcareous deposits. It is true that the shape of the deposits is fairly constant from one specimen to another, but within the individual it varies quite perplexingly corresponding to the different parts of the body surface. As nobody has previously taken this into consideration when classifying specimens of *Bathyplores*, a few typical figures of deposits from 1) the "shoulder", 2) the dorso-posterior area, 3) the midventral area, 4) the large dorsal papillae (textfig. 11), are given.

The examination of the anatomy of the specimens shows 20 tentacles, a faint but well developed calcareous ring, a single polian vesicle, and two tufts of dichotomously branched gonads. The stone canal is large and the madreporite is quite or often only partly buried in the body wall. The respiratory trees are well developed with a single base and small lobes on one side.

An outer genital papilla is totally lacking.

The distribution of *Bathyplores natans* has been given on p. 11 in textfig. 10.

### *Bathyplores heterostylides* n. sp.

## Localities:

- 62°58' N. 23°28' W. "Ingolf" St. 73, 915 m, 5°.5 C. . . . . 2 spec.  
 59°28' N. 8°01' W. "Michael Sars" St. 76, 12/8-02, 1300 m 6 -

papillae, not the single distinct row of large papillae along the margin of the ventral side, which is so characteristic of *B. natans* and several of the other species of *Bathyplores*.

Ventrally there are two rows of tube-feet along each side, but midventrally there are no tube-feet at all. Over the mouth there are some irregularly arranged papillae.

There are 18 tentacles in both the type and cotype, and the calcareous ring is much reduced and only visible in a transverse section. There are no tentacle ampullae, but one large polian vesicle and one stone canal with a free madreporite, which is not—as in *B. natans*—buried in the body wall. The gonads are paired, and consist of numerous dichotomously branched tubes. At the base of these tubes, which include small but nearly ripe eggs, there are some small rudimentary thread-like tubes. The gonoduct opens into the dorsal interambulacrum with a rather large longitudinal slit, and is without any trace of genital papilla.

The respiratory organs are small and supplied with a common stem. They are simple tube-shaped organs with some low lobes on one side. The left one also has a small branch close to the base.

The longitudinal muscles are undivided.

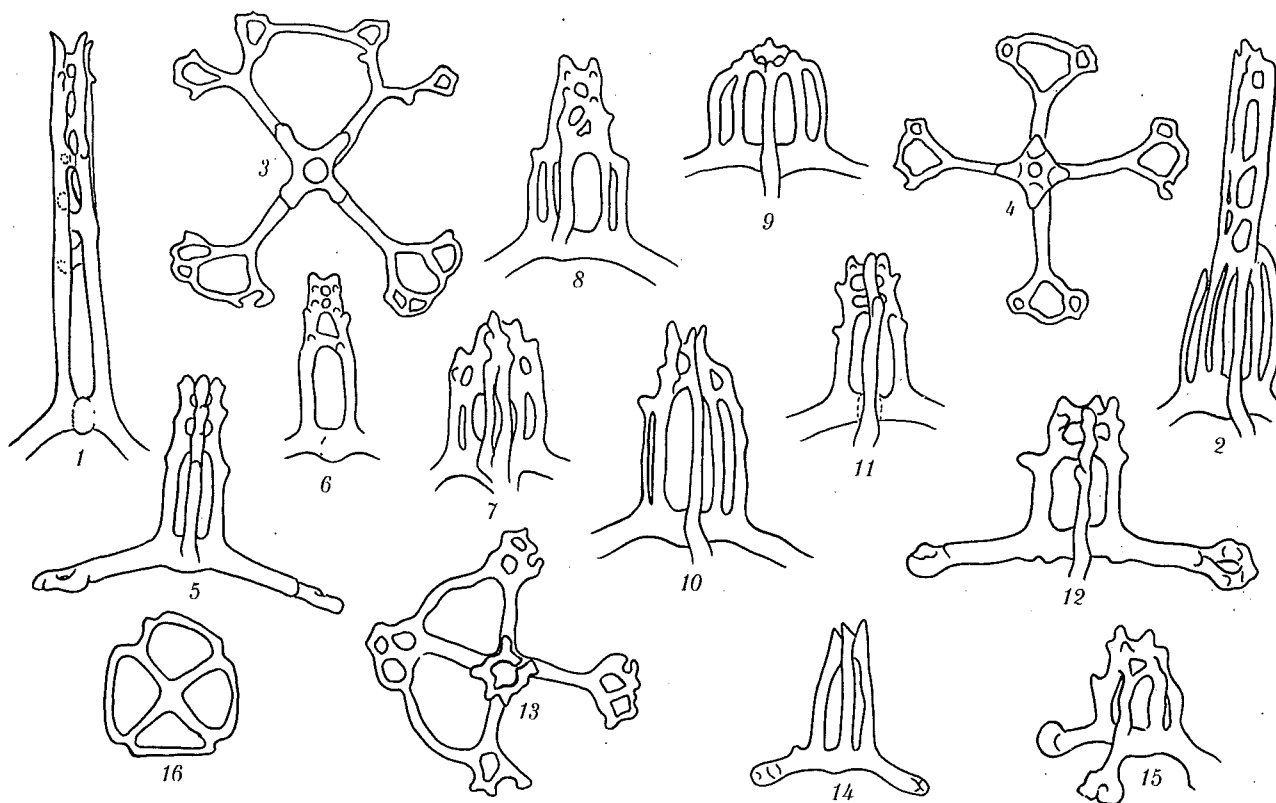
The calcareous deposits of the "shoulder" (textfig. 13 3-12) usually consist of four-armed tables with one to three pores in each arm. Now and then two of the arms are united by a rod. The spires consist in the simplest case of four columns, but normally there are six, and then the shape of the spire is somewhat irregular. Ventrally the deposits of the middle part, i. e. along the unpaired ambulacrum, which normally forms a longitudinal furrow, have

the plates smaller, with the arms fairly often united to circular plates with four large holes and four to twelve small ones.

In the posterior part of the dorsal side of the body, the tables are more than twice as large as in the anterior part. They are normally four-armed with seven holes in the ends of each arm, but often the arms are united to a large polypore plate. The spires (textfig. 12) are low and irregularly shaped, thus differing clearly from the corresponding spires in *B. natans* (textfig. 12 1-2).

In the dorsal papillae there are some very high tables (textfig. 13 1-2). The base of these is either four short arms, each with a single perforation in the ends, or ringshaped plates.

*B. hexastylides* differs definitely from all other species of *Bathyplores* in having more than four pillars in the spires. At first I supposed that these specimens were only abnormal specimens of *B. natans*, since normal four-pillared tables may also be found, but the presence of the characteristic tables appears to be typical. The specific difference from *B. natans* is also confirmed by the presence of only 18 tentacles and by the different shape of the large posterior tables as well as that of the general appearance of the body. There is no doubt that we have here a valid and independent form of *Bathyplores*.



Textfig. 13. *Bathyplores heterostylides*, calcareous deposits.  $\times 300$ . 1 and 2, from a papilla. 3-12, from the shoulder. 13-16, from the midline of the ventral side.

# Ordo Elasipoda.

## Family Laetmogonidae.

Genus *Laetmogone* Théel.

*Laetmogone violacea* Théel.

*Laetmogone violacea* Mitsukuri 1912: Actinopodous Holothurioidea p. 192-198, Pl. VI, figs. 52-54, textfig. 36.

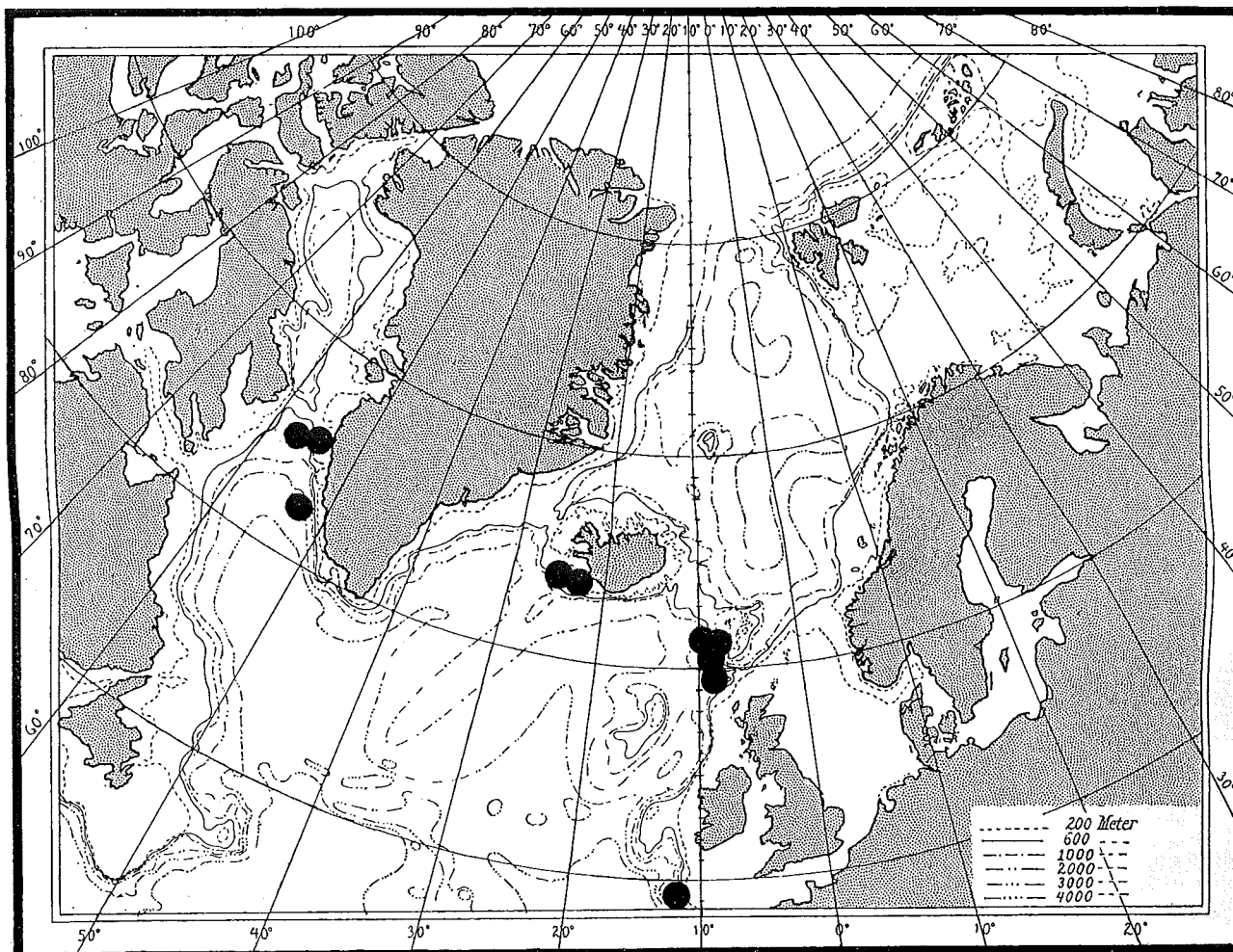
*Laetmogone violacea* Deichmann 1930: Holothurians of the Atlantic Ocean p. 120.

Localities:

- 3°56' N. 24°40' W. "Ingolf" St. 8, 256 m, 6°.0 C..... 1 spec.
- 6°35' N. 56°38' W. "Ingolf" St. 32, 599 m, 3°.9 C..... 1 -
- 9°28' N. 8°01' W. "Michael Sars" St. 76, 1293 m..... 42 -

- 61°08' N. 9°36' W. "Michael Sars" St. 79, 847 m..... 3 spec.
- 64°13' N. 27°30' W. "Thor" St. 119, <sup>11</sup>/<sub>6</sub>-03, 828 m .... 6 -
- 61°07' N. 9°30' W. "Thor" St. 78, <sup>12</sup>/<sub>5</sub>-04, 835 m ..... 10 -
- 61°15' N. 9°35' W. "Thor" St. 99, <sup>22</sup>/<sub>5</sub>-04, 900 m ..... 2 -
- 49°23' N. 12°13' W. "Thor" St. 74, <sup>9</sup>/<sub>6</sub>-06, 1220 m..... 5 -
- 63°17' N. 52°02' W. "Tjalfe" St. 437, <sup>10</sup>/<sub>6</sub>-09, 700-1055 m 2 -
- 66°37' N. 50°37' W. "Dana" St. 2346, <sup>22</sup>/<sub>6</sub>-25, 450 m... 1 -

All these specimens have been carefully examined, and as far as I am able to see they are all referable to *L. violacea* Théel. There appears to be a very faint difference between the North Atlantic specimens and those from Greenland, as the latter have one or two more papillae along the sides and have more regularly



Textfig. 14. *Laetmogone violacea* Théel.

five-radiate crosses, whereas the other specimens have regularly four-radiate ones. These features are, however, so slight that they cannot be used for any reasonable distinction between two forms, but as they strongly resemble the corresponding features within *Elpidia* (see p. 17-18) they appear to be of no small interest.

All the specimens differ definitely from *L. wyville-thomsoni* as they have 14 papillae along each side and abt. 20-35 papillae along each of the dorsal ambulacra.

As to the distribution, this species is usually collected between the Faroes and Scotland and often in large numbers. This is also the fact with the "Michael Sars" station. Further it has been taken by the "Thor" off Reykjavik and S. W. of Ireland, and by the "Ingolf" and "Tjalfe" in Davis Strait. It is astonishing that *L. violacea* was not taken in several of the "Ingolf" stations as well in the Godthaab stations, and this indicates that it is in the northern Atlantic bound to the limit between the shelf and the abyssal region cf. textfig. 14.

*L. violacea* appears to be a cosmopolitic species, originating from the Indo-Pacific and often found in depths of between 500 and 1000 m. Up to now it has not been found in the Arctic regions, and in the Atlantic it appears not to be able to cross the ridges between the Faroes and Iceland, between Iceland and Greenland and between Greenland and Canada.

### Genus *Benthogone* Koehler.

#### *Benthogone quadrilineata* Perrier.

*Benthogone rosea* v. *4-lineata* Perrier 1902: *Holothurians*, Travailleur et Talisman, p. 401, Pl. XIV, figs. 1-2.

*Benthogone quadrilineata* Heding 1940: *Die Holothurien der Deutschen Tiefsee-Expedition* p. 369.

#### Locality:

49°25' N. 12°20' W. "Thor" St. 93, 25/6-05, 1330-1440 m 2 spec.

This species was not taken by the "Ingolf" Expedition. The two specimens at hand are typical specimens of *quadrilineata*, which species, as shown in the *Holothurians* of the German Deep-Sea expedition, must be regarded as different from *B. rosea* Koehler.

This record of "Thor" is, for the present, the most northern one for *B. quadrilineata*. It has previously been taken off the Irish coast by the "Helga", but was recorded as *B. rosea*. However, a specimen of the "Helga" collection received from Dr. STELFOX definitely shows that it is not *rosea* but *quadrilineata*.

### Genus *Benthodytes* Théel.

#### *Benthodytes janthina* v. Marenzeller?

*Benthodytes janthina* v. Marenzeller 1893: *Contribution à l'étude des Holothurians de l'Atlantique Nord* p. 10, Pl. I, fig. 3 & Pl. II, fig. 4.

*Benthodytes janthina* Heding 1940: *Die Holothurien der Deutschen Tiefsee-Expedition* p. 368.

#### Locality:

58°20' N. 40°48' W. "Ingolf" St. 20, 3192 m, 1°5 C. . . . 1 spec.

This 140 mm long specimen, agrees with *B. janthina* almost perfectly, but for a slight difference in the number of the papillae. In the type there are two large—two to four small—one large—two distant small—one large, papillae on each side.

In the present specimen there are no papillae present, but the examination of the inner side of the body wall shows that there have been three of diminishing size—one large—three diminishing

—two diminishing—one large. This difference can reasonably be regarded as within the individual variation, but as long as the limits of this variation are not known, and the specimen is from a locality so different from the other known, it ought to be mentioned.

GRIEG records (1921 *Echinodermata* of "Michael Sars" p. 11) *B. janthina* from the Bay of Biscay in 4700 m. The present find of this species from "Ingolf" St. 20 shows that it may be distributed all over the Northern Atlantic.

### *Benthodytes lingua* R. Perrier.

Perrier 1902: *Holothurians*, Travailleur et Talisman, p. 456, Pl. XII, figs. 1-2, Pl. XXI, figs. 1-9.

Deichmann 1930: *Holothurians of the Atlantic Ocean* p. 124.

Heding 1940: *Die Holothurien der Deutschen Tiefsee-Expedition* p. 368.

#### Locality:

61°44' N. 30°29' W. "Ingolf" St. 18, 2137 m, 3°0 C. . . . 1 spec.

This specimen, which is abt. 70 mm long, and very gelatinous, appears to be a typical *B. lingua*. Certainly, the dorsal papillae are not well preserved, but the characteristic calcareous deposits leave no doubt as to the identification of the specimen.

This "Ingolf" record is much more northern than usual, as *B. lingua* is hitherto recorded from its type locality off Morocco, and from several localities in the West Indies and along the New England coast.

### Genus *Euphronides* Théel.

#### *Euphronides talismani* R. Perrier.

Deichmann 1930: *Holothurians of the Atlantic Ocean* p. 129.

#### Localities:

64°34' N. 31°12' W. "Ingolf" St. 11, 2448 m, 1°6 C. . . . 1 spec.

61°44' N. 30°29' W. "Ingolf" St. 18, 2137 m, 3°0 C. . . . 23 -

62°57' N. 19°58' W. "Thor" St. 166, 957 m . . . . . 3 -

The specimens before me were previously determined by E. DEICHMANN as *Euphronides talismani* R. Perrier, and certainly nothing of importance except the locality is against this determination. They are from fairly northern localities, and in fact the small specimens from "Ingolf" St. 18 differ somewhat from the typical form. These specimens measure from two to six cm in length, but on a little label it is stated that they are contracted to half their size.

The deposits of these specimens (textfig. 15) are characteristic in being of varying size and in having unusually long central processes. These differences are, however, most likely due to the small size of the specimens, and I quite agree with DEICHMANN that these specimens are most naturally to be referred to *E. talismani*.

The three specimens from "Thor" St. 166 differ from the others in being larger, more distinctly red, and quite especially in being from a depth less than 1000 m.

### *Euphronides violacea* R. Perrier.

Deichmann 1930: *Op. cit.* p. 128.

#### Localities:

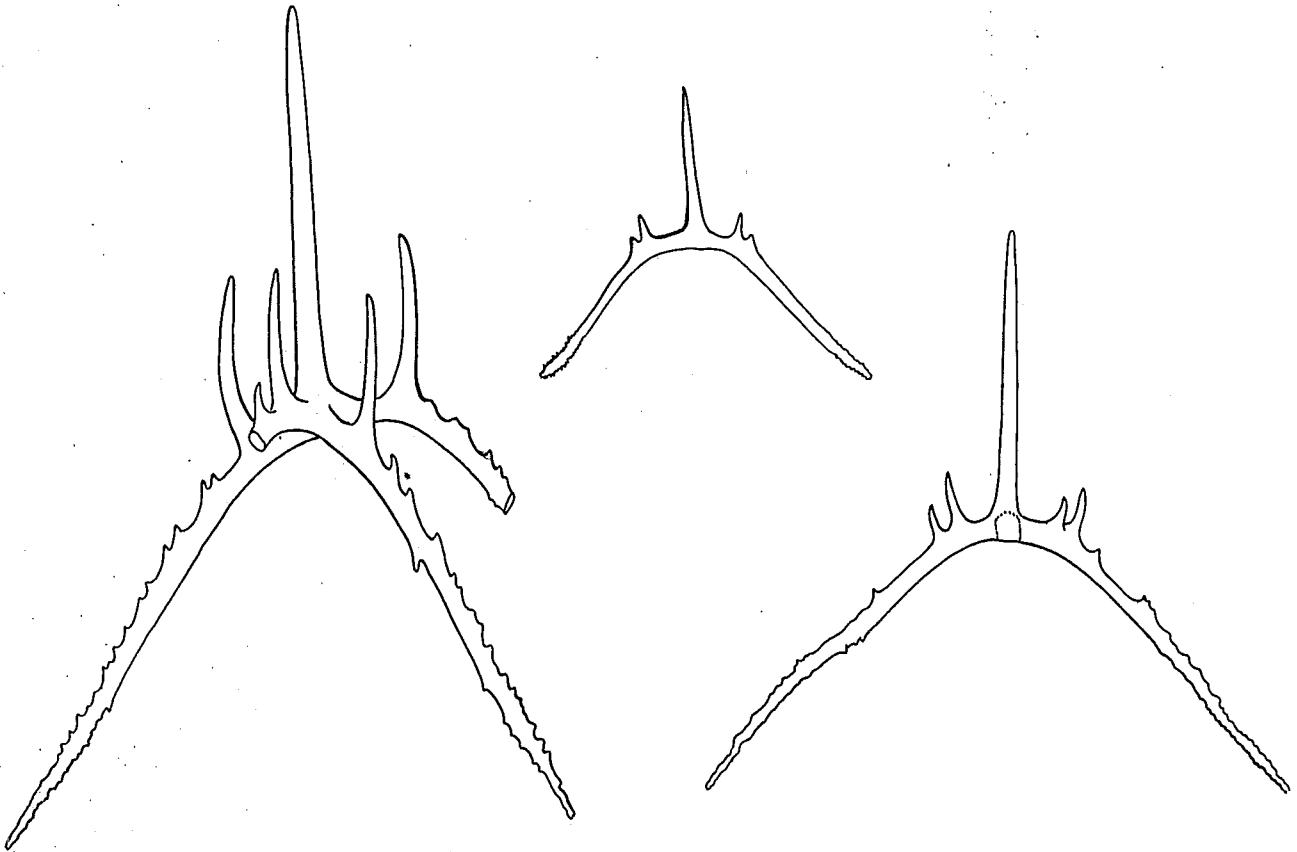
62°00' N. 22°38' W. "Ingolf" St. 39, 1629 m, 2°9 C. . . . 1 spec.

62°25' N. 28°30' W. "Ingolf" St. 83, 1717 m, 4°1 C. . . . 1 -

*Euphronides violacea* is previously recorded from the coast of Morocco and between the Azores and Europe. Further it is recorded by DEICHMANN from Bequia and Gulf of Mexico. The comparison of these localities with those of the "Ingolf" is very interesting, as it shows that this species is distributed over all the abyssal part of the Atlantic.

The two specimens at hand are determined by DEICHMANN as *E. violacea*, and I admit that they have rather few ventral

deposits, which are furthermore not so spinous as the ventral deposits of the specimens determined as *E. talismani*. Indeed, were these two specimens not determined as *violacea* by Dr. DEICHMANN I would certainly have referred them to the same species as the other "Ingolf" *Euphronides* i. e. to *E. talismani*, and I am not at all certain that these two species are in reality specifically different.



Textfig. 15. *Euphronides talismani*, calcareous deposits of the dorsal side of a small specimen (abt. 2 cm long).  $\times 110$ .

## Family Elpidiidae.

### Subfamily Elpidiinae Ekmann.

#### Genus *Elpidia* Théel.

In his large study on the family *Elpidiidae* in 1923 (Holothuries provenant des campagnes des Yachts Princesse Alice et Hiron-delle II p. 42-83) HÉROUARD has shown that the genus *Elpidia* for the present must be regarded as monotypic, as all the different species previously referred to it must be placed in various genera. Further HÉROUARD has shown that the number and arrangement of papillae within the whole family is of the greatest value for its classification.

Therefore it was thought useful to undertake a closer study of the variation within the present fairly large collection of *Elpidia glacialis* containing more than five hundred specimens collected by the "Ingolf" and the "Godthaab", and indeed the results have shown that the specimens from Baffin Bay may be regarded as survivor's now developing into an endemic species.

The material measured, in all of which the papillae are counted, consists of 554 well preserved specimens. Of these 322 were collected by the "Ingolf" in the fairly deep water between Iceland

and Jan Mayen, and the others by the "Godthaab" in Baffin Bay and adjacent waters. Of these latter 86 specimens are from fairly deep water, about 2000 m, and 146 are from less than 900 m, from localities close to the shore. In reality these 146 specimens differ strikingly from the others, and must be regarded as an independent form, variety or species.

It is usually stated that the number of ventro-lateral papillae in *E. glacialis* is 4-6 along each side, so it was rather perplexing to find that of the 322 specimens from the "Ingolf" all but one had four papillae along each side, and this one had four and three, being obviously abnormal. The variation in number of lateral papillae in specimens from the North Atlantic is consequently close to zero. In the specimens from Baffin Bay, however, there is a fairly clear variation, as some specimens have four pairs of papillae and others five, but the variation is closely, though not completely, correlated with the localities of the specimens, and there are, further, some few specimens with more than five papillae along each side.

In the material from the different "Godthaab"-stations the numbers are as follow:



station	depth	4 pairs	5 pairs	4-5
54.....	1880 m	84	2	0
144.....	733 m	2	59	1
143.....	685 m	5	67	4
119.....	610 m	0	9	0

From this it is seen that the normal number of **ventro-lateral papillae** in the material from the deep station (1880 m) is four on each side, only two have five. In the other stations there are, however, normally five papillae, but in seven specimens there are not more than four, the few specimens with different numbers on the two sides, I suppose are abnormal, like the one from the "Ingolf" material lacking one papilla, i. e. they may really be regarded as specimens with five papillae along each side.

It seems likely that this difference in number of papillae is occasioned by the different sizes of the specimens, and indeed in comparing the size of the "Ingolf" specimens with 4 pairs of papillae (average length (M) = 20.8 mm) with that of the "Godthaab" specimens with five pairs of papillae (M = 29.1 mm) it appears natural to believe that the number of papillae increases with the size of the specimens, as MORTENSEN did in describing these specimens in the "Godthaab" report.

Comparing the specimens from the "Godthaab" St. 54 with four pairs of papillae, with those from the stations 143 and 144 (which may be regarded as a single station) it is found that it is the largest specimens which have but four pairs of papillae, and consequently the larger number of papillae in the specimens from "Godthaab" St. 143-144 cannot here be correlated with the size of the specimens.

A closer study of the sizes of the specimens shows that they fall into four different groups, of which, however, the specimens from "Godthaab" St. 119 represent the largest, but as it does not consist of more than 9 specimens this group is left out of the study. All the specimens are measured in mm, and the measurements are given in textfig. 16.

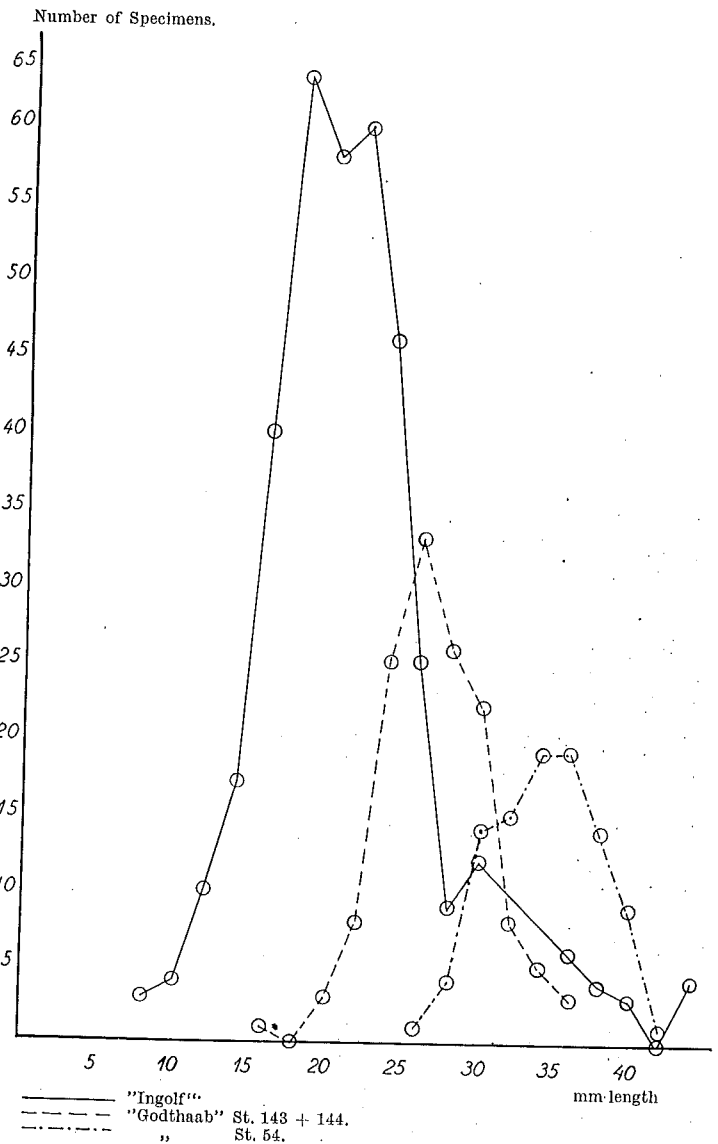
As already shown on p. 16 all the specimens from the "Ingolf" may be considered as a single population, as in the case of the two "Godthaab" stations St. 143 and 144, whereas the material from "Godthaab" St. 54 represents a group by itself. From the figure it appears that the specimens from the "Ingolf" are the smallest, with the average size 20.8 mm, and those from the "Godthaab" St. 54 are the largest having the average size 34.0 mm. Fairly close to these are the other "Godthaab" specimens with the average size 29.1 mm.

From the figure (textfig. 16) it also appears that measurements of the "Ingolf" specimens give an asymmetrical curve lacking many of the small ones. This is not so pronounced in the collections from the "Godthaab". This indicates that we cannot rely upon the lower limits of the material as it seems likely that a part of the small specimens may have escaped through the meshes of the trawl, for which reason we can compare safely only the right hand halves of the curves. Even if we suppose that many of the smaller specimens have escaped in this way, which is not at all certain, it is evident that the "Godthaab" material is larger than the "Ingolf" material, and that the two groups from the "Godthaab" are of different sizes.

Superficially, it would appear to be safe to regard the specimens from the "Godthaab" St. 54 with four pairs of ventro-lateral papillae as belonging to quite the same form as those taken by the "Ingolf", being only somewhat larger, perhaps on account of more food or other conditions in Baffin Bay. A closer study of the **dorsal papillae**, however, shows that it is not so simple as this.

The table II p. 18 shows how these dorsal papillae may be arranged. They are always placed in two longitudinal rows, one along each of the dorsal ambulacra, and are divided into two groups, an anterior (nuchal) group, and a posterior (pygal) group. Now and then, however, a few extra papillae are found on that

part of the dorsal side lying between the two named areas, and in the table these papillae are reckoned as pygal, as they are normally distinctly separated from the nuchal group. Normally these dorsal papillae are, as stated, paired, and in the table this is shown by giving the two sides an equal number e. g. 2-2 or 3-3. When there are different numbers of papillae on the two



Textfig. 16. *Elpidia glacialis*, diagrams showing the variation in size and number of the three populations studied.

sides, this is indicated by two different figures e. g. 3-4 or 2-5. In the upper part of the table is shown how many per cent. of the specimens which have the nuchal papillae arranged in the way indicated by the figures above, without mentioning which of these numbers refer to the left or the right side. In the lower part of the table are the corresponding figures for the posterior papillae.

From this table it appears that both the "Ingolf" specimens and those from the "Godthaab" St. 54 have normally 3-3 nuchal papillae, as shown by the framed figures, and that the specimens from the two other "Godthaab" stations have normally 4-4 nuchal papillae. There are, however, in the "Ingolf" specimens abt. 38% which have a smaller number of nuchal papillae, and only 1.1% with more, and this 1.1% has only 1 extra (3-4). In the "Godthaab" St. 54, the percentage of specimens with 3-3 nuchal papillae is much larger and here are another 9.5% with more papillae. In the specimens from "Godthaab" St. 143-144 there

Table I.

Length in mm	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
"Ingolf" St. 96	..	..	..	..	..	..	..	..	..	..	1	2	3	5	3	5	3	..	..	..	..	..	..	..	..	..	..	..	..	..
— St. 104	1	2	0	0	1	3	0	1	5	3	0	3	1	1	1	0	1	0	0	0	0	0	0	2	0	0	0	0	4	..
— St. 112	..	..	..	..	..	..	..	..	1	0	2	0	3	0	3	1	3	1	..	..	..	..	..	..	..	..	..	..	..	..
— St. 113	..	..	..	..	..	..	..	..	1	0	4	3	4	9	6	16	14	5	5	2	..	..	..	..	..	..	..	..	..	..
— St. 117	..	..	..	1	2	2	4	3	8	3	5	5	5	1	3	4	5	4	9	2	5	2	4	5	1	3	0	2	0	
— St. 118	..	..	..	..	..	..	..	4	1	0	2	3	1	2	4	2	5	0	0	1	0	0	0	1	0	1	0	1	..	
— St. 120	..	..	1	2	0	2	0	5	10	11	11	22	10	14	7	5	1	4	4	2	1	1	0	0	0	0	1	..	..	
— all stations	1	2	1	3	3	7	4	13	26	14	25	38	27	31	27	33	32	14	18	7	6	3	4	8	1	4	1	3	4	
"Godthaab" St. 54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	3	4	10	4	11	11	8	12	
"Godthaab" St. 119	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— St. 143	..	..	..	..	..	..	..	..	..	..	..	..	..	1	0	2	4	9	16	7	8	7	7	7	2	2	1	1	1	
— St. 144	..	..	..	..	..	..	..	..	..	1	0	0	1	1	2	4	7	6	4	6	4	7	0	8	2	2	2	1	1	
— St. 143 + 144	..	..	..	..	..	..	..	..	..	1	0	0	1	2	2	6	11	14	20	13	12	14	7	15	4	4	3	2	2	

are indeed 15.4 % of the specimens with 3-3 nuchal papillae but 17.1 % have more than 4-4 nuchal papillae.

Thus the number of the nuchal papillae gradually increases from the sea north of Iceland over the deeper part of Baffin Bay to the shallower water along the coasts, whereas the number of four or five ventro-lateral papillae cannot be regarded as being of specific value. This conclusion is strengthened when the lower part of the table is studied.

The normal number of pygal papillae is, in all three groups, 1-1, but there are many variations, and these definitely show numbers increasing in the same way as those of the nuchal papillae.

The single specimen from "Godthaab" St. 143-144 without any pygal papillae I suppose may be regarded as an abnormality.

This study of the papillae definitely shows that the number of ventro-lateral papillae, as is previously stated, varies from four to six (seven) on each side, and that the number of dorsal papillae also varies considerably, but it also shows that the variation within the local populations is fairly small and is in correlation with the geographical distribution. Why the specimens in Baffin Bay have a higher number of papillae, naturally cannot be known until much more material from different localities is available, but the few specimens from "Godthaab" St. 119 (Jones Sound) abt. 600 m, all have five ventro-lateral papillae, four nuchal, and beside one to two pairs in the pygal group also one to two pairs of intermediates, indicating a further increase of papillae toward the north.

In this connection I have re-examined the specimen taken by the German Valdivia Expedition in 24°35'.3" N. 17°4'.7" W., and found that this specimen fully agrees with the "Ingolf" specimens.

67°14' N. 08°48' W. "Ingolf" St. 111, 1619 m, ÷0°.9 C. 1 spec.  
 67°57' N. 06°44' W. "Ingolf" St. 112, 2386 m, ÷1°.1 C. 23 -  
 69°13' N. 08°29' W. "Ingolf" St. 117, 1889 m, ÷1°.0 C. 90 -  
 68°27' N. 08°20' W. "Ingolf" St. 118, 1996 m, 1°.0 C... 29 -  
 67°29' N. 11°32' W. "Ingolf" St. 120, 1666 m, 1°.0 C... 128 -

These numerous specimens are all fairly well preserved and together with the specimens collected by the "Godthaab" Expedition they form very valuable material, and a rare opportunity for a statistical examination of the variation within this species. As in reality we do not know anything of the specific variation within the *Elpidiidae*, I have taken the opportunity to use the material for such an examination, and have studied all the various features used, or supposed to be useful, as classificatory characters. The result is that *Elpidia glacialis* must be regarded as a very constant species with very narrow limits for the specific variations. The shape of the calcareous deposits and the rods of the calcareous ring show some individual variation, but, except for the fact that they are larger in the larger specimens, no clear variation can be discerned. The same holds good for the tentacles and the inner anatomy. The only features which show any clear variation is the number and arrangement of the ambulacral papillae. As the variation of the papillae appears to be of interest not only for the discussion of the geographical variation of this species, but also for our consideration of the classification of the whole family, it has been thought best to give a special report on these studies in the remarks on the genus.

From this report it appears that the specimens collected in Baffin Bay and adjacent waters differ slightly from the very uniform group of specimens collected in the Norwegian Sea and

Table II.

Arrangement of dorsal papillae in % of total number of specimens.

Arrangement of antero-dorsal papillae	0-0	0-1	0-2	1-1	1-2	1-3	2-2	2-3	2-4	2-5	3-3	3-4	3-5	4-4	4-5	4
All "Ingolf" stations	..	..	..	..	0.3 %	..	26.2 %	11.5 %	..	..	60.9 %	1.1 %	..	..	..	..
"Godthaab" St. 54	..	..	..	..	..	..	..	5.9 %	..	..	85.7 %	8.3 %	..	1.2 %	..	..
"Godthaab" St. 143 + 144	..	..	..	..	..	..	0.9 %	..	..	..	15.4 %	..	..	66.7 %	13.7 %	3
Arrangement of postero-dorsal papillae	0-0	0-1	0-2	1-1	1-2	1-3	2-2	2-3	2-4	2-5	3-3	3-4	3-5	4-4	4-5	4
All "Ingolf" stations	0.8 %	2.7 %	0.2 %	91.2 %	4.0 %	..	1.3 %	..	..	..	..	..	..	..	..	..
"Godthaab" St. 54	..	..	..	70.4 %	18.5 %	1.2 %	4.9 %	3.7 %	..	1.2 %	..	..	..	..	..	..
"Godthaab" St. 143 + 144	0.8 %	..	..	44.9 %	15.5 %	3.5 %	17.8 %	13.2 %	1.5 %	..	0.8 %	..	0.8 %	0.8 %	..	..

In fact, I have some faint doubt as to the label of this specimen, which is said to be found definitely outside the known limits of distribution of this species.

*Elpidia glacialis* Théel.

Localities:

66°23' N. 10°26' W. "Ingolf" St. 102, 1412 m, ÷0°.9 C. 12 spec.  
 66°23' N. 07°25' W. "Ingolf" St. 104, 1802 m, ÷1°.1 C. 39 -

adjacent waters. This difference is indeed slight but it is fairly distinct, and, in connection with the distribution of the species, it appears to be of no little interest.

The numerous dredgings in the northern Atlantic which have not brought up *Elpidia* show that this species is, in fact, not living there, and as the depth north of Greenland cannot be regarded as great enough for such deep-sea animals as *Elpidia*, there does not appear to be any connection between the populations of

43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	1	M = 20.8 mm	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
= 84 mm	2	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
nm	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Genus *Kolga* Danielssen and Koren.

*Kolga hyalina* Danielssen and Koren.

Mortensen 1932: Echinoderms. The Godthaab Expedition 1928 p.43.

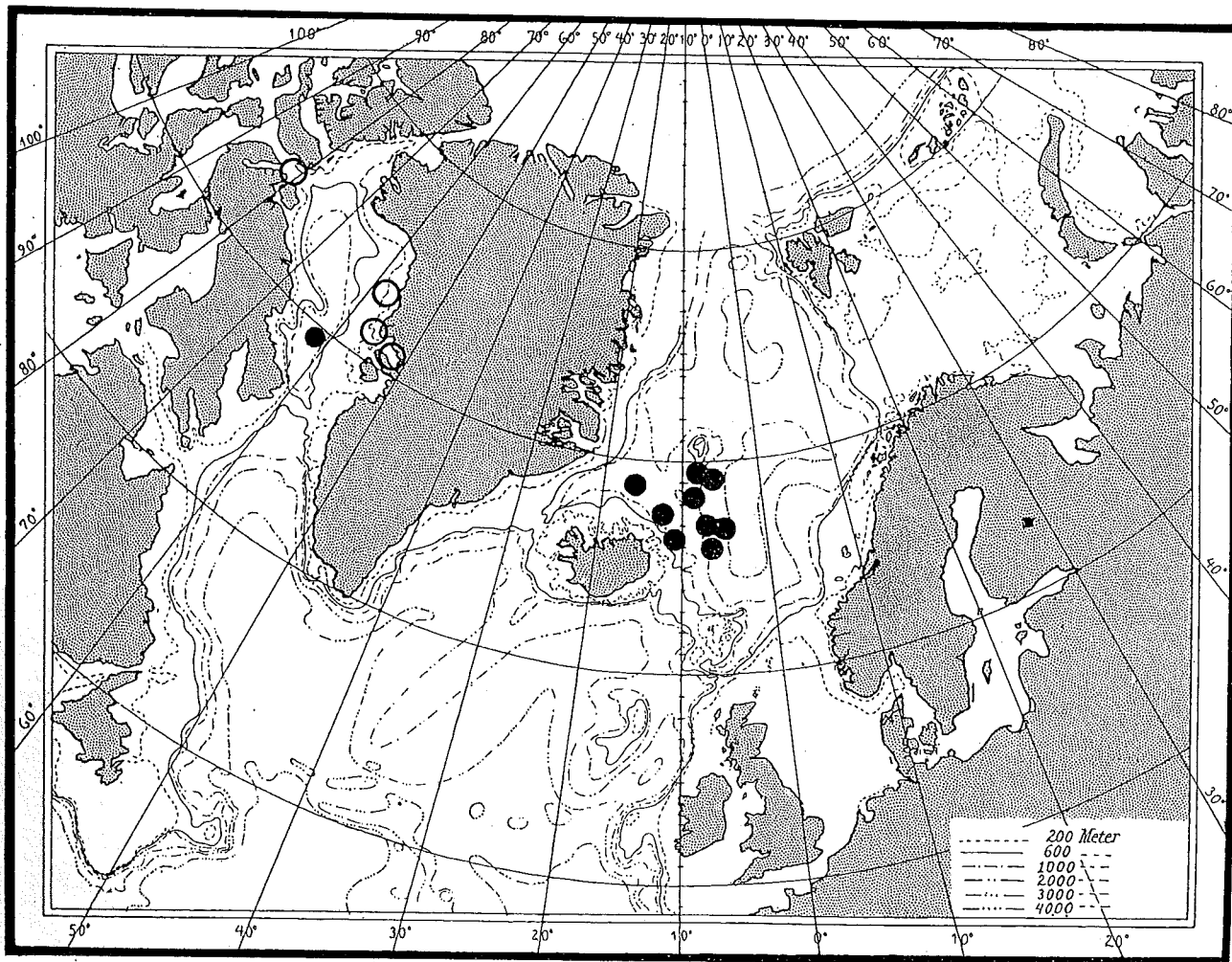
Localities: (cf. Textfig. 18)

58°02' N. 40°48' W. "Ingolf" St. 20, 3192 m, 1°5 C...	11 spec.
61°50' N. 56°21' W. "Ingolf" St. 36, 2702 m, 1°5 C. abt.	125 -
60°17' N. 54°05' W. "Ingolf" St. 37, 3229 m, 1°4 C...	32 -
67°57' N. 06°44' W. "Ingolf" St. 112, 2346 m, 1°0 C. several	-
69°31' N. 07°06' W. "Ingolf" St. 113, 2465 m, 1°0 C. abt.	125 -
67°53' N. 19°00' W. "Ingolf" St. 119, 1902 m, 1°0 C. abt.	75 -
Between Jan Mayen and Iceland. "Ingolf".....	43 -

*Elpidia* in the Norwegian Sea and Baffin Bay. Thus the Baffin Bay *Elpidia* must be regarded as survivors from a time where there was a free connection between the two areas. This does not concern *Elpidia* alone, but also a number of other deep-sea Echinoderms, e. g. *Trochostoma boreale*. In fact, the real deep-sea Echinoderms of Baffin Bay appear to be a community separated from its area of distribution in such a way that the present author regards it as a relict fauna. This may be a matter of opinion, and especially a matter of definition; what is, however, of the greatest interest is that these specimens do show slight differences from their allies in the Norwegian Sea and the North Atlantic, and apparently are developing into new species, better adapted to the physical conditions in the deeps of Baffin Bay.

These are all typical specimens of *Kolga hyalina* and even the structure of the calcareous ring is identical in specimens from south of Jan Mayen and from Davis Strait.

In 1932 TH. MORTENSEN describes some specimens of *K. hyalina* from the "Godthaab" St. 54. This find was at that time rather perplexing, but as we also find *E. glacialis* north of the two ridges bounding the Atlantic, there is no reason to doubt the determinations. MORTENSEN supposes that these specimens have been able to cross the ridge off Holsteinsborg, but when these finds are compared with those of *Hymenaster pellucidus*, *Ophiopleura borealis* and *Poutalesia jeffreysi*, I find it more reasonable to think that they do not cross the ridge but are distributed round the northern side of Greenland, most likely in an earlier zoological period with deeper water, as must be supposed to be the fact with *Elpidia glacialis*.



Textfig. 17. *Elpidia glacialis* Théel. ● Specimens with 4 pairs of papillae. ○ Specimens with 5 pairs of papillae.

# Ordo Dendrochirota.

## Family Phyllophoridae.

- Mortensen 1927: British Echinoderms p. 408.  
Deichmann 1930: Holothurians of the Atlantic Ocean p. 140.  
Engel 1933: Résultats Scientifiques du Voyage aux Indes Orientales Néerlandaises, Holothuries p. 13-38.  
Heding 1936: Echinoderms, 6. og 7. Thule Expedition p. 19-26.  
Deichmann 1938: Holothurians from the Western Coast of Lower California etc. p. 378.

Three different genera of the family *Phyllophoridae* have been already recorded from the northern Atlantic, viz. *Pseudocucumis* — *Thyonidium* — *Phyllophorus*.

Of these the genus *Pseudocucumis* is not recorded from the area explored by the "Ingolf", nor was it taken by this expedition.

As to the two other genera *Thyonidium* and "*Phyllophorus*" there has been much discussion as to whether they should be separated or they are in reality identical.

In 1930 DEICHMANN collected all the *Phyllophoridae* with more than ten tentacles in the old genus *Phyllophorus*, but in 1938 her extensive studies of this group resulted in the establishing of a number of well defined genera.

In spite of this DEICHMANN is not convinced that I am right in stating that the two North Atlantic species *pellucidus* and *commune* must be referred to two different genera. The main reason for her disagreement is the fact that in 1936 when I re-established the genus *Thyonidium* I left the species *commune* in the genus *Phyllophorus* where DEICHMANN some years before had placed it, and this only because I had then neither time nor material for such extensive studies as those undertaken by DEICHMANN in the following years.

I quite agree with DEICHMANN that *commune* is no *Phyllophorus* sensu stricto, but I must maintain that neither can it be referred to *Thyonidium*. The difference in the number of tentacles alone is definitely against so doing, and my renewed studies based on the "Ingolf" Material have further convinced me that the number of tentacles is not a variable feature, as DEICHMANN supposes.

Therefore it is necessary to establish a separate genus for *commune* Forbes, and as the present material of *commune*-like specimens does not show any clear difference between those from Scandinavia and the Arctic I find it beyond any doubt necessary to reestablish AYRES' old, and for many years abandoned, genus *Duasmodyla* for *commune*.

The different problems regarding the distinction between these genera will be discussed more in detail in a separate paper; here it can only be stated that the genus *Phyllophorus* does not occur in the northern Atlantic, where we find, besides *Pseudocucumis*, the two genera *Thyonidium* and *Duasmodyla*.

### Genus *Thyonidium* Db. and Kor.

#### *Thyonidium barthii* (Troschel)?

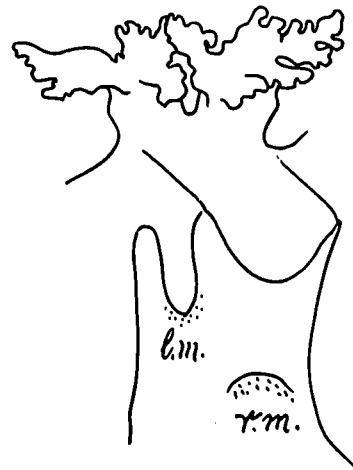
Heding 1936: Echinoderms, 6. and 7. Thule Expedition p. 19.

#### Localities:

Davis Strait. 66°35' N. 56°38' W. "Ingolf" St. 32, 600 m 4 spec.

Of the four specimens present three are only very small, measuring 3-6 mm in length, and with the tentacles only partly developed.

The calcareous deposits are, however, well developed and characteristic, and agree so well with those of the larger specimen (which has its deposits slightly attacked by acid in the preserving



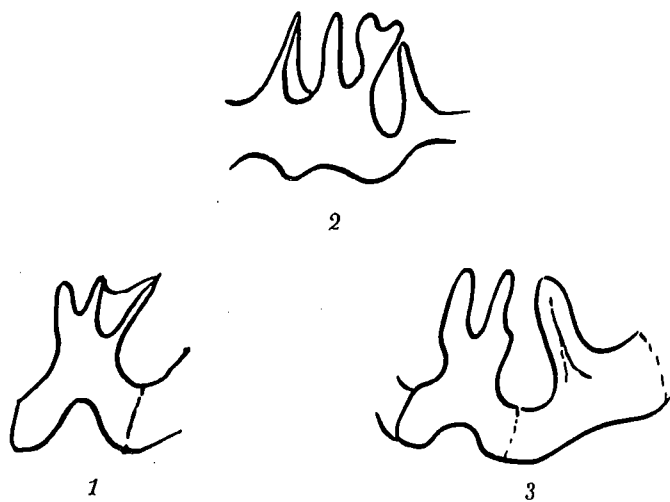
Textfig. 20. *Thyonidium barthii*, "Ingolf", St. 32, expl. IV. The anterior end of the mid ventral radial, showing the insertions of the retractor muscle (r. m.) and the longitudinal muscle (l. m.) as well as the single insertion of the bifid mid-ventral radial tentacle.  $\times 30$ .

fluid) that there is no doubt that these four specimens all belong to the same species.

The large specimen has 15 tentacles, of which the ten large are arranged in a single outer circle and the five smaller in one inner circle. Each of the small tentacles is divided into two, and one might suppose that there are really five pairs, but a closer examination shows that each of the pairs has but one origin from the calcareous ring (cf. textfig. 20) being thus definitely only one tentacle, contrary to the conditions within the genus *Duasmodyla*.

*dactyla*, where the pairs of small tentacles have always separate origins.

In the largest of the small specimens the ten tentacles of the outer circle are well developed, but of those in the inner circle only the two dorsal ones are fully developed, the two ventrolateral ones being only partly developed and the midventral one



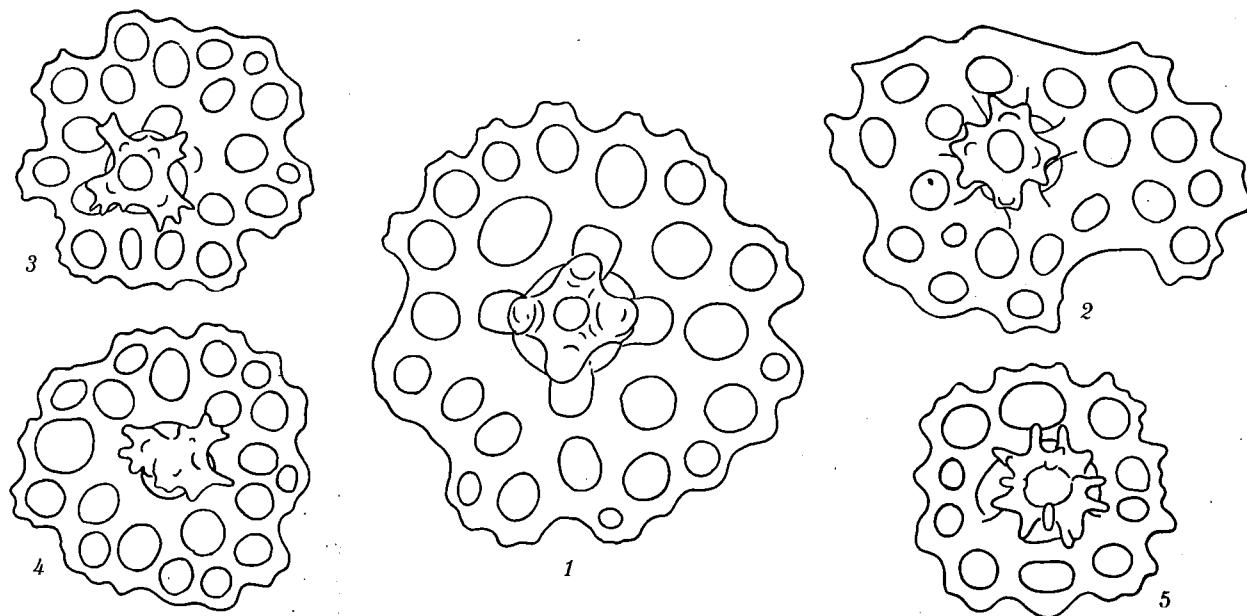
Textfig. 21. *Thyonidium barthii*, "Ingolf", St. 32, small specimen.  $\times 60$ . 1, left dorsal radial. 2, left ventral radial with the adjoining interradial. 3, mid-ventral radial with the left ventral interradial.

lacking, and only the shape of the mid-ventral radial indicates that a radial tentacle is developing. Of the figures (textfigs. 20 and 21) it is easily seen how clearly the number and arrangement of the tentacles may be made out from the shape of the calcareous ring.

The calcareous deposits of the large specimen are partly

of dissolution of the deposits in the largest specimen was a natural process due to age. To this I must say 1) The appearance of the dissolution indicates acidity and not a biological process. 2) Not only the deposits of the body wall but also those of the introvert as well as the end-plates of the pedicels (deposits which are always present in large specimens of *commune*) are attacked by the acid. 3) There are in the collections of the Zoological Museum specimens of *Thyonidium* from Greenland, of more than three times the length which have the deposits of the body wall (i. e. acid fragments of such) persisting. At first sight these specimens, all appear to be TROCHEL's species *barthii*, but the calcareous deposits differ slightly from those of the various specimens of supposed *barthii* examined for the preparation of the report on the Echinoderms of the Thule Expedition (op. cit.). Especially the two sizes of tables so characteristic of the East Greenland and South-West Greenland specimens do not appear to be so distinct here, if indeed there really is more than one size of tables in the "Ingolf" specimens. This may be due to the very minute size of the three specimens, the fourth being, as stated, so much attacked by acid that its tables cannot be closely studied. On account of the minute size of the three specimens the deposits of the introvert cannot be examined, in the large specimen, however, the deposits of the introvert are fairly well preserved and show the perplexing feature of not being rosette shaped tables but oblong perforate plates (textfig. 23). This indicates the possibility that the "Ingolf" specimens are not *Th. barthii* but a new species, a possibility which is strengthened by the fact that the specimen from the "Godthaab" Expedition St. 51, described by, Dr. TH. MORTENSEN as *Th. pellucidum* (Medd. om Grønland Bd. 79, Nr. 2, p. 48), quite agrees with the "Ingolf" specimens, also in the shape of the spicules of the introvert.

On account of this, one is inclined to establish a new species for the "Ingolf" specimens, but several reasons are definitely against it. Certainly the different shape of the deposits of the introverts appear to be very clear, but the fact that the deposits



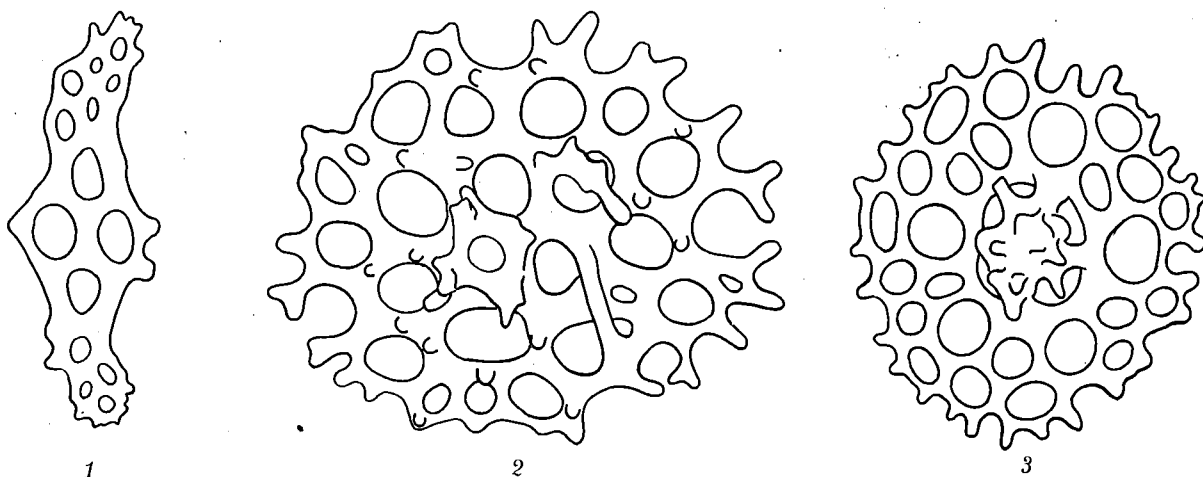
Textfig. 22. Tables from the body wall of different specimens of *Thyonidium barthii* and *Th. pellucidum*.  $\times 300$ . 1, *Th. barthii*, "Ingolf", St. 32, Expl. I. 2, *Th. barthii*, "Ingolf", St. 32, Expl. II. 3 and 4, *Th. barthii*, "Ingolf", St. 32, Expl. III. 5, *Th. pellucidum* from the Øresund.

dissolved though fragments are present in all parts of the body-wall. In the three other specimens the deposits are well preserved (textfig. 22) being smallest in the smallest specimen and largest in the largest specimen. One might perhaps think that the onset

of the "Ingolf" specimens are nearly identical with those found in the bases of the tentacle of *Th. barthii*, which are further identical with the spicules of the bases of the tentacle in the specimen from the "Godthaab", shows that we cannot lay too much

weight on this character, in any case not till more and well preserved material is available.

The studies made for determining these specimens have shown that the species *Th. barthii* is found in two slightly different populations, one along the East Greenland coast, and one off West Greenland. The first of these, which is characterized by the numerous very large and "fat" plates (tables), gives no difficulty, whereas that from West Greenland is not at all so clearly limited, especially as some specimens from Skovfjord and some of the specimens from Bredefjord show clear "East Greenland" features.



Textfig. 23. Calcareous deposits from the introvert of 1, *Thyonidium barthii* large specimen, "Ingolf", St. 32. 2, *Thyonidium barthii* specimen from Angmagssalik. 3, *Thyonidium pellucidum* from Hellebæk (northern Øresund).  $\times 300$ .

In spite of these slight differences we may maintain *Th. barthii* as a valid arctic species. Besides the occurrence off Greenland this species is found along north and east Iceland down to Berufjord, whereas the *Thyonidium* found along the west coast of Iceland and north east over to about Øfjord is the real Scandinavian *Th. pellucidum*.

The two species are fairly easily separated, as *pellucidum* has not more than one circle of holes around the central hole in the deposits, only in the tube feet there may now and then be traces of a second circle. Very often the circle of holes is more or less incomplete. Further the deposits of the introvert are always circular.

In *barthii* there are normally found two sizes of tables, of which the plates are of irregular shape with either scattered holes or with more than one circle of holes. The deposits of the introvert are very irregular, usually oblong and usually more "open" (cf. the figures of textfig. 22).

## Family Ypsilothuriidae. fam. nov.

The study of the fine collection of the genera *Ypsilothuria* E. Perrier (syn. *Sphaerothuria* Ludwig) and *Echinocucumis* M. Sars from the "Ingolf" Expedition has shown reasons for the establishment of a separate taxonomic group for these forms, a group of the same rank as the *Psolidae* and the *Phyllophoridae*. The arrangement of the tentacles, and especially the shape of the calcareous deposits, appear to be valuable characters, whereas the U-shape of the bodywall cannot be regarded as a taxonomic feature of higher rank.

There has always been some doubt as to the systematic place of the genus *Ypsilothuria*. In the report on the "Travailleur & Talisman", PERRIER established the family *Rhopalodimidae* for the genera *Rhopalodina* and *Ypsilothuria* (the latter regarded by PERRIER as a synonym of *Sphaerothuria*), as he regarded the

## Genus *Duasmodyctyla* Ayres.

### *Duasmodyctyla commune* (Forbes).

*Thyonidium commune* Mortensen 1927: British Echinoderms p. 412, fig. 250.

*Phyllophorus communis* Deichmann 1930: Holothurians of the Atlantic Ocean p. 143, pl. 17, figs. 16, 17.

This species is not represented in the "Ingolf" collections, but the "Godthaab" specimen from St. 112, mentioned by

Dr. MORTENSEN in 1932 (Echinoderms of the "Godthaab" Expedition p. 48) as *Thyonidium pellucidum* is a characteristic specimen of *commune*, characterized by the shape of the deposits of the introvert and in having twenty tentacles.

There has been some discussion of how far *commune* is in reality specifically different from *pellucidum*. That it is, is definitely shown by Dr. DEICHMANN, who was aware of the very clear difference in the shape of the spicules of the introvert. Unfortunately DEICHMANN did not study the shape of the calcareous ring and the number of the tentacles more closely, so these differences have not been used in the classification of the two species *commune* and *pellucidum*.

Beside by the shape of the spicules of the introvert (MORTENSEN 1927 p. 413, fig. 250), *commune* is characterized by the shape of the spicules of the body wall of specimens smaller than about three cm, whereas such spicules are lacking in larger specimens.

peculiar shape of *Ypsilothuria* as a connecting link between *Echinocucumis* and *Rhopalodina*. That PERRIER did not then place *Echinocucumis* within his family *Rhopalodimidae* may be due to the fact that LUDWIG regarded *Echinocucumis* as a synonym of *Cucumaria* and PERRIER himself did not know this form well.

Later on, HÉROUARD, in his Monaco report (1923), discussed these problems very carefully, and showed that PERRIER's genus *Ypsilothuria* was merely a synonym of *Echinocucumis*, whereas he regarded the genera *Rhopalodina* and *Sphaerothuria* as independent genera, without stating, however, anything about their connection with each other. This supposition of HÉROUARD was, however, adopted by neither DEICHMANN nor MORTENSEN, who both regarded the species *talismani* as a valid species, and the genus as a synonym of *Sphaerothuria*.

In studying some specimens of *Rhopalodina* some years ago (HEDING 1937, A new dendrochirote Holothurian from South Africa, Ann. South African Mus. and Ueber die von Dr. Monod in 1927 beschriebenen Rhopalodiniden, Zool. Anzeig.) and in examining the present "Ingolf"-material, I have gained the opinion that the shapes of the body must be regarded as parallel features for different groups, being of no special systematic classificatory value, and in using the features of the tentacles and the calcareous ring, features which are certainly rather difficult to use, for technical reasons, I believe I have been able to clear up the intricate classification of these specimens.

It must be pointed out that older statements as to the number of the tentacles in the specimens of both *Rhopalodina* and *Ypsilothuria* are often erroneous, as none of these genera has ten tentacles. *Rhopalodina* has, as I have shown in the papers cited, about 18 to 20 tentacles, and in no specimens of *Ypsilothuria* examined I have seen more than 8 tentacles. In fact the number of tentacles cannot be counted directly with complete certainty, but the shape of the calcareous ring fairly clearly shows the number of tentacles. All the specimens of *Echinocucumis* have ten tentacles. From this it appears that the *Rhopalodinidae* cannot include the genus *Ypsilothuria* as well as the genus *Echinocucumis* and in fact this "family" must most likely be regarded as a subfamily of the *Phyllophoridae*.

On the other hand the genera *Echinocucumis* and *Ypsilothuria* are much alike in the structure of the calcareous deposits, and differ in this feature rather definitely from all the Cucumarians with large plates in the body wall. Indeed the deposits of such as *C. kirschbergi* or *C. syracusana* or perhaps better of *C. hyndmanni* may faintly recall the shape of the deposits of *Echinocucumis*, but in the species named the "spire" is but the spiny outer end of the plates, whereas the spire in *Ypsilothuria* and *Echinothuria* is a real spire.

This feature, in connection with the two large lateral tentacles, unites the two genera, as also does the shape of their body, and separates them clearly from the other members of the *Cucumariidae*, thus making natural the establishing of a separate family for them.

The diagnosis of the family *Ypsilothuridae* consequently is as follows: Spherical to U-shaped, dendrochirote Holothurians with eight to ten tentacles, of which two are much larger than the others. Calcareous deposits of the body wall large plates with a spiny spire. Tube-feet slightly developed, usually placed along the ambulacra.

### Genus *Ypsilothuria* E. Perrier.

#### Pl. II.

*Ypsilothuria* E. Perrier 1886: Les Explorations sous-marines p. 285-286, figs. 293-294

*Sphaerotheruria* Ludwig 1894. The Holothurioidea, Albatross Exp., p. 153.

*Echinocucumis* part. Hérouard 1923: Holothuries provenant des campagnes etc. p. 118-127.

*Sphaerotheruria* Hérouard 1923. Op. cit. p. 127.

*Sphaerotheruria* part. Deichmann 1930: Holothurians of the Atlantic Ocean p. 152.

Diagnosis: Spherical to U-shaped Dendrochirotes, always with eight tentacles, and without the two ventral interradials. Two of the tentacles, one on each side, are much larger than the others. Calcareous deposits of body wall large plates with a more or less central spine. These plates form a real test. Those of anterior and posterior end much imbricating, and without spire.

Remarks: There are in the collections of "Ingolf", "Thor" and "Godthaab" 24 well preserved specimens of this genus, and the present author also has had the opportunity of studying a few

West Indian specimens, and some collected by the "Valdivia", numerous specimens collected by the "John Murray", and some few collected in the East Indies by Dr. TH. MORTENSEN.

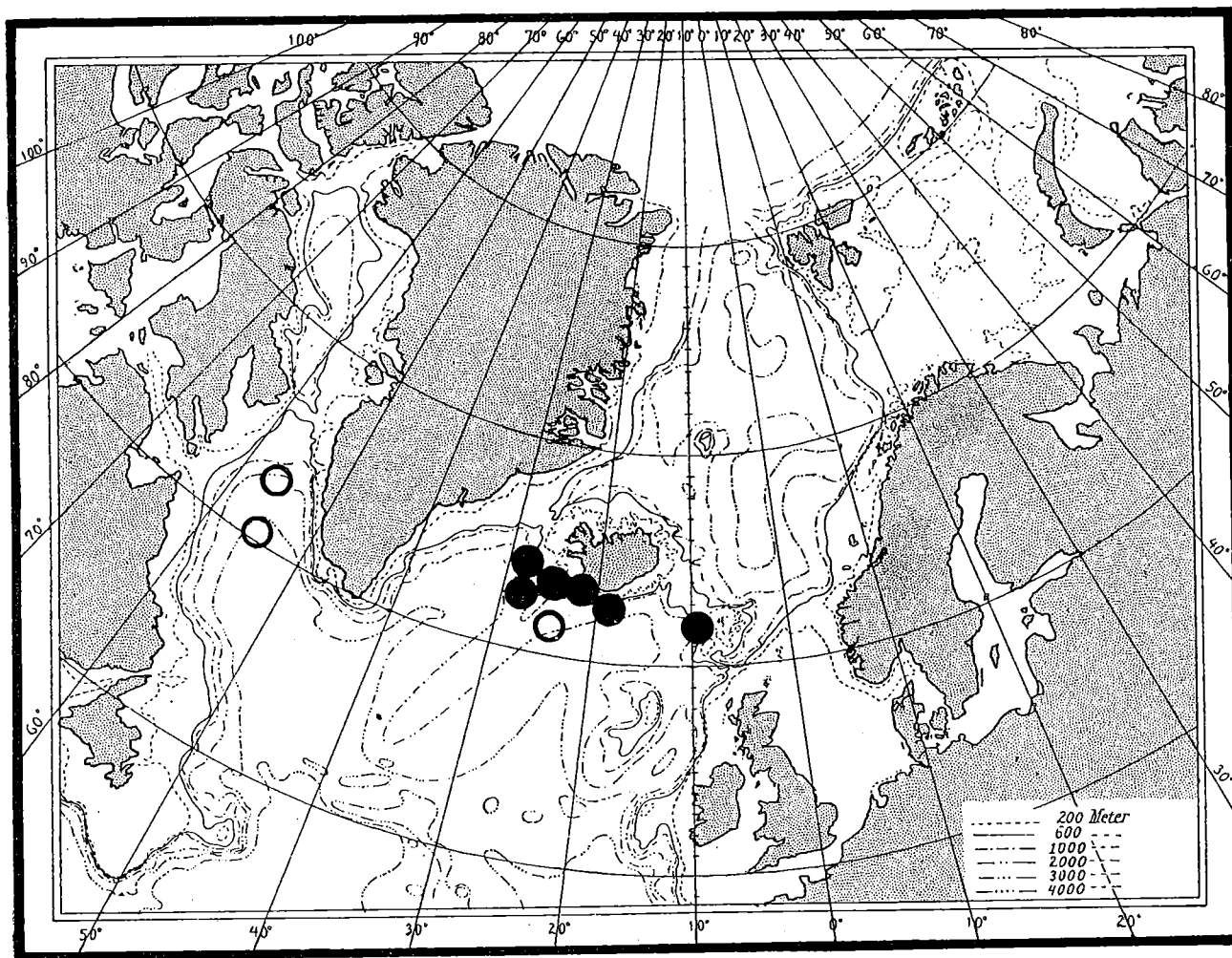
The study of this unusual material has definitely shown that the genus *Ypsilothuria* E. Perrier is a valid genus, which, though closely related to the genus *Echinocucumis*, is, however, distinctly and easily separated from it. The two genera are separated definitely by the structure of the calcareous ring, as *Echinocucumis* has two well developed ventral interradials, and *Ypsilothuria* has no ventral interradials at all. Also, the spire of the calcareous plates in the body wall of *Echinocucumis* is, as a rule, placed at the margin of the plate, and in *Ypsilothuria* always more or less close to the centre.

By this latter feature it is easily seen that the specimens described by R. PERRIER in 1902 cannot be referred to *Echinocucumis* as stated by HÉROUARD in 1923, and E. PERRIER's figures from 1886 are so characteristic that there can be no doubt as to the identity of the genera *Sphaerotheruria* and *Ypsilothuria*. The conclusion that the generic name *Sphaerotheruria* must be abandoned and placed as a synonym of *Ypsilothuria*, admits of no discussion.

Further it is evident that R. PERRIER was mistaken in stating that *Ypsilothuria* has ten tentacles. In fact the counting of tentacles in these specimens is more than usually difficult, and indeed in trying a direct counting of the tentacles in these species the present author, in spite of good instruments and a good will, has got a varying number, and even Dr. TH. MORTENSEN was not able to find more than the two large tentacles in a specimen from the "Godthaab". The real number of tentacles may, however, easily be found from the shape of the calcareous ring. Such studies show that in all the specimens of *Ypsilothuria* before me the two ventral interradials are lacking, or they are at least closely united with the ventro-lateral radials, in such a way that there is no insertion for a tentacle muscle. Thus there are not more than eight muscular insertions left, and it follows, there are not more than eight tentacles. This is distinct from conditions in *Echinocucumis*, where there are two well developed ventral interradials, with ten muscular insertions and ten tentacles.

This shape of the calcareous ring appears to me as being of much phylogenetic interest. Various authors e.g. DEICHMANN 1930 p. 154, suggest that the lacking tentacles in "*Sphaerotheruria*" may be the usually rudimentary ventral tentacles which are totally aborted. The rudimentary ventral tentacles are, however, always the two which are placed at the sides of the mid-ventral radial, and in *Ypsilothuria* these two tentacles persist, whereas the missing tentacles are those which are normally placed between the ventral interradials and the ventro-lateral radials.

In 1930 DEICHMANN suggests that there are two species of *Ypsilothuria* (*Sphaerotheruria*) in the Atlantic, *asperrima* (Théel) and *talismani* (Perrier). I have had the opportunity in the collections of the Zoological Museum to examine a fine specimen of *asperrima*, determined by DEICHMANN as *Echinocucumis asperrima*. There is no doubt that this specimen is a good *Echinocucumis*, and, as there cannot be any doubt as to the specific determination, I must state that *asperrima* cannot be referred to the genus *Ypsilothuria*. On the other hand, the material present shows that we have indeed two different species of *Ypsilothuria* in the Atlantic, viz. PERRIER's two species *talismani* and *attenuata*. Of these *talismani* is a valid species, whereas *attenuata* is perhaps a synonym of *bitentaculata* (Ludwig). As there are, however, some faint differences between *bitentaculata* and *attenuata*, and I have also some specimens from the West Indies collected by Dr. MORTENSEN, which represent two different forms of which one appears to be a variety of *talismani* and the other a variety of *bitentaculata* but different from *attenuata*, I for the present regard it most natural to separate these different forms. We have thus for the present four different forms of *Ypsilothuria* in the Atlantic:



Textfig. 24. ● *Ypsilothuria talismani* E. Perrier. ○ *Ypsilothuria bitentaculata attenuata* R. Perrier.

*Ypsilothuria talismani talismani* E. Perrier  
 — — — *elegans* n. var.  
 — — — *bitentaculata attenuata* R. Perrier  
 — — — *virginiensis* n. var.

As it appears from the different figures, these two main groups *talismani* and *bitentaculata* differ clearly in the size and shape of the calcareous plates (cf. Pl. II), in the shape of the deposits in the two large tentacles, and in the shape of the lateral radial, so no doubt as to their classificatory difference can remain. Exteriously the two species may be separated in that while *talismani* is fairly soft, *bitentaculata*, at any rate the variety *attenuata*, is as hard as a little echinoid.

As to the varieties, *elegans* has slightly longer spires on the plates than *talismani*, and the plates are more regularly built, with smooth margins. There are faint differences also in the shape of the tentacle rods. As to the varieties of *bitentaculata* both *attenuata* and *virginiensis* have smaller plates than *bitentaculata*, but the size of the plates in *attenuata* appears to be so variable that in any case the two varieties cannot safely be separated by this feature. There are, however, some faint differences in the structure of the network, and also the shape of the calcareous ring appears to indicate some systematic difference.

In the "Ingolf" and "Thor" collections there are specimens of both *talismani* and *attenuata*, but, as seen from the map, textfig. 24, they are distributed in such a way that all the specimens of *talismani* are found in somewhat shallower water than those of *attenuata*, which quite agrees with PERRIER's statements. As a rule we may say that *talismani* is found to depths about 1500 m and *attenuata* in depths from about 1800 m and deeper.

#### *Ypsilothuria talismani talismani* E. Perrier.

*Ypsilothuria talismani* E. Perrier 1886. Op. cit. p. 286, fig. 294.  
*Echinocucumis typica* v. *abyssalis*: Koehler 1896: *Echinodermes* du "Caudan" p. 118, fig. 22.

*Ypsilothuria talismani* R. Perrier 1902: *Holothuries*, Travailleur et Taliman, p. 518, textfig. 12, Pl. XII, figs. 9-10.

#### Localities:

"Ingolf" St. 10.	64°24' N.	28°50' W.	1484 m,	3°.5 C.	.....	2 spec.
— St. 73.	62°58' N.	23°28' W.	915 m,	5°.5 C.	.....	2 —
— St. 83.	62°25' N.	28°30' W.	1717 m,	3°.5 C.	.....	1 —
"Thor" St. 166.	62°57' N.	19°59' W.	957 m,	14/7-03	.....	4 —
— St. 167.	63°05' N.	20°07' W.	557 m,	14/7-03	.....	4 —
— St. 99.	61°15' N.	9°35' W.	900 m,	25/5-04	.....	2 —
— St. 43.	43°37' N.	2°08' W.	480-1500 m,	15/5-06.	.....	1 —

The specimens present measure from about 2 mm to about 15 mm in length. They are oblong spherical (cf. textfig. 25 5-6) with fairly short anal and oral parts. The body wall is thin and fairly soft, very like that of *Echinocucumis hispida*. There are eight tentacles (not ten as stated by R. PERRIER) of which one on each side, the ventro-lateral, is much larger than the others. The tentacles appear to be finger-shaped without any branches, the tentacle muscles have, however, their terminal tip faintly bifid.

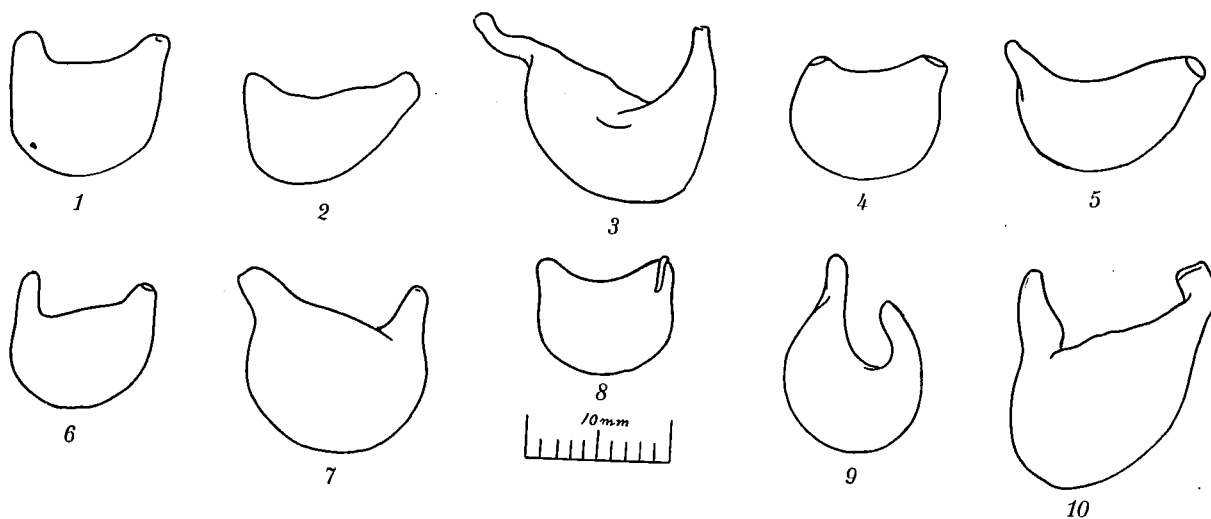
The calcareous ring (textfig. 26 1 and 3) consists of eight pieces, of which the two ventro-lateral radials are formed by the coalescence of the original ventro-lateral radial and the ventral interradial. The lateral interradials are supplied with an undivided anterior process. There is a single stone-canal and one (two?) very thin polian vesicle.



The calcareous deposits of the body wall (textfig. 27 a and Pl. II, figs. 13-15 and 21-26) measure about 0.7-1.0 mm in diameter. They are supplied with a number of equally large holes and in the median part with an open meshwork. Somewhat eccentrically there is a spiny spire. The margin of the plates is irregular, and the holes are placed regularly out to the margin.

*Echinocucumis*, but the calcareous ring (textfig. 29 2) definitely shows that it is an *Ypsilothuria*.

This species, *Ypsilothuria talismani talismani* E. Perrier, is recorded with certainty not only from the stations of "Ingolf" and "Thor" but also from the "Travailleur" and "Talisman" off the coasts of France, Spain, Morocco, and Senegal. There is



Textfig. 25. The outline of various specimens of *Ypsilothuria*. 1, *Ypsilothuria bitentaculata attenuata* ("Godthaab"). 2, *Ypsilothuria bitentaculata attenuata* ("Ingolf", St. 67). 3, *Ypsilothuria bitentaculata attenuata* ("Ingolf", St. 37). 4, *Ypsilothuria bitentaculata attenuata* ("Ingolf", St. 67). 5, *Ypsilothuria talismani talismani* ("Ingolf", St. 10). 6, *Ypsilothuria talismani talismani* ("Ingolf", St. 73). 7, *Ypsilothuria bitentaculata virginienensis* (Frederikssted). 8, *Ypsilothuria talismani elegans* (Frederikssted). 9 and 10, *Ypsilothuria bitentaculata* (Indo-Pacific specimen).

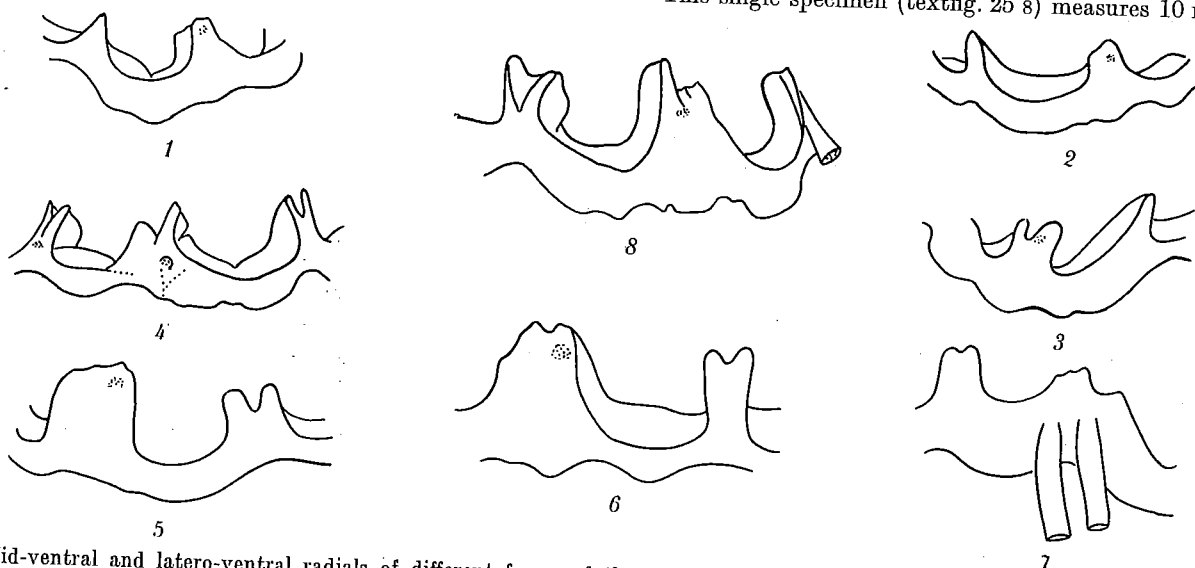
The spicules of the tentacles are fairly solid spiny staves, with one, two, or no perforations in the ends (textfig. 28 1-2). The shape of these spicules is clearly different from that of the deposits of the tentacles in the different forms of *Y. bitentaculata* (textfig. 30).

LUDWIG states (1894 p. 146) that the tube-feet of *Sph. bitentaculata* penetrate the large plates of the body wall, and it is supposed that this feature may be characteristic for the genus *Sphaerothuria* (i. e. *Ypsilothuria*) and separates it from *Echinocucumis*. It is to be expected that the tube-feet should penetrate the large perforated plates, as these are placed so closely that there is no room between them; that this feature is, however, to be regarded as accidental is seen from the specimen from the "Thor" (St. 167) where there are also tube-feet which are placed between the plates of the body wall (cf. textfig. 29 1). It appears at first sight that this little specimen is not *Ypsilothuria* but an

also a single specimen from the West Indies (Frederikssted <sup>20</sup>/<sub>1</sub> 1906, 375 m, coll. TH. MORTENSEN) which in all details agrees with the specimens from the North Atlantic, and must be referred to the same species and form. This indicates that the different American localities for this species mentioned by DEICHMANN in 1930, may be right, though we cannot be sure, as DEICHMANN did not distinguish clearly between the different forms of *Ypsilothuria* and *Echinocucumis*. This is obvious not only from her dealing with these forms in her "West Atlantic Holothurians" but also from the material in the Zoological Museum, which is determined by her.

***Ypsilothuria talismani elegans* n. var.**

The West Indies, Frederikssted, <sup>20</sup>/<sub>1</sub>-1906, 375 m, col. TH. MORTENSEN ..... 1 spec.  
This single specimen (textfig. 25 8) measures 10 mm in length.



Textfig. 26. Mid-ventral and latero-ventral radials of different forms of the genus *Ypsilothuria*. × 30. 1, *talismani talismani* ("Thor", St. 166). 2, *talismani talismani* (Frederikssted). 3, *talismani talismani* (Frederikssted). 4, *bitentaculata* (Indo Pacific). 5, *bitentaculata attenuata* ("Ingolf", St. 67). 6, *bitentaculata attenuata* ("Godthaab"). 7, *bitentaculata attenuata* ("Ingolf", St. 67, abnormal specimen with double latero-ventral retractor). 8, *bitentaculata virginienensis* (Frederikssted).

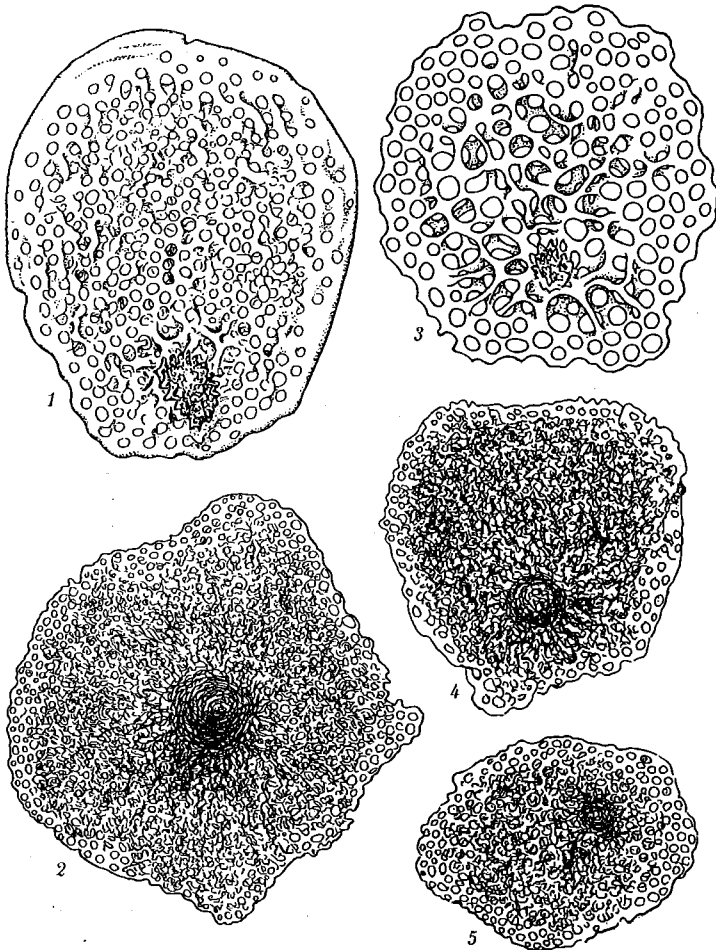
In most of its features it quite agrees with *talismani talismani*, but in some few details it differs so much that I do not consider it safe to refer it to that form.

The main difference is the shape of the calcareous plates, which in this form, is ovoid to circular with smooth margin and with no or few holes close to the margin, (cf. the figures: textfig.

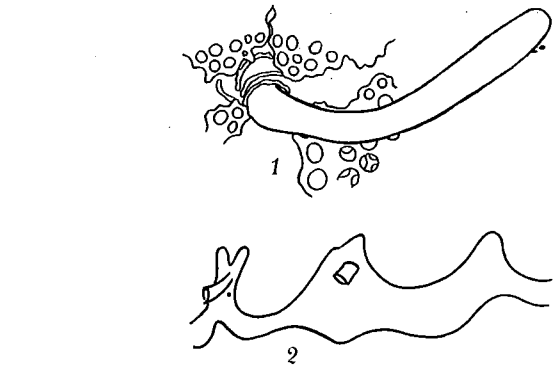
***Ypsilothuria bitentaculata attenuata* R. Perrier.**

*Ypsilothuria attenuata* R. Perrier 1902: *Holothuriales*, "Travailleur" et "Talisman", p. 522, textfig. 13.

*Ypsilothuria Talismani* Th. Mortensen 1932: *Echinoderms*, the Godthaab Expedition 1928, p. 49.



Textfig. 27.



Textfig. 29.

Textfig. 29. *Ypsilothuria talismani talismani* ("Thor", St. 167). 1, Tube-foot placed between the calcareous plates, and not penetrating one of them as is usually stated. 2, calcareous ring with the mid-ventral radial, the left ventral radial and the left lateral interradial, showing that the specimen, in spite of the arrangement of the tube-feet, is a real *Ypsilothuria*.

Textfig. 27. Calcareous shields of different forms of the genus *Ypsilothuria*, showing differences in the shape and the structure. Figs. 1 and 3 are drawn with higher magnification ( $\times 60$ ) than the others ( $\times 26$ ) (cf. Pl. II). 1, *Y. talismani elegans* (Frederikssted). 2, *Y. bitentaculata* (Indo-Pacific). 3, *Y. talismani talismani* ("Ingolf", St. 73). 4, *Y. bitentaculata virginiensis* (Frederikssted). 5, *Y. bitentaculata attenuata* ("Ingolf", St. 37).

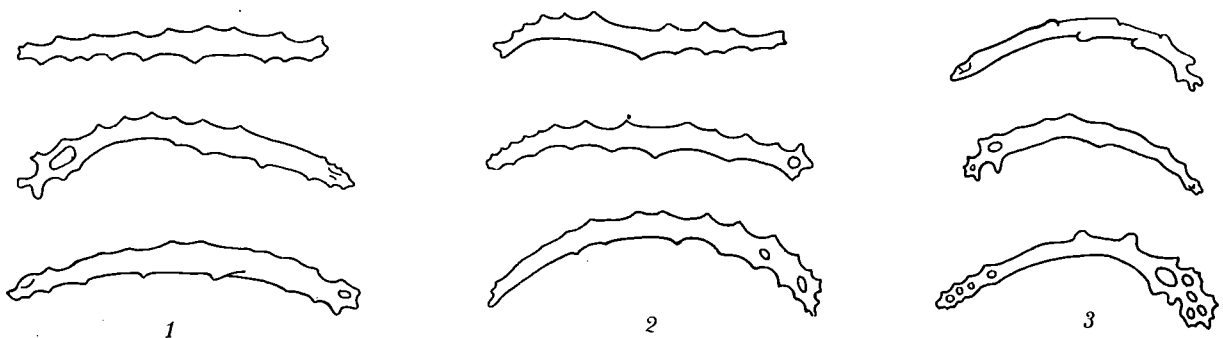
27 1 and Pl. II, figs. 17-20). Further the staves in the large tentacles appear to be characteristic.

As this form is easily mistaken for *talismani talismani*, and superficially also resembles a specimen of a separate form of *bitentaculata* collected in the same locality, it is not possible to ascertain how far this form is to be included in the material of *Ypsilothuria* known from American Seas.

Localities:

- "Ingolf" St. 37. 60°17' N. 54°05' W. 3231 m, 1° 4 C . . . . 1 spec.
- St. 67. 61°30' N. 22°30' W. 1836 m, 3° 0 C . . . . 3 —
- "Godthaab" St. 180. 62°07' N. 55°00' W. 2750 m, 9/10-28 5 —

These specimens measure from 10 mm to 20 mm in length, and vary much in shape, as those from the "Godthaab" are nearly

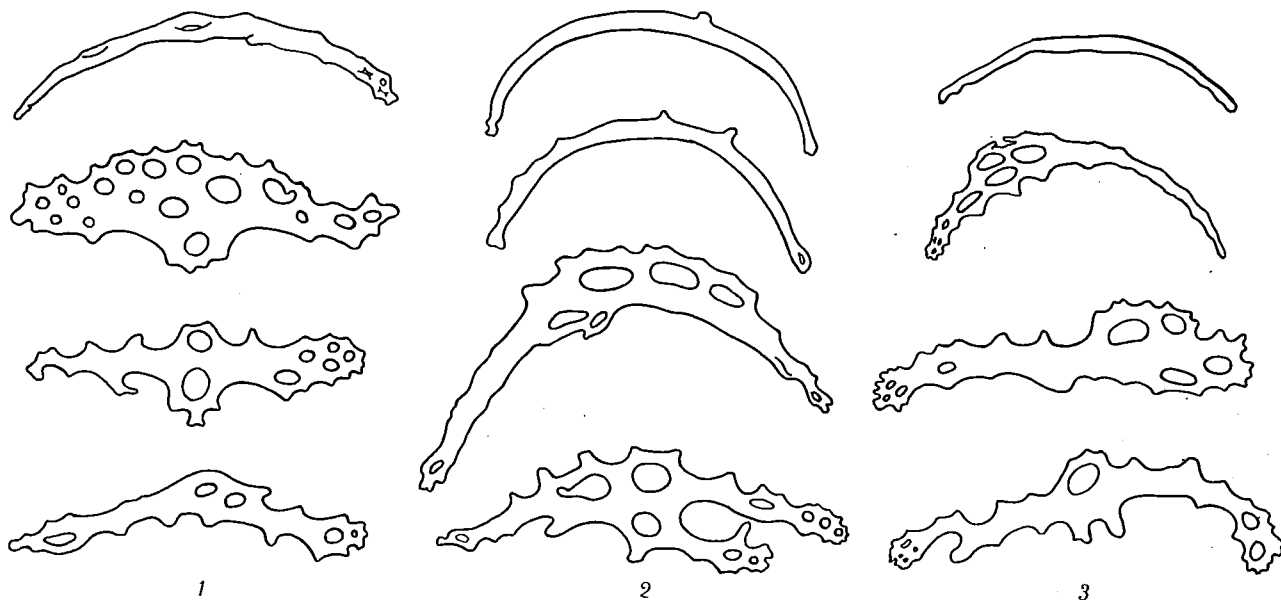


Textfig. 28. Calcareous spicules from the tentacles.  $\times 140$ . 1, *Ypsilothuria talismani talismani* ("Thor", St. 166). 2, *Ypsilothuria talismani talismani* (Frederikssted). 3, *Ypsilothuria talismani elegans* (Frederikssted).

spherical with very short anal and oral tubes, and the specimens from the "Ingolf" are more ovoid with fairly long anal and oral tubes (cf. Pl. II, figs. 1-4). The plates of the body wall are so large and solid and placed so closely to each other that they form a real test, and seeing this e. g. in the specimens from the "Godthaab", it is difficult to think that these specimens may change their shape, as it has also been stated previously to be impossible. A single specimen, however, shows that the large plates, which are usually not distinctly imbricating, may be much imbricating

This specimen is very like the specimens of *attenuata* from the "Godthaab" St. 180, but differs slightly in the structure of the calcareous plates and in the shape of the calcareous ring (cf. textfig. 27 4, textfig. 26 8 and Pl. II, figs. 11-12). Further its habitat in less deep water, while all the localities of *attenuata* are abyssal, gives another reason for keeping the two forms separate.

*Ypsilothuria bitentaculata attenuata* is distributed in the abyssal parts of the Atlantic, from Davis Strait to the type locality off Senegal.



Textfig. 30. Calcareous spicules of the tentacles.  $\times 140$ . 1, *Ypsilothuria bitentaculata attenuata* ("Ingolf", St. 67). 2, *Ypsilothuria bitentaculata attenuata* ("Godthaab"). 3, *Ypsilothuria bitentaculata* (Indo Pacific).

when the specimen is strongly contracted and thus change the shape of the specimen to a fairly high degree.

There are, as in *talismani*, not more than eight tentacles, of which the two lateral, one on each side, are much larger than the others. Also the calcareous ring is as in *talismani*, with no free ventral interradians, but here the lateral interradians have their anterior process cleft (textfig. 26 4-6). There are usually two polian vesicles and a single stonecanal.

The calcareous shields of the body wall (textfig. 27 5, see, however, also figs. 2 and 4 and Pl. II, figs. 1-2 and 5-10) measure about 1.2 mm to 1.8 mm, and are supplied with an irregular meshwork in several layers and a solid more or less central spire. The shape of the plates varies, usually ellipsoid but often it may be polygonal as in *bitentaculata* (cf. textfig. 27 2 and Pl. II, figs. 3-4). Normally these plates are distinctly smaller than the plates in *bitentaculata*, but the size varies somewhat.

The deposits in the large tentacles (textfig. 30) vary from the base of the tentacles to their tips. At the base they are large, irregular polypore plates, while at the tips they are bent staves. The shape of the tentacle staves is quite like that of the tentacle staves in *bitentaculata*.

*Ypsilothuria bitentaculata attenuata* is closely related to *bitentaculata* from the Indo-Pacific and it is reasonable to suppose that it is the same species or indeed subspecies. As there are, however, some faint but apparently characteristic differences in the structure of the calcareous plates, and perhaps also in the shape of the calcareous ring, I think it safer for the present to keep the two forms separate. In the same degree I think it the better course to regard a single specimen collected by Dr. TH. MORTENSEN in the West Indies at Frederikssted in a depth of 375 m as a separate form, naming it *Ypsilothuria bitentaculata virginensis* n. var.

#### Genus *Echinocucumis* M. Sars.

In the discussion of the family *Ypsilothuridae* and the genus *Ypsilothuria* it is shown that the genus *Echinocucumis* is a valid genus distinctly different from the genus *Cucumaria* with which it is often regarded as synonymous. From its closest related genus, *Ypsilothuria* it differs in having ten tentacles, or, what is more easily ascertained, in having two free ventral interradians.

For the present the genus includes not more than three species *hispidus* Barrett, *asperrima* Théel and *paratypica* Ludwig & Heding. In her "Atlantic Holothurians" DEICHMANN refers *asperrima* to the genus *Sphaerothuria* (i. e. *Ypsilothuria*). This cannot hold good, as *asperrima* has ten tentacles, and furthermore the shape of the calcareous deposits differs clearly from *Ypsilothuria*.

A fourth species previously referred to the genus *Echinocucumis* is SEMPER's *adversaria*. That this species cannot reasonably be kept within the genus *Echinocucumis* is shown by DEICHMANN in 1930, who, however, referred it to *Cucumaria*. In my paper: The Holothurians of the Iranian Gulf, I have shown that *adversaria* represents a genus its own: *Thorsonia*.

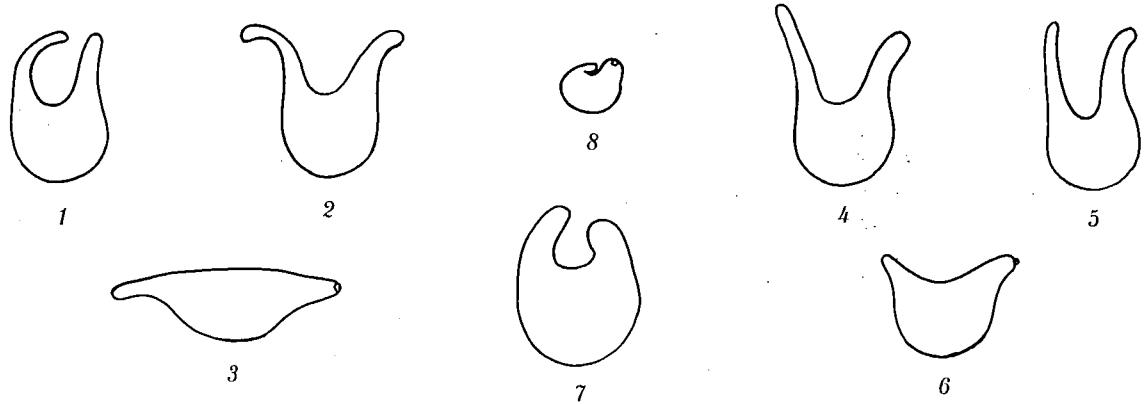
The "Ingolf" Expedition took only a single *Echinocucumis*, which belongs to the only known species from the northern Atlantic, *hispidus* Barrett, but beside this, there are a number of specimens collected by the research steamer "Thor". For clearing up the rather intricate systematics of these specimens large collections made by S/S "Michael Sars" in the Norwegian Sea, and by different collectors along the Norwegian coast, have also been carefully studied.

#### *Echinocucumis hispidus* (Barrett).

*Eupyrgus hispidus* Barrett 1857: Descriptions of four new species of Echinodermata p. 46, Pl. IV, fig. 1 a-b.

*Echinocucumis typica* M. Sars 1861: *Oversigt over Norges Echio-  
odermer* p. 102-110. Tab. X, figs. 11-20, Tab. XI, figs. 1-17.  
*Echinocucumis typica* Hérouard 1923: *Holothuries provenant des  
campagnes des Yachts Princesse-Alice et Hirondelle II.* p.  
118-127.

"Thor" St. 77, 61°06' N. 8°30' W. 116 m, 11/5-04 . . . . .	1 spec.
— St. 99, 61°15' N. 9°35' W. 900 m, 22/5-04 . . . . .	14 —
— St. 93, 49°25' N. 12°25' W. 1275-1180 m, 27/6-05	1 —
— St. 1571, 58°06' N. 9°00' E. 660-420 m, 24/6-11.	7 —



Textfig. 31. *Echinocucumis hispida*. Outlines of different specimens showing how strongly this species may vary in shape. In fig. 7 the scales on the dorsal side are strongly imbricating and in fig. 3 they are all scattered with fairly large intervals. Same magnification as in textfig. 25. 1-6, specimens from "Michael Sars", St. 51. 7, specimen from "Ingolf", St. 8. 8, specimen from "Thor", St. 171.

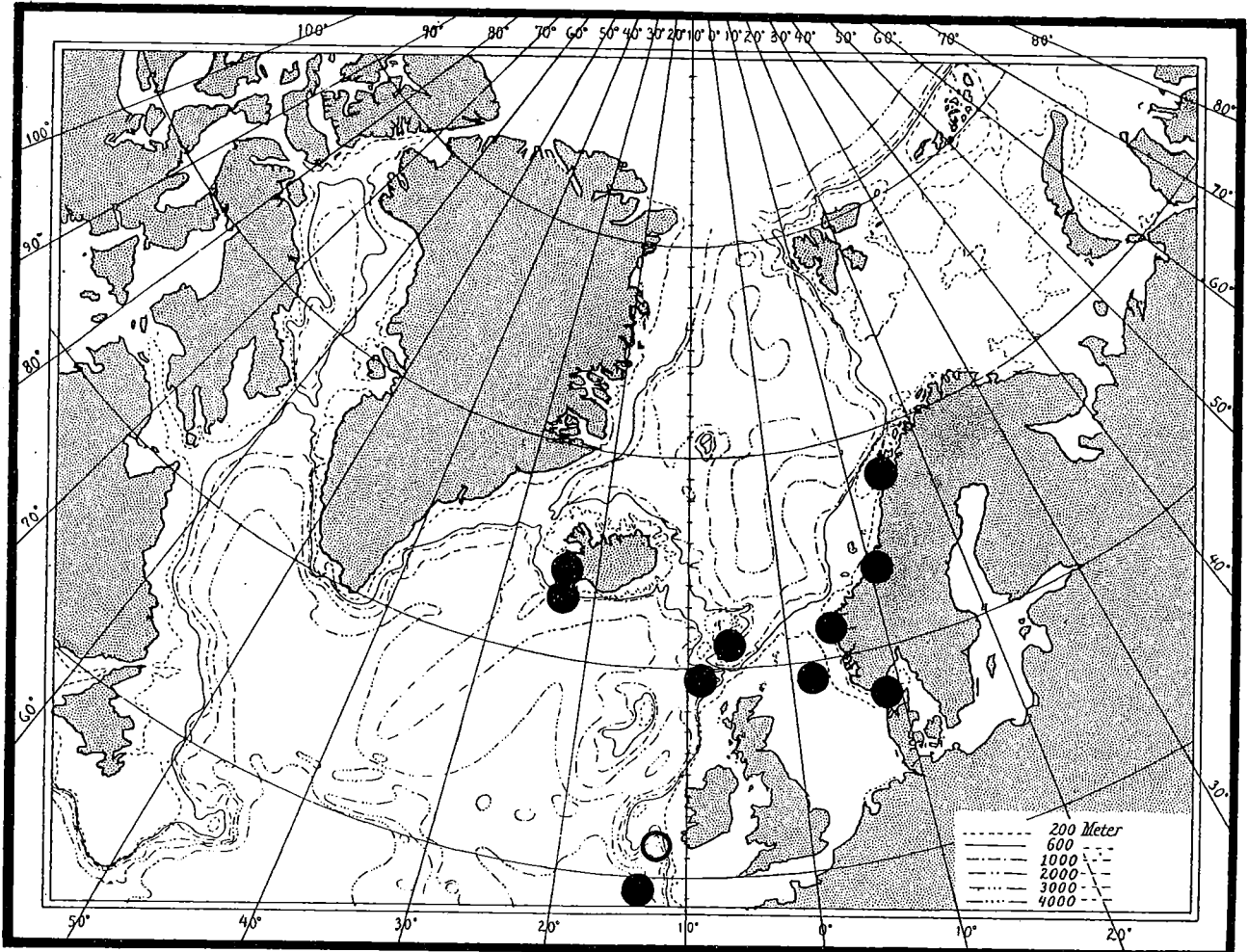
*Echinocucumis hispida* Mortensen 1927: *British Echinoderms*  
p. 404, fig. 243.  
*Echinocucumis hispida* Deichmann 1930: *Holothurians of the  
Atlantic Ocean* p. 150, Pl. 18, fig. 9.

"Thor" St 171, 63°15' N. 22°23' W. 326-216 m . . . . .	1 spec.
"Michael Sars" St. 76, 59°28' N. 8°01' W. 1300 m . . . . .	10 —
— St. 51, 61°40' N. 3°11' E. 405 m . . . . .	6 —
— St. 47, 60°57' N. 3°42' E. 357 m . . . . .	3 —

Localities:

"Ingolf" St. 8, 63°56' N. 24°40' W. 256 m, 6°0 C . . . . . 1 spec.  
"Thor" St. 3, 58°32' N. 4°18' E. 280 m, 30/4-03 . . . . . 3 —

The specimens (textfig. 31) are all quite typical, agreeing in all respects with Sars' description. There is a slight variation in the size of the calcaresous deposits, but the comparison of a



Textfig. 32. *Echinocucumis hispida* (Barrett). ● Specimens examined by the author ○ reference ("Porcupine").

fair number of preparations shows that this variation is in correspondence with the size of the specimens. Also the calcareous ring may vary slightly, as the anterior processes, which are normally bifid, may be single pointed in some small specimens, but apparently this also is due to the small size of these specimens.

As to the anatomy of *Echinocucumis hispida*, M. Sars has worked it out excellently. In spite of this DEICHMANN in 1930 states (p. 151) that the tentacles are "simple, fingershaped" and that the respiratory trees are "quite abortive, with 1-2 small lobes". As to the tentacles, only the four ventral ones are fingershaped, the four dorsal are always supplied with two digits, and the two large lateral ones are supplied with some few branches, just as Sars had figured it. As to the respiratory trees Sars has certainly figured some fairly simple ones, but in all the specimens I have examined closely, the respiratory trees are well developed. They are paired as figured by Sars, but they have quite separate origins, and each of them has two main branches of nearly equal size.

The bathymetrical distribution is given by MORTENSEN (1927) as from about 50 m to about 1400 m but that there is evidently

some confusion with *Y. talismani* as regards the specimens from the greater depths. This may be, but the present material shows that *Echinocucumis hispida* is taken down to a depth of 1300 m, and in this case there is no possibility of any confusion with *Y. talismani*. DEICHMANN states (op. cit. p. 151) that in all cases where she has been able to go over the records of the depth, it has been taken at 100-250 fathoms i. e. 188 m to 470 m, and she adds that it refers to Scandinavian material. However, the Scandinavian material studied by DEICHMANN is the same as here dealt with, as is evidenced by her handwriting on the labels, and the depths recorded on these labels are 116 m to 1300 m.

*Echinocucumis* is distributed (cf. textfig. 32) all along the Norwegian coast and down to the Bay of Biscay, as well as round the English coast and off the south and west coasts of Iceland. It is also recorded from the American coast, but these records cannot be trusted as it may there be confused with not only *Y. talismani* but also with *E. asperrima*. That in any case DEICHMANN has confused these different forms is evident from the present material, which was previously determined by her.

## Family Cucumariidae.

### Genus Cucumaria.

#### *Cucumaria*(?) *calcigera* (Stimpson).

Duncan & Sladen 1881: The Echinodermata of the Arctic Sea to the West of Greenland p. 5, Pl. I, figs. 3-8.

Koehler 1927: Les Echinodermes des mers d'Europe p. 153, Pl. XIV, fig. 9a-b.

Deichmann 1930: Holothurians of the Atlantic Ocean p. 156, Pl. 11, figs. 9-12.

Mortensen 1932: Echinoderms, the Godthaab Expedition, p. 52.

#### Localities:

S. W. Greenland, Ameragdla  $22^{\circ}7'95''$  ..... 1 spec.  
Davis Strait,  $63^{\circ}30' N. 54^{\circ}25' W.$ , 1096 m,  $3^{\circ}.3 C$ , "Ingolf" St. 25 ..... 1 -

The specimen from St. 25 is but a very small one measuring only 3 mm in length, and as the calcareous deposits are faintly attacked by acid there is the possibility of an erroneous determination. The specimen has, however, been determined as *C. calcigera* by DEICHMANN and after having compared it carefully with a specimen 4 mm long from Bredefjord in W. Greenland I quite agree with DEICHMANN.

This is of interest as it is the first find of *C. calcigera* in Davis Strait and further it is from by far the deepest locality hitherto recorded for this species. These two small specimens are also interesting for the reason that they are nearly totally devoid of the inner layer of calcareous deposits, having but the superficial tables, which are also more stellate than in the large specimens.

The specimen from Ameragdla is fairly large, and differs from all the other specimens seen of *C. calcigera* in having the cloacal part of the body protruded to a veritable tail.

#### *Cucumaria* juv. (*elongata*?).

S. W. of Iceland,  $63^{\circ}15' N. 22^{\circ}23' W.$ , about 300 m, "Thor" St. 71 ..... 1 spec.

This little specimen measures 5 mm in length. It is of the curved shape normal for *C. elongata*. The tube-feet are fairly well developed

ventrally, but dorsally there are very few. The calcareous deposits resemble fairly well those of *C. elongata*, being large imbricating scales, and small baskets, but there is only one size of large scales and the baskets are more strongly developed than is usual in *elongata*. The primary cross is very solid, and the ring is supplied with long spines which now and then may unite, then forming a secondary cross over the primary one.

On account of these faint differences, which may be juvenile features, and the unusual deep water in which this usually littoral species was collected, I think it the better not quite definitely to refer this specimen to *C. elongata*.

#### *Cucumaria* *paraglacialis* n. sp.

"Ingolf" St. 29,  $65^{\circ}34' N. 54^{\circ}31' W.$  128 m,  $0^{\circ}.2 C$ ,  $5^{\circ}7'95''$  1 spec.

This little specimen, which does not measure more than 9 mm in length and 3 mm in width, resembles *Cucumaria glacialis* so closely, that I determined it at first as this species. There are, however, some faint, but apparently clear differences between this specimen and a number of real *glacialis* with which I have compared it, that I do not think it safe to refer it to *glacialis*. Naturally, it would be better to have more specimens, but for the present there is only the single one available.

The introvert with the tentacles is drawn in, but from the calcareous ring it is seen that there are ten (equally large?) tentacles. There are but few tube-feet, 13 in the mid-ventral ambulacrum, about 7 in each of the ventro-lateral ones and about 4 in each of the dorsal ambulacra. The tube feet of the ventral side are large and are placed in a zigzag row, whereas the dorsal tube-feet are small, papilliform, and apparently placed in a single row.

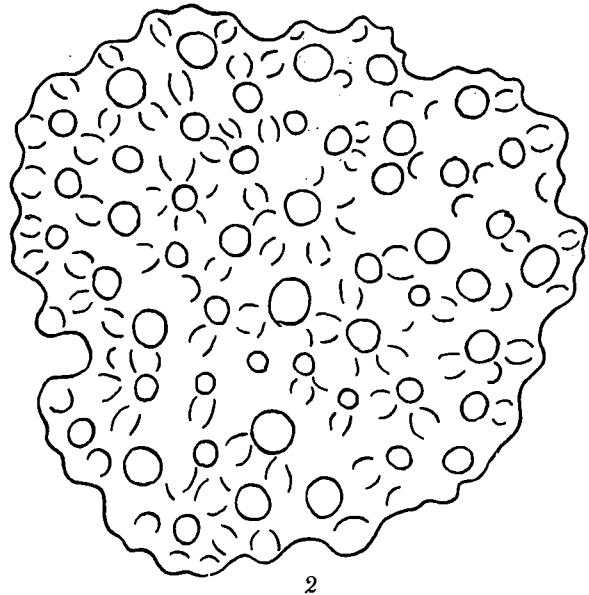
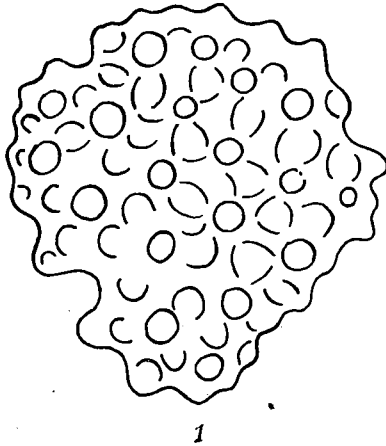
The calcareous ring is simple, and the retractors are placed about one third behind the end of the body wall proper, i. e. in the specimen with withdrawn introvert. There is one large polian vesicle placed in the left lateral interambulacrum. The stone canal is long, and supplied with a transversally folded, nearly spherical, large, inner madreporite.

The intestine is supplied with a bulbshaped stomach, the respiratory trees are paired and are fairly well developed. The gonads are but faintly developed.

The calcareous deposits of the body wall consists of but one

sort, large, very knobbed, perforated plates of varying size, textfig. 33. These plates are all distinctly imbricating, with their free margin towards the dorsal side.

As it is evident from the description, this species is very like *C. glacialis*, from which it differs in lacking the small cruciform deposits, in the imbricating of the large plates, as also in the somewhat different shape of these plates.



Textfig. 33. *Cucumaria paraglacialis*, deposits of the body wall.

### Genus *Abyssocucumis* n. g.

*Staurocucumis* partim. Ekman 1927: Holothurien, Deutsche Südpolar-Expedition, p. 374.

Diagnosis: Fairly small fusiform cucumarids with no distinct difference between bivium and trivium. With ten equal tentacles and with the water-vascular appendages in two alternating rows along the ambulacra, and totally lacking in the interambulacra. Calcareous ring well developed and simple, i. e. without any posterior prolongations. Intestine with muscular stomach, polian vesicle and stonecanal single, and respiratory trees more or less reduced. Retractor muscles for the larger part free, only united by the longitudinal muscles by a web close to their base.

Calcareous deposits of the body wall proper exclusively four-armed crosses with perforated ends and an excentrically placed spire or with no spire, and then with the one arm spinous, resembling a spire. This latter case the more common in large specimens.

Genotype: *Cucumaria abyssorum* Théel.

Remarks: The species *Cucumaria abyssorum* Théel was referred by EKMAN in 1927 to his new genus *Staurocucumis* in which he was later followed by CLARK and DEICHMANN in their paper: "On *Psollicucumis* Heding and its Allies." A closer study of the literature and of a fair number of specimens, both of *liouvillei* Vaney and *turqueti* Vaney collected by the "Terra Nova" Expedition (the report of the Holothurians of the "Terra Nova" Expedition will appear later in connection with that of the "B.A.N.Z.A.R.E." Expedition<sup>1</sup>) definitely shows that the genus *Staurocucumis*, as established by EKMAN, cannot hold good, and that it must be divided into a number of quite different genera. This will not cause surprise, as EKMAN himself, in discussing the genus more carefully, shows how clearly *liouvillei* differs from the other species referred to the genus, and he finishes his remarks on this with the words "Möglicherweise wäre es am besten, diese

beide Gruppen als besondere Untergattungen (oder sogar Gattungen?) zu bezeichnen". I fully agree with EKMAN that *liouvillei* clearly differs from the other species which he collected into the genus *Staurocucumis*, and that, not only in the shape of the calcareous deposits, as shown by EKMAN, but also in several anatomical features (see below), and, as *liouvillei* is the genotype, all the other species must be removed from the genus *Stauro-*

*cucumis*, either as a separate genus or as members of other genera. The revision of the known specimens hitherto referred to the species *nocturna* Sluiter and *apneumona* Heding (cf. On *Psollicucumis* Heding, a reply by S. G. HEDING, at present in M. S.) has shown that the genus *Psollicucumis* Heding must be maintained for the species *nocturna* and *apneumona*, which are specifically different, and a third species *echinata* Heding, the type of which was erroneously regarded as a specimen of *nocturna* by both SLUITER and CLARK & DEICHMANN.

As *sluiteri* Ohshima and *ingolfi* Deichmann as stated below must both be regarded as synonyms of *abyssorum* Théel, we have now the two species *turqueti* Vaney and *abyssorum* Théel left either to be referred to the old genus *Cucumaria* or to a new genus (perhaps genera). It is obvious at once from the comparison of the calcareous deposits that these two species have very little to do with each other, and when further the differences in the relative length of the gonads, in the development of the respiratory trees, the fully free retractor muscles, and the lack of a calcareous ring in *turqueti*, are taken into consideration, there may be little doubt that these two species cannot be referred to the same genus.

Thus for the present we are forced to regard each of the species placed by EKMAN in his genus *Staurocucumis* (of course separated from *sluiteri* which is synonymous with *abyssorum*) as representing its own genus. This being right one could naturally say that it might be a matter of taste how far we regard these groups as genera or subgenera, as they are most probably closely related and form a group of cucumarids of their own, but I for my part am not able to see that they are very closely related. EKMAN's studies of the development of the deposits in *liouvillei* are certainly very valuable, and cannot be doubted, but the studies of *turqueti* are based upon a rather small number, and as this species does not have such characteristic deposits as the round and perforated, so-called cups, of *liouvillei*, there may be some doubt left as to the generic identity of these species and as to *abyssorum* and *nocturna* as well as to *apneumona*, we certainly do not know anything about their development, in spite of CLARK and

<sup>1</sup>) British-Australian-New Zealand-Antartic-Research Expedition.

DEICHMANN's statement that "a similar change is found in *S. nocturna*" (On *Psollicucumis* Heding and its Allies p. 566). For the present nobody knows anything of the change of the deposits in *nocturna*, not even CLARK and DEICHMANN. Though I am for the present not able to see any feature which unites these genera closely, I admit that it is possible that future studies may show such, but until a real study of the whole *Cucumaria*-group is undertaken, it is not safe to say too much of the affinities of its different subgroups.

It must, however, be stated that EKMAN's genus *Staurocucumis* consists of four different genera:

*Staurocucumis* Ekman, genotype *C. liouvillei* Vaney.

*Ekmocucumis* n. g., genotype *C. turqueti* Vaney.

*Psollicucumis* Heding, genotype *Ps. apneumona* Heding.

*Abyssocucumis* n. g., genotype *C. abyssorum* Théel.

A diagnosis of the first three genera is needed for comparison with that of *Abyssocucumis* given above.

### Genus *Staurocucumis* Ekman.

Diagnosis: Fairly large cucumarids with no distinct difference between bivium and trivium. With ten equal tentacles and with the water-vascular appendages in rows along the ambulacra. Calcareous ring lacking or rudimentary, intestine with muscular stomach, more than one polian vesicle and more than one stone canal. Respiratory trees large and much branched, gonads long, and retractor muscles for their whole length united with longitudinal muscle.

Calcareous deposits in specimens smaller than 7 mm partly four-armed crosses with thorny spires, partly rounded perforate plates, "cups". In larger specimens only "cups".

Genotype: *Cucumaria liouvillei* Vaney.

### Genus *Ekmocucumis* n. g.

Diagnosis: Large cucumarids with no distinct difference between bivium and trivium. With ten equal tentacles and with the water-vascular appendages in rows along the ambulacra. Calcareous ring lacking, or rudimentary, intestine with muscular stomach. One polian vesicle and one stone-canal. Respiratory trees large and much branched, gonads long and retractor muscles long and free.

Calcareous deposits in very small specimens, according to EKMAN, four-armed crosses, in larger specimens from about 2 cm in length oval perforated plates, with a marginal chief spire or prolongation, always supplied with thorns. No "cups" in the body-wall.

Genotype: *Cucumaria turqueti* Vaney.

### Genus *Psollicucumis* Heding.

Diagnosis: Bilateral symmetrical cucumarids, with the bivium distinctly different from the trivium. Mouth subdorsal, anus dorsal. Water-vascular appendages in rows along the ambulacra, those of the trivium large, tube-feet, those of the bivium papilliform. Ten equal tentacles and a simple calcareous ring, which is always well developed.

Intestine with a large muscular stomach. One polian vesicle and one stone-canal. Respiratory trees lacking or quite rudimentary, retractor muscles free.

Calcareous deposits four-armed crosses or rounded perforated plates with or without a central spire, those of the deeper layer often somewhat different from the more superficial.

Genotype: *Psollicucumis apneumona* Heding.

### *Abyssocucumis abyssorum* (Théel).

*Cucumaria abyssorum* Théel 1886: Challenger Holothurioidea II p. 66-67, Pl. IV, fig. 6, Pl. XVI, fig. 6.

*Cucumaria abyssorum* v. *grandis* Théel 1886: Op. cit. p. 67-68. Pl. V, fig. 1.

*Cucumaria abyssorum* v. *hyalina* Théel 1886: Op. cit. p. 68-69. Pl. IV, fig. 7.

*Cucumaria abyssorum* v. *Marenzeller* 1893: Contribution à l'étude des Holothuries de l'Atlantique Nord p. 14. Monaco Resultats Fasc. VI.

*Cucumaria abyssorum* Ludwig 1894: The Holothurioidea p. 122-125. Pl. IX, figs. 28-29, Pl. XIII, figs. 1-5. Mem. Mus. Comp. Zool. Vol. XVII, No. 3.

*Cucumaria sluiteri* Ohshima 1915: Holothurians, Northwest Pacific, p. 263, Pl. X, fig. 21a-b.

*Cucumaria abyssorum* Grieg 1921: Echinodermata p. 11, text-fig. 9. Rep. "Michael Sars" North Atlantic Deep-Sea Expedition 1910, Vol. III.

*Cucumaria ingolfi* Deichmann 1927 in Dr. Th. Mortensen: British Echinoderms p. 396.

*Staurocucumis abyssorum* Ekman 1927: Holothurien, Deutsche Südpolar-Expedition p. 385-387.

*Cucumaria abyssorum* Ludwig & Heding 1935: Holothurien I der Deutschen Tiefsee-Expedition p. 179.

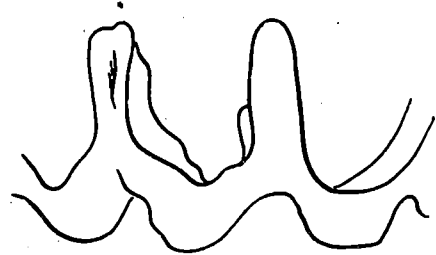
*Staurocucumis abyssorum* Clark & Deichmann 1936: *Psollicucumis* Heding and its Allies p. 566.

*Staurocucumis ingolfi* Clark & Deichmann 1936: Op. cit. p. 567.

Localities: Both in Davis Strait, west of Greenland.

61°50' N. 56°21' W. 2702 m, 1°5 C, "Ingolf" St. 36 . . . . 1 spec.  
60°17' N. 54°05' W. 3229 m, 1°4 C, "Ingolf" St. 37 . . . . 4

I have not been able to find more than these five specimens of this species in the Zoological Museum, and as they have all been examined and labelled by Dr. DEICHMANN herself there may be little doubt that these are the type material for her undescribed species *Cucumaria ingolfi* Deichmann which is mentioned in Dr. MORTENSEN's Handbook of British Echinoderms. In 1936 CLARK and DEICHMANN Op. cit. p. 567, mention this species, but in such a way that one is led to suppose that they then regarded *C. ingolfi* as a synonym of *C. abyssorum* Théel, and a careful reexamination of the specimens now here, clearly shows that they are all referable



Textfig. 34. *Abyssocucumis abyssorum*. Calcareous ring.  $\times 15$ .

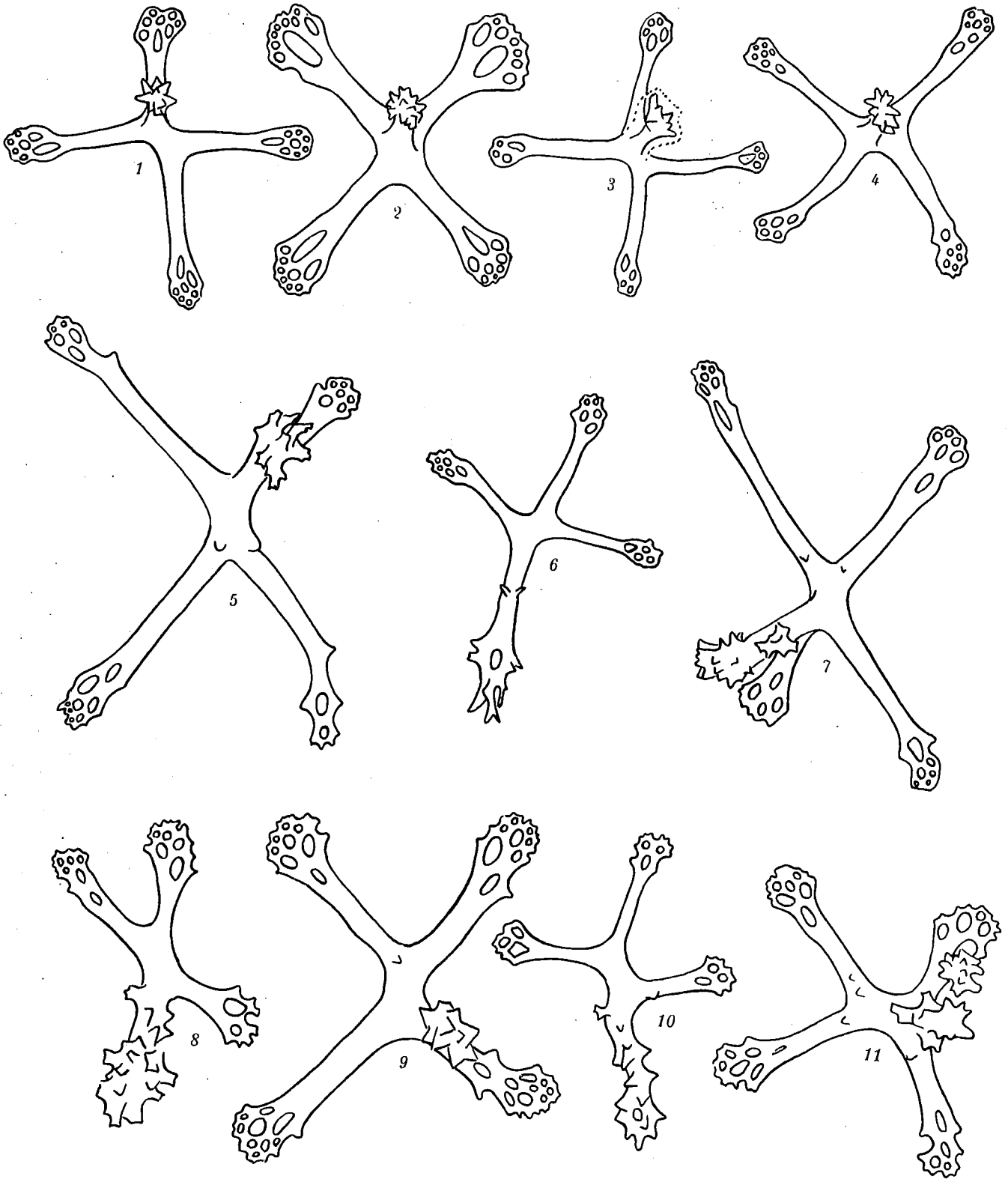
to THÉEL's species. CLARK & DEICHMANN record "*Cucumaria ingolfi*" Deichm., from south of Iceland, but all the specimens are from the "Ingolf" Stations 36 and 37 which are both in Davis Strait, so the locality for this species "south of Iceland" is erroneous.

The specimens are all fusiform, the larger of them with the posterior end rather strongly contracted as to form a little tail, quite in agreement with THÉEL's description and figure of the shape of *abyssorum*. In all the specimens both the mouth and the anal opening are terminal. The sizes of the "Ingolf" specimens are 38-30-27-12-8 mm; in the smallest specimen the anal end is not contracted.

The tube-feet are placed in two alternating rows in the ambu-

lacia. They are all alike, but those of the bivium are more scattered. The ten tentacles are all equally large. There is one polian vesicle and one stone-canal, and the calcareous ring is well developed

large specimens, fairly well developed, as large unbranched sacs with some few small lateral branches, but in the two smallest specimens they are totally lacking.



Textfig. 35. *Abyssocucumis abyssorum*. Calcareous deposits from the body-wall.  $\times 60$ . 1 and 2, "Ingolf", St. 37 (specimen 1.2 cm long). 3 and 4, "Ingolf", St. 37 (specimen 0.8 cm long). 5-7, "Ingolf", St. 37 (specimen 3.4 cm long). 8-11, "Ingolf", St. 36 (from the dorsal side of the large specimen).

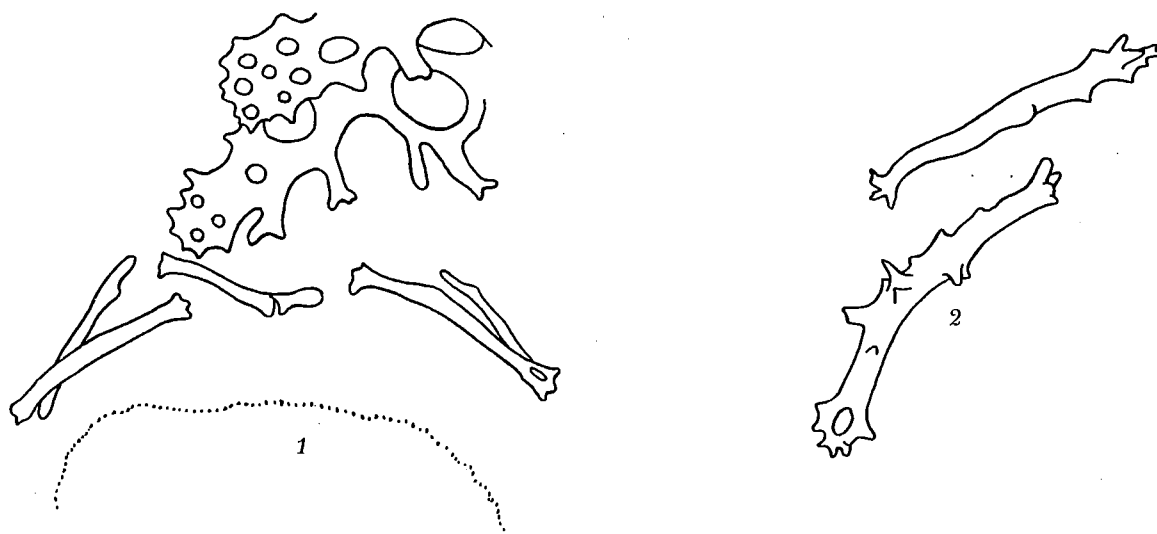
(textfig. 34). The gonads in the small specimens are little developed, but in the large they are fairly large, and contain ripe sperm or eggs. They are very short and unbranched and form a distinct cluster placed on both sides of the dorsal mesentery. The intestine has a large muscular stomach. The respiratory trees are, in the

The calcareous deposits (textfig. 35 1-11) are all four-armed crosses with perforated ends and an excentrically placed spire, or, when a spire is lacking, with the one arm spiny, and formed like a spire. The deposits of the different specimens are very alike, but the number of deposits which are lacking the spire and have



the one arm formed as a spire, increases with the size of the specimens.

The tentacle rods are figured by GRIEG op. cit. fig. 9, and in the oral disk there are short bent spiny staves (textfig. 36 2). The examination of the specimen from St. 36 showed that real anal teeth are lacking, but that there are some radially placed, fairly large, perforated plates close to the anal opening. In the actual margin of the anal opening there are some small smooth staves (textfig. 36 1).



Textfig. 36. *Abyssocucumis abyssorum* ("Ingolf", St. 36). 1, the anal opening with the posterior end of two large plates and some spicules. 2, rods from the tentacles.  $\times 60$ .

## Family Psolidae.

### Genus *Psolus* Oken.

In the "Ingolf" collections the genus *Psolus* is represented by the following five species:

- phantapus* (Strussenfelt)
- fabricii* (Düben & Koren)
- squamatus* Koren
- pourtalesii* var. *dyscritus* n. var.
- hypsinotus* n. sp.

Of these *fabricii* and *squamatus* are represented by some very small specimens the determination of which is consequently not quite certain, especially since the juvenile stages are hitherto unknown, and EKMAN has even tried to show that *P. valvatus* Östergren is the juvenile stage of *P. squamatus*.

Though the determination of these two species is not certain, the presence of small *Psolus* with supplementary small scales at the inner side of the large oral scales indicates that EKMAN cannot be right in his supposition that a species like *valvatus* is the young of *squamatus*; consequently these small specimens also indicate that the specimens described as *P. hypsinotus* are in reality a valid species.

The validity of the new variety of *P. pourtalesii* is not very convincing, but on account of the state of our knowledge of the classification of Psolids, I do not find it safe to refer these specimens to *pourtalesii*, since there are differences, the classificatory value of which we do not know.

The "Ingolf" material affords features of interest in the geographical distribution of the North Atlantic Psolids. *P. phantapus* has not previously been taken in Davis Strait, and *P. squamatus* not as far north as in Danmark Strait; also the distribution of the variety *dyscritus* shows some peculiar

features. As seen on the map (textfig. 40) *dyscritus* is only found along the 1000 m line in a positive temperature. The same holds good of *P. hypsinotus*. Further it is shown that the record of *P. valvatus* from Bredefjord, S. W. Greenland, cannot stand a closer examination, so this species is still found only along the Norwegian coast.

### *Psolus phantapus* (Strussenfelt).

Mortensen 1927: British Echinoderms p. 415, textfigs. 251-252.  
Mortensen 1932: Echinoderms, the "Godthaab" Expedition, p. 48.

Locality: Davis Strait.

66°35' N. 56°38' W. 599 m, 3°.9 C, "Ingolf" St. 32, several spec.

The specimens vary in size from 1 mm to 17 mm in length. The larger are typical *phantapus*, with large round knobs around the large scales, and the smaller ones, which are quite smooth and fairly flat, have the typical deposits in the sole.

This is the first time that *P. phantapus* has been collected in Davis Strait, and this record is from very deep water.

### *Psolus* sp. (*squamatus*?)

Locality: Danmark Strait.

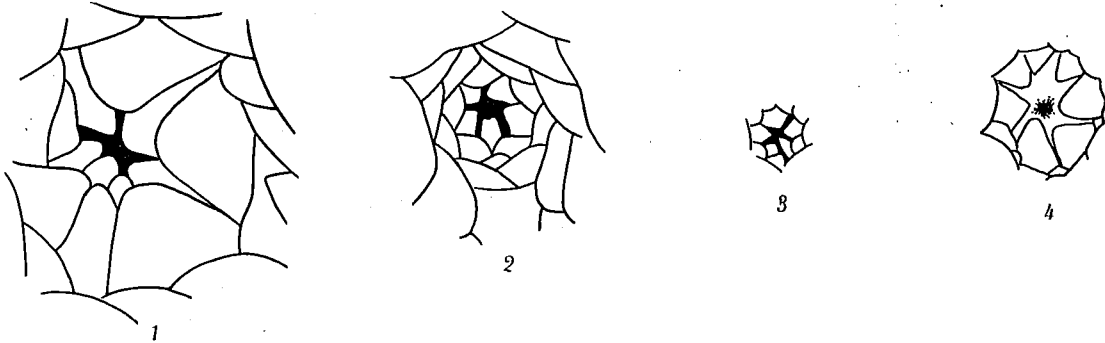
65°24' N. 27°39' W. "Ingolf" St. 97, 847 m, 5°.5 C . . . . 1 spec.

The single specimen is small, measuring but 6 mm in length. The mouth is surrounded by 7 scales of varying size, and these scales are not able to close the oral opening. The anal part is

irregularly built, but fairly distinctly limited towards the surrounding scales (textfig. 371-4).

The calcareous deposits are partly dissolved by acid in the preserving fluid, but the remains resemble fairly well those from *P. squamatus*.

I have little doubt that this specimen is a young *P. squamatus*, but the damaged calcareous deposits cannot give definite proof. The shape of the remains shows, however, that there is no possibility that we have here a young *P. phantapus*.



Textfig. 37. *Psolus squamatus*, oral and anal valves.  $\times 5$ . 1 and 2, of specimen from Ireland (received from Dr. STELLFOX) 1, oral, 2, anal area. 3 and 4, of specimen from "Ingolf", St. 97. 3, anal, 4, oral area.

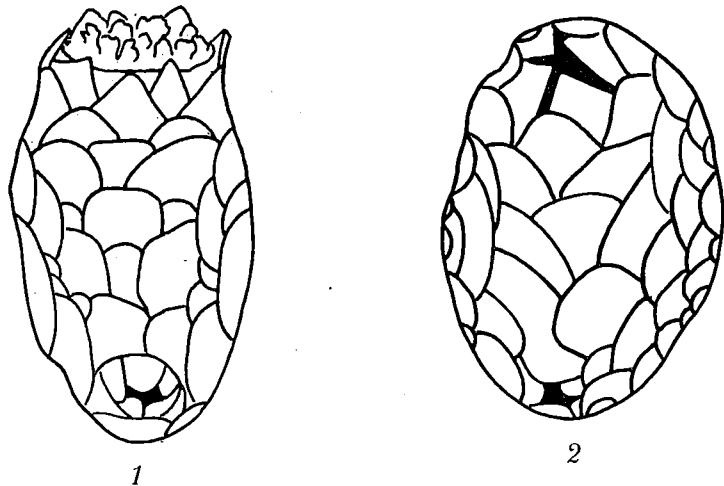
### *Psolus fabricii* (Db. and Koren).

Mortensen 1932: Echinoderms, the "Godthaab" Expedition, p. 49.

Locality: Davis Strait.

66°35' N. 56°38' W. 599 m, 3°.9 C, "Ingolf" St. 32 ..... 4 spec.

These specimens are all very small, the largest measuring only 4 mm in length. In general appearance they resemble the specimens of the new species *P. hypsinotus*, but they differ clearly in having some radially placed scales under the large interradial oral ones. This feature indicates that these small specimens are



Textfig. 38. 1, *Psolus fabricii*, "Ingolf", St. 32, specimen 4 mm long.  $\times 7$ . 2, *Psolus phantapus*, Hellebæk, specimen 1.5 mm long.  $\times 20$ .

the young of a *Psolus* which has more than five oral shields, and on account of the locality there may be little doubt that they are young of *P. fabricii* or *P. phantapus*. As there are from the same station a number of small *Psolus* which, on account of the shape of the calcareous deposits, are all referable to *P. phantapus*, and these specimens differ slightly from them, the only possibility left is that these small specimens are *P. fabricii*. In any case these specimens indicate that *P. hypsinotus* cannot be regarded

as young *fabricii*, as was to be expected from EKMAN's paper on *Psolus squamatus*.

### *Psolus pourtalesii* v. *dyscritus* n. var.

Pl. I fig. 1-2.

*Psolus pourtalesii* Mortensen 1932: Echinoderms, the "Godthaab" Expedition 1928, p. 49.

non: *Psolus pourtalesii* Deichmann 1930: Holothurians of the Atlantic Ocean p. 188, Pl. 20 5-7.

#### Localities:

64°24' N. 28°50' W. 1484 m, 3°.5 C, "Ingolf" St. 10 ...	1 spec.
63°30' N. 54°25' W. 1096 m, 3°.3 C, "Ingolf" St. 25 ...	3 -
61°32' N. 11°36' W. 1356 m, 2°.4 C, "Ingolf" St. 46 ...	1 -
62°06' N. 19°00' W. 1960 m, 3°.1 C, "Ingolf" St. 64 ...	7 -
61°33' N. 19°00' W. 2051 m, 3°.0 C, "Ingolf" St. 65 ...	55 -

These specimens agree fairly well with THÉEL's description of *P. pourtalesii* as well as with DEICHMANN's redescription of 1930. There are, however, some minute differences on account of which I do not consider it correct to refer them to *pourtalesii* sens. strict. In the Holothurians of the Atlantic Ocean p. 188, DEICHMANN states that the large tube-feet in *pourtalesii* are placed in zigzag. This agrees fairly well with a specimen in the Zoological Museum, received from the Smithsonian Institution, and determined by DEICHMANN herself, but, in all the specimens from the "Ingolf" collections, the large tube-feet are all placed in a single row, which also is surprisingly regular.

Further DEICHMANN states that the calcareous deposits of the sole are "usually completely smooth". In the "Ingolf" specimens nearly all the deposits are supplied with a few small but distinct knobs (textfig. 39). At first I supposed that the variation of the plates was of no classificatory value, but the examination of the named specimen from America shows that the presence of the knobs may be of some use in classification.

How far the variety *dyscritus* is in reality a valid form different from *pourtalesii*, it is not possible to ascertain at present. The two forms are from the same zoogeographical area, and the differences are so faint that they may be regarded as merely individual variations. As there appears, however, to be some reason to regard the named differences as typical for the "Ingolf"- "Godthaab" specimens I prefer to distinguish between the two forms, even if in the future they turn out to be identical.

### *Psolus hypsinotus* n. sp.

Pl. I fig. 3.

#### Localities:

Davis Strait:

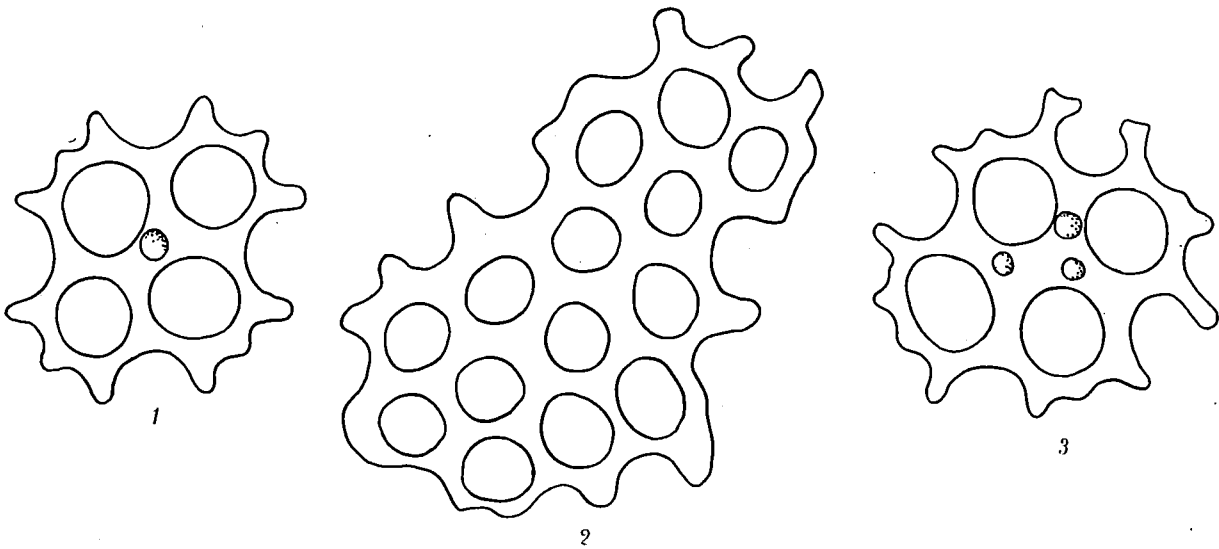
63°30' N. 54°25' W. 1096 m, 3°.3 C, "Ingolf" St. 25 ...	7 spec.
64°54' N. 55°10' W. 740 m, 3°.8 C, "Ingolf" St. 27 ...	3 -
66°35' N. 56°38' W. 599 m, 3°.9 C, "Ingolf" St. 32 ...	1 -

Bredefjord (the mouth), Greenland, 350 m, 3° 5 C, "Rink"  
 St. 55 (K. STEPHENSEN)..... 1 spec.

Diagnosis: Semi-circular Psolids, with the mouth surrounded by five large triangular interradiial plates (some of which may

interambulacrum, each supplied with one to three small knobs. Anal opening surrounded by 5-7 triangular scales, which do not close the opening perfectly.

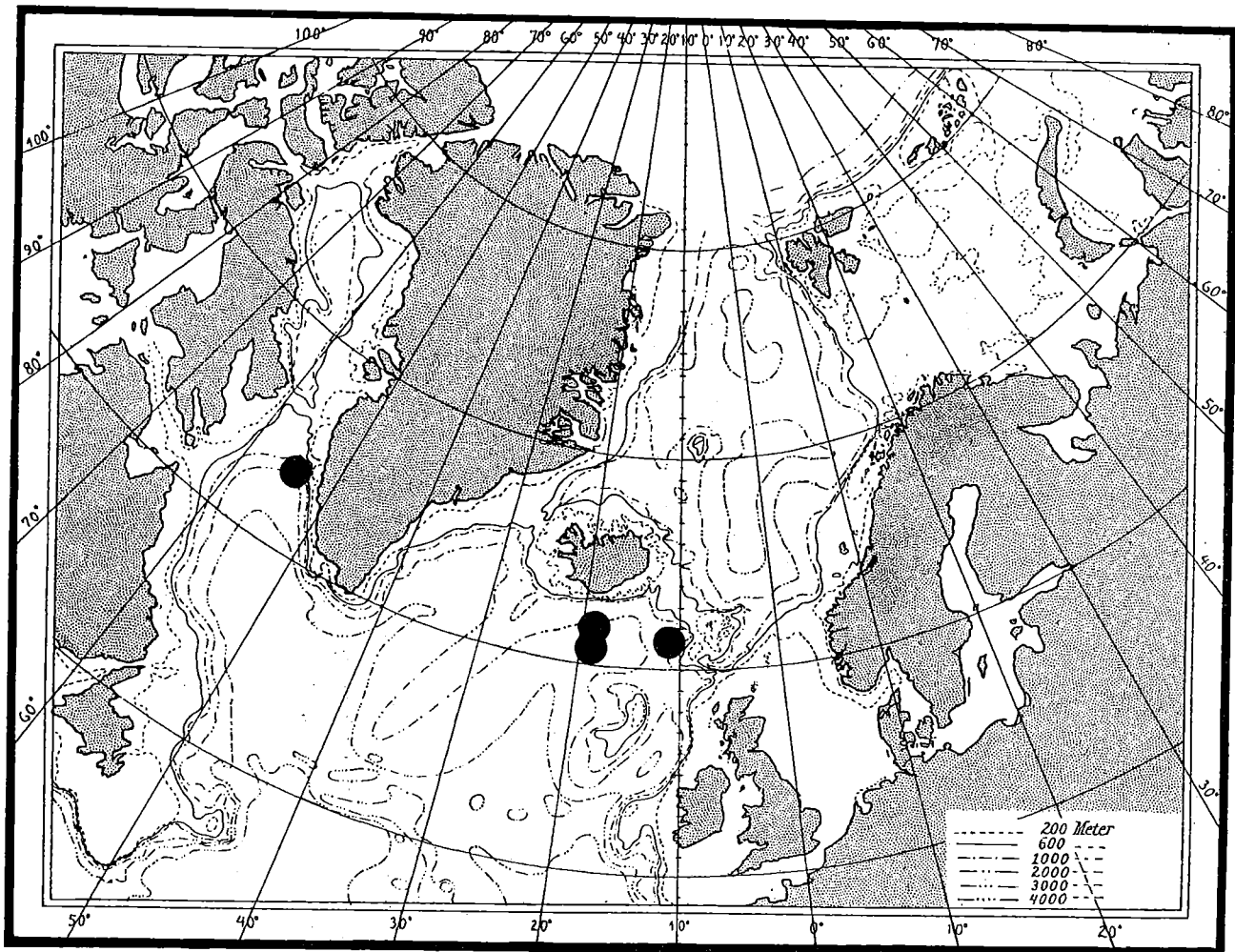
The ventral side has no tube-feet along the unpaired ambulacrum, only anteriorly and posteriorly there are a few large



Textfig. 39. *Psolus pourtalesii* var. *dyscritus*. Deposits of the sole.

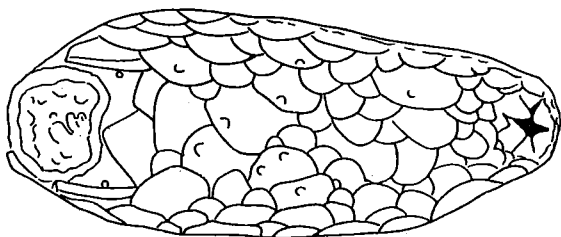
be longitudinally divided), without any supplementary smaller ones at their inner sides. Medial scales of two sorts, some few large and a fair number of smaller, i. e. about ten along the dorsal interambulacrum. The larger are, in any case along the dorsal

feet which, with those of the inner marginal circle, form a small group. Round the margin there is an inner circle of large tube-feet, often alternately large and small, and an outer circle with small feet.



Textfig. 40. *Psolus pourtalesii* var. *dyscritus* var. nov.

Ventral retractor fastened closely to the margin of the sole. One polian vesicle and a single stone-canal. Respiratory organs relatively well developed. Calcareous ring without any special characteristics, showing that the ten tentacles are all of equal size.



Textfig. 41. *Psolus hypsinotus*. Dorsal side of type specimen.

Calcareous deposits of the sole small four- to seven-holed plates supplied with a few knobs. Most closely related species: *Psolus dubiosus* Ludwig and Heding.

Type specimen: "Ingolf" St. 27.

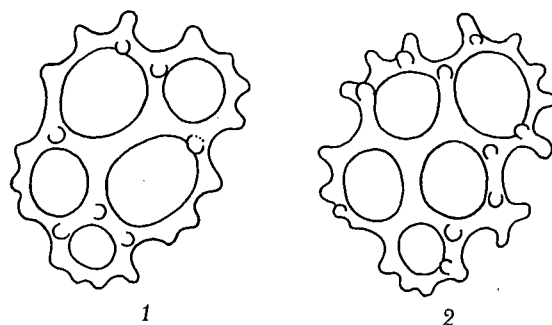
Description: The specimens are all rather small, the largest, from St. 32, measuring not more than 14 mm in length and 6 mm in width as well as in height. They are pure white, and the scales along the sides are smooth, whereas those along the dorsal interambulacrum are usually supplied with one to three small but distinct knobs. There are two distinctly different sizes of scales, as the few very large ones are intermingled with rows of small ones. All the scales are imbricating, a feature which is most remarkable for the small scales. All the marginal scales are small and form a thin and sharp edge.

The skin of the sole is fairly thin but not translucent, partly on account of the numerous deposits. The tube-feet are only found along the margin of the sole, where they are placed in two rows, an inner one with large tube-feet and an outer one with much smaller ones. The inner tube-feet are usually of a somewhat varying size and are often alternately large and small. They are placed in a fairly regular row, only at the two ends of the unpaired ambulacrum there is a group of tube-feet.

The calcareous deposits of the sole (textfig. 43 1-2) are small flat plates with normally four large and a few smaller perforations, and all the fully developed plates are supplied with some fairly large distinct knobs.

Remarks: This species resembles in most characters *Psolus valvatus* Östergren, but differs distinctly from that species in being not so flat as usually stated for *valvatus*. Further, there are differences in the arrangement of the scales, and it may probably be regarded as a feature indicating specific difference that the gonads in these specimens are undeveloped, whereas the gonads in equal sized specimens of *valvatus* are fully developed.

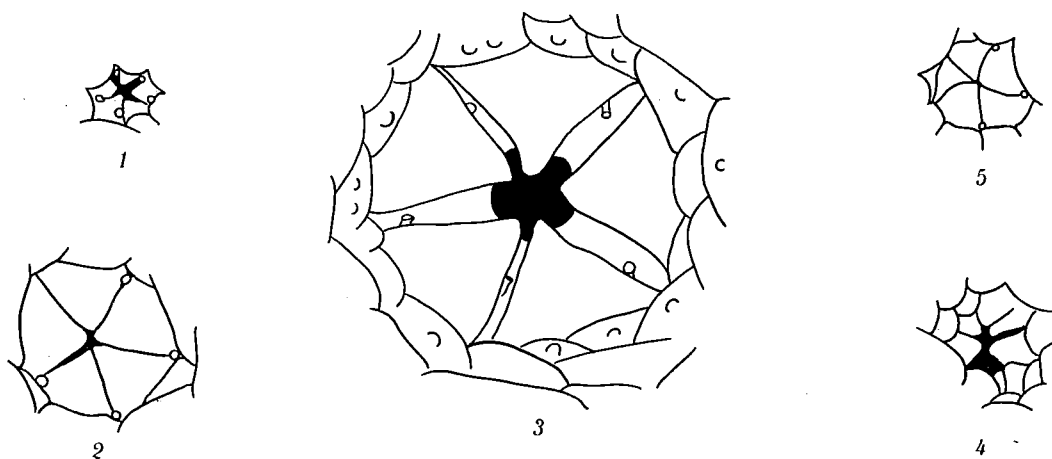
This indicates that the specimens here described are juvenile stages of a rather large form, and from EKMAN's studies on *P. squamatus* it appears likely that we have here the young of either *P. squamatus* or *P. fabricii*. *P. squamatus* is not known outside European waters (apart from EKMAN's supposition of its synonymy with several foreign forms), and if it has in reality



Textfig. 43. *Psolus hypsinotus*, deposits from the sole.  $\times 150$ .

juvenile stages like *P. valvatus* (which I do not think probable), the find of this *valvatus*-like species in Greenland waters without any real *squamatus*, not only is against the supposition that these specimens might be *squamatus* but also against their synonymy with *valvatus*.

As to *P. fabricii*, the supposition that these specimens may



Textfig. 42. *Psolus hypsinotus*. 1 and 2, anal (1), and oral (2), area of a specimen from "Ingolf", St. 25. 3 and 4, oral (3), and anal (4), area of a specimen from "Ingolf", St. 32. 5, Oral valves of the smallest specimen from "Ingolf", St. 25.  $\times 10$ .

The anatomy does not show any features of interest. There is a single polian vesicle, a single stone-canal, well developed but faintly branched respiratory trees. The unpaired retractor is attached immediately behind the anterior margin of the sole with a single origin from the longitudinal muscle. The calcareous ring is elegant and fairly well developed, but does not show any structures of interest; from the shape of the calcareous ring it is evident that the ten tentacles are of equal size.

be the young of this species seems rather natural, if EKMAN is right in regarding *P. valvatus* as the young of *squamatus*. There are, however, in the "Ingolf" collections some small *Psolus* from Davis Strait (St. 32) which are no doubt the young of *P. fabricii*, and these are so different from *P. hypsinotus* that any closer relation between *P. hypsinotus* and *P. fabricii* is out of the question. This is another fact which weighs against the supposed synonymy of *P. squamatus* and *P. valvatus*.

The species which *P. hypsinotus* resembles most closely is *P. dubiosus* Ludwig and Heding, and the possibility that they are synonymous is fairly great. The differences are, however, such that the two species must for the present be kept separate. *P. dubiosus* is more flat, has more scales along the dorsal interambulacrum and more holes in the calcareous plates of the sole.

As to the distribution of *P. hypsinotus*, this species was taken at only three stations, all lying close to each other in Davis Strait. There is also in the Zoological Museum of Copenhagen,

a specimen from Bredefjord, W. Greenland, collected by K. STEPHENSEN, and, in *Conspectus Faunae Groenlandicae* 1913, recorded as *P. valvatus* Östergren by MORTENSEN. Its determination as *valvatus* must be specially considered as it was not MORTENSEN but ÖSTERGREN himself who regarded this specimen as a *valvatus*. I have, however, no doubt that it is a specimen of *hypsinotus*, and in fact it was found in the same area as the other specimens. Further *valvatus* is not known elsewhere than along the Norwegian coast.

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Plate I.

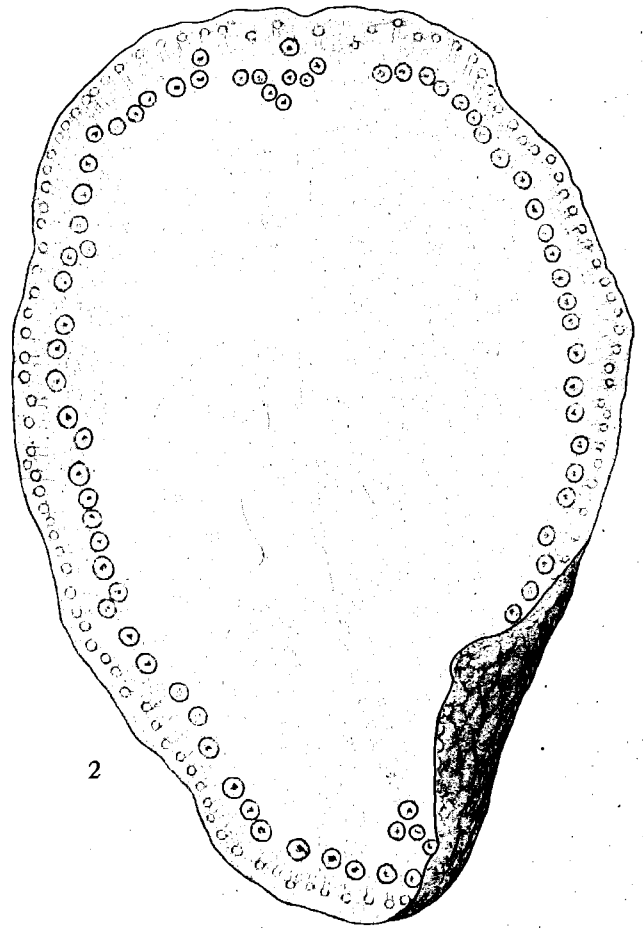
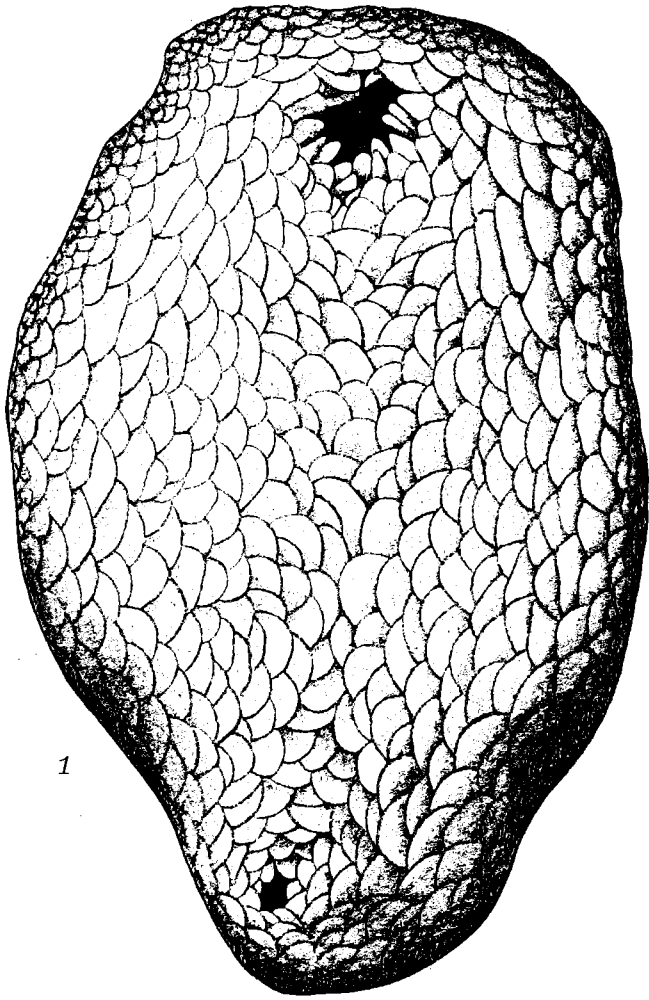
- Fig. 1. *Psolus pourtalesii* var. *dyscritus* n. var.  
Type specimen seen from above, showing the arrangement of scales.
- 2. *Psolus pourtalesii* var. *dyscritus* n. var.  
Type specimen seen from the sole, showing the arrangement of the tube-feet.
- 3. *Psolus hypsinotus* n. sp.  
Type specimen seen from the side, showing the large

oral and anal scales, and the few large tubercles on the dorsal scales.

Figs. 4-5. *Plicastichopus ingolfi* n. sp.

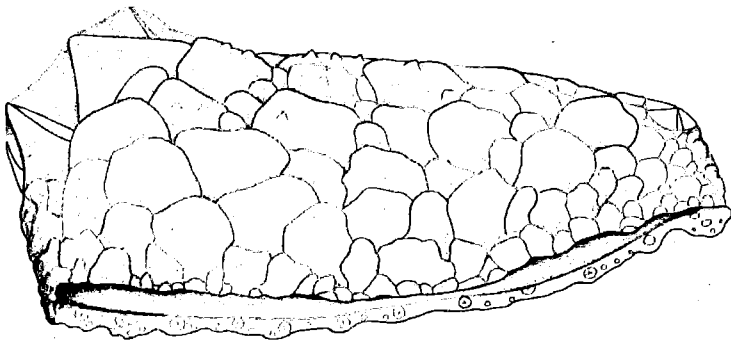
4. Type specimen seen from the ventral side, showing the arrangement of the large papillae.

5. Left side of the pygal portion, showing the large papillae and the scattered small tube-feet.



1

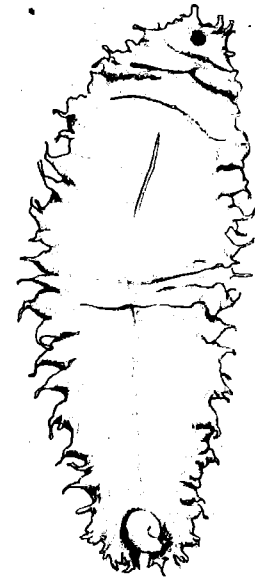
2



3



5



4

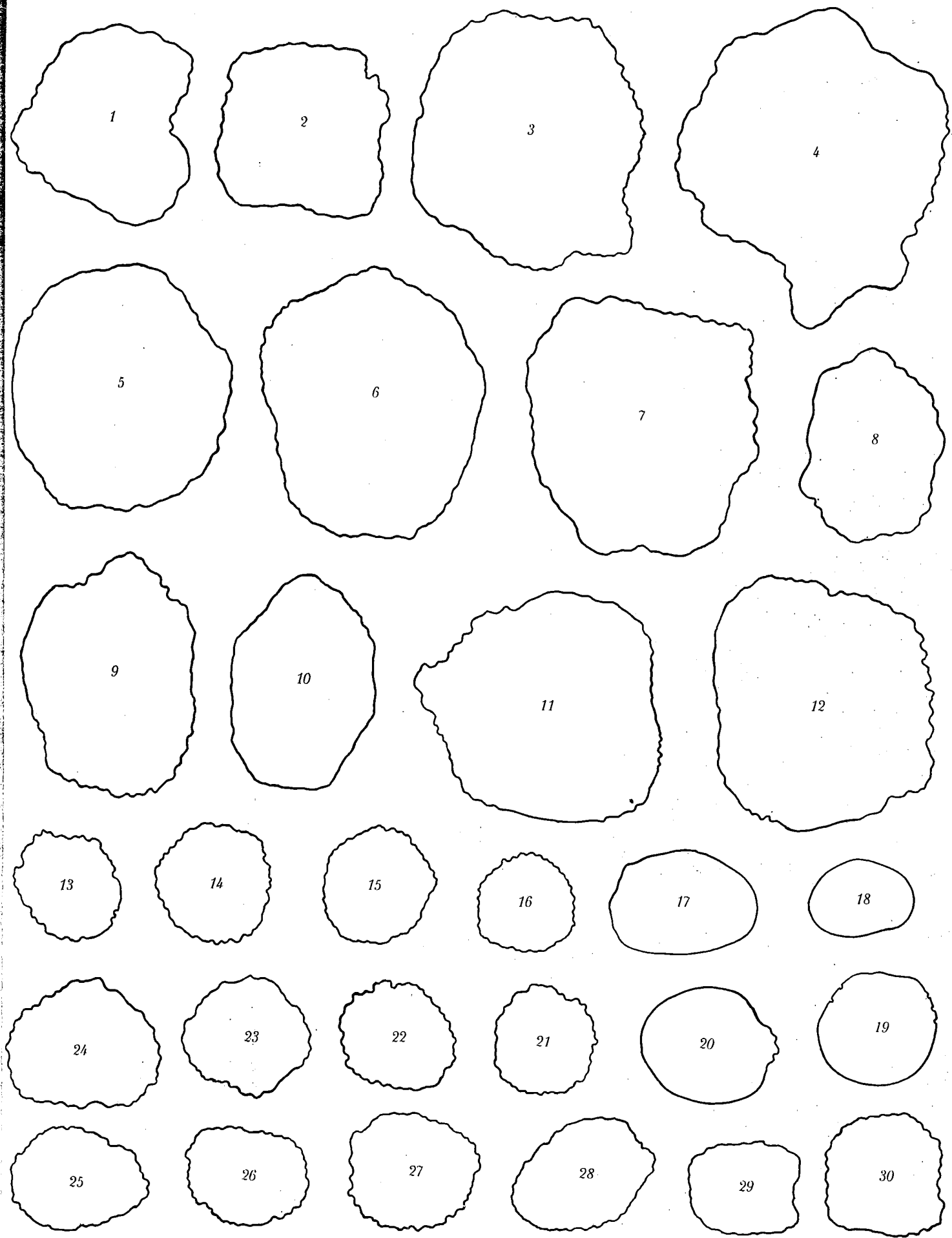
Plate II.

Shape and size of the large plates of the different forms of the genus *Ypsilothuria*.

1- 2.	<i>bitentaculata attenuata</i> , "Ingolf" St. 67, small specimen.	Figs. 11-12.	<i>bitentaculata virginiensis</i> var. nov. The West Indies, Frederikssted, coll. Dr. TH. MORTENSEN.
3- 4.	<i>bitentaculata</i> , specimen from the Murray-Expedition, loc. Indopacific.	- 13-14.	<i>talismani talismani</i> , "Ingolf" St. 73 specm. I.
5- 6.	<i>bitentaculata attenuata</i> , "Godthaab".	- 15-16.	— — "Thor" St. 166.
6- 7.	— — "Ingolf" St. 67, large specimen.	- 17-20.	<i>elegans</i> , The West Indies, Frederikssted.
8-10.	<i>bitentaculata attenuata</i> , "Ingolf" St. 37.	- 21-22.	<i>talismani</i> , "Thor" St. 99.
		- 23-24.	— — "Ingolf" St. 83.
		- 25-26.	— — "Ingolf" St. 10.
		- 27-30.	— — The West Indies, Frederikssted.

Figs. 1-30 × 35.





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