

XI.

MARINE PLANKTON

FROM

THE EAST-GREENLAND SEA

(W. OF 6° W. LONG. AND N. OF $73^{\circ} 30'$ N. LAT.)

COLLECTED DURING THE "DANMARK EXPEDITION" 1906—1908

II. PROTOZOA

BY

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INTRODUCTION

The present paper is based upon the examination of a number of plankton samples collected during the "Danmark Expedition" to N. E.-Greenland 1906—1908. The samples have been collected by means of fine-meshed tow-nets and are all surface samples.

In the introduction to another paper on the Diatoms and Flagellates of the same samples I have rendered, more in details, an account of the data concerning the collection, etc. It will therefore, I think, be sufficient to repeat here the more important data.

The samples examined originate all from more or less ice-filled water which may be divided into three areas:

1°. Samples taken in the pack-ice (drift-ice) in August 1906 and July 1908. The geographical area is about $73^{\circ}30'$ — 76° N. Lat. and 6° — 13° W. Long.

2°. Samples taken in the coastal water west of the pack-ice and east of the coast of Greenland, between 76° — 78° N. Lat.; August 1906 and July 1908.

3°. Samples taken in Danmarks Havn, Germania Land, $76^{\circ}46'$ N. Lat., $18^{\circ}43'$ W. Long., during the stay of the Expedition from the autumn of 1906 to July 21st 1908.

As already pointed out in my above mentioned paper, the samples from the last area are of greatest interest, but unfortunately it has not been possible for the Expedition to take samples during the whole time of the stay, at regular short intervals. There are only a few samples from October 1906, circa 10 from June—September 1907 and a couple from July 1908 when the steamer left the harbour.

From the opposite coast of Greenland, the west coast, we have VANHÖFFEN'S valuable regular collection of the plankton of Karajak Fjord, ca. 70° N. Lat., upon which K. BRANDT (1896) has based his interesting paper on arctic *Tintinnodea*. It is but natural that the samples from these two points on the coasts of Greenland are to be compared; and the following list will show a close resem-

blance between them. Almost the same species of *Tintinnodea* occur in both places, but it is remarkable that three species of *Tintinnopsis* (viz.: *T. nitida* Bdt., *T. sinuata* Bdt. and *T. sacculus* Bdt.) described by BRANDT from the Karajak Fjord, have not been seen in our samples; perhaps the more northern latitude of Danmarks Havn (6--7° higher) and the thereof resulting more strictly arctic conditions of life may have some relation to the absence.

Besides the *Tintinnodea* which are best taken by means of surface hauls with fine-meshed nets, the samples contain but few *Protozoa*, viz.: two *Radiolaria*, one *Foraminifera* and the resting stage of an unknown organism.

The *Radiolaria* have, taken in general, not their home in the surface water, and, no doubt, vertical hauls would have given many more species. *Globigerina bulloides*, one of the few pelagic Foraminifera, is an atlantic organism. Lastly we have the peculiar resting stage, HENSEN's "Sternhaarstatoblast" which has hitherto been known only from the Baltic and the occurrence of which consequently is of some zoogeographical interest. Nothing is known on its place in the system, and it may perhaps be a stage of some Metazoon.

In the following papers remarks on the species mentioned in the list and on their occurrence in the East-Greenland Sea are to be found:

- BRANDT, K.: Die Tintinnen, in Zoologische Ergebn. d. von d. Ges. für Erdkunde zu Berlin unter Leitung Dr. von Drygalski's ausges. Grönlandexp. nach Vanhöffen's Sammlungen bearbeitet. — Bibl. Zoologica, Heft 20, 1896.
- : Die Tintinnodeen der Plankton-Expedition. Atlas u. Tafelerklärungen 1906; Systematischer Teil 1907.
- CLEVE, P. T.: Plankton coll. by the Swedish Exp. to Spitsbergen in 1898. — K. Svenska Vet. Akad. Handl., Bd. 32, No. 3, 1899.
- : Report on the Plankton coll. by the Swedish Exp. to Greenland in 1899. — Ibidem, Bd. 34, No. 3, 1900.
- DAMAS, D. et KOEFOED, E.: Le Plankton de la Mer du Grönland, in: Duc d'Orléans: Croisière Océanographique accomplie à bord de La Belgica dans la Mer du Grönland 1905. Bruxelles 1909.
- JØRGENSEN, E.: Ueber die Tintinnodeen der norwegischen Westküste. — Bergens Museums Aarbog 1899, No. II, 1899.
- : Protophyten und Protozoën im Plankton aus der norwegischen Westküste. — Ibid., No. VI, 1900.
- : Protistenplankton aus dem Nordmeere in den Jahren 1897—1900. — Ibid., 1900, No. VI, 1901.
- : Protistplankton, in: O. Nordgaard: Hydrographical and biological Investigations in Norwegian Fiords. — Bergens Museums Skrifter, 1905.
- HENSEN, V.: Über die Bestimmung des Planktons. — 5. Bericht der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere in Kiel für die Jahre 1882—86. Kiel 1887.
- POPOFSKY, A.: Die nordischen Acantharien. — In: K. Brandt u. C. Apstein: Nordisches Plankton, Kiel u. Leipzig. 3. Lief. 1905.

I. Tintinnodea.

In the list of species given beneath I follow BRANDT'S large work of 1907 where we find nearly all our knowledge concerning the systematical matters of this group of Infusorians put down.

Tintinnopsis Stein, 1867.

1. *Tintinnopsis karajacensis* Brandt, 1896, p. 57, pl. 3, fig. 5; 1906—07, p. 162, pl. 19, figs. 5, 7, 10—12, pl. 26, fig. 3, (varr.) pl. 19, figs. 1—2, 9, 19, 20, pl. 26, fig. 9; H. Laackmann, *Wiss. Meeresunters.*, Bd. 10, Abt. Kiel, 1906, p. 21, pl. 1, figs. 12—14.

Nov. var. *lagenoides* (Fig. 1).

Differs from the main species in the inflated lower end of the house and in the scarceness of foreign bodies upon its wall.

In three samples (August—Septm. 1907) from Danmarks Havn I found rather sparsely a *Tintinnopsis* form which has caused me much trouble. It stands in many respects between *T. karajacensis* Bdt. and *T. sacculus* Bdt., but as I had not been able to find the peculiar structure of the "Primärwaben" characterizing *T. sacculus* (see BRANDT 1907, p. 164), I prefer to keep my form under *T. karajacensis*. From this it differs in the inflated lower end of the house and the distinct neck. The foreign bodies are small and rather few. I have not seen more than one nucleus.

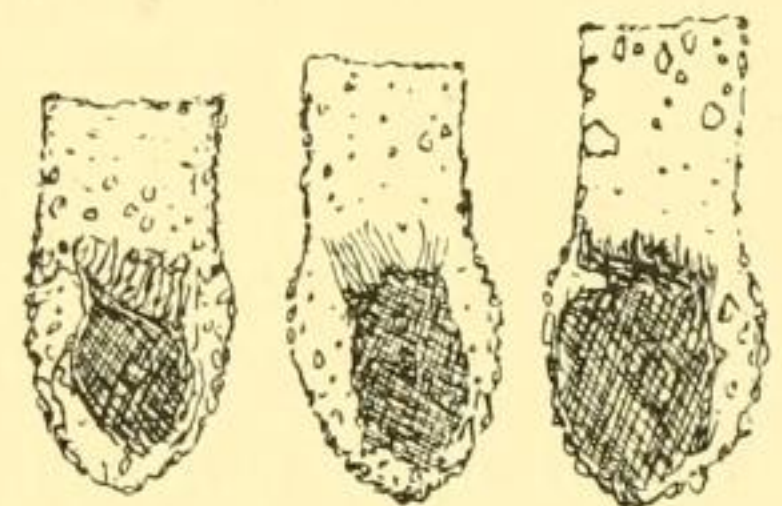


Fig. 1. *Tintinnopsis karajacensis* Brandt var. *lagenoides* n. var. 250 t. m.

The dimensions are as follows:

| | |
|-------------------------------|---------------|
| Length | 80—88 μ , |
| Breadth of the neck | 32 μ , |
| — of the lower part | 40 μ . |

It seems related to the var. *b* from Tocantin figured by BRANDT 1906, and perhaps to LAACKMANN'S *T. Lohmanni* (l. c., p. 20, pl. 1, figs. 10—11).

Distrib.: (main species) Karajak Fjord, Davis Strait; Kiel Fjord; Norwegian Fjords; off Helder; (varr.) off Borneo; Tocantin; off Bombay; Iceland.

2. *Tintinnopsis? pellucida* (Cleve) Brandt, 1906, p. 18, 1907, p. 172, pl. 23, figs. 8, 14, 15; *Tintinnus* (?) *pellucidus* Cleve, 1899, p. 24, pl. 1, fig. 4; *T. bottnicus* Brandt, 1896, p. 53, pl. 3, fig. 11; *Leptotintinnus bottnicus* Jørgensen, 1899, p. 10; 1900, pl. 2, fig. 3; *L. pellucidus* Jørgensen, 1901, p. 18. (Fig. 2).

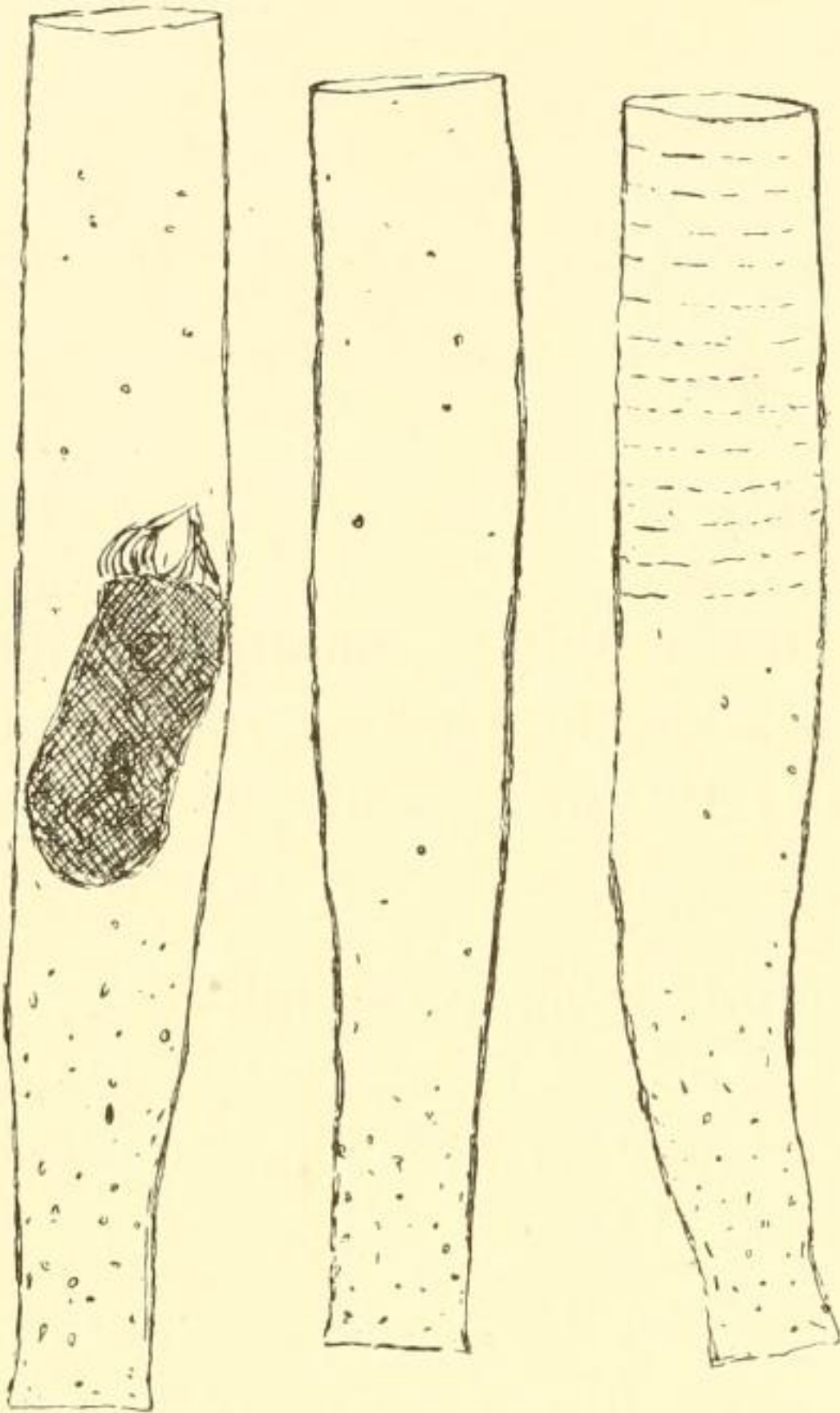


Fig. 2. *Tintinnopsis pellucida* (Cleve)
Brandt. 250 t. m.

In one sample from September 1907 from Danmarks Havn and in two July-samples from the pack-ice *T. pellucida* was present, but rather rare. The annexed figures show the variability of the houses: rings are present or not, the lower part is straight or faintly curved, the foreign bodies are more or less abundant, etc.

The contracted animal figured in the left figure had two distinct nuclei.

Length of the houses 330—344 μ (Brandt 0,2—0,27 mm.) Breadth 32 and 48 μ (narrowest and largest part).

Distrib.: Karajak Fjord; Davis Strait; N. and W. of Spitsbergen; Norwegian Coast off Bergen.

Cyttarocyclus Fol, 1881.

3. *Cyttarocyclus pseudannulata* Jørgensen, 1901, p. 15, pl. 2, fig. 28; Brandt 1906—07, p. 269, pl. 28, fig. 8, pl. 29, fig. 1; *C. annulata* Jørgensen, 1899, p. 36.

Only found in few specimens in a single sample from the pack-ice in August 1906.

Distrib.: Irminger Sea; N. E. of Jan Mayen; Norwegian West-coast.

4. *Cyttarocyclus denticulata* Ehrbg., Jørg. emend.; Jørgensen 1899, p. 31, pl. 2, figs. 13, 15; 1901, p. 12, pl. 3, figs. 25—26; 1905, p. 144; Brandt 1906—07, p. 232, pl. 37, figs. 9—10, 15—17; non *C. denticulata* Brandt 1896, p. 62, nec Ostenfeld, in M. Knudsen & C. Ostenfeld, Iagttagelser over Overfladevandets Temperatur, Saltholdighed og Plankton paa islandske og grønlandske Skibsrouter i 1898, København 1899, p. 62.

The forms belonging to the group *C. denticulata* are of great importance for the plankton of the area here treated of. When we

follow JØRGENSEN (l. c.) and BRANDT's latest paper (1906-07), we have the following three "varieties" in the samples, all neritic varieties.

a. var. *typica* Jørg., 1899, p. 31, etc. (Fig. 3). This variety shows

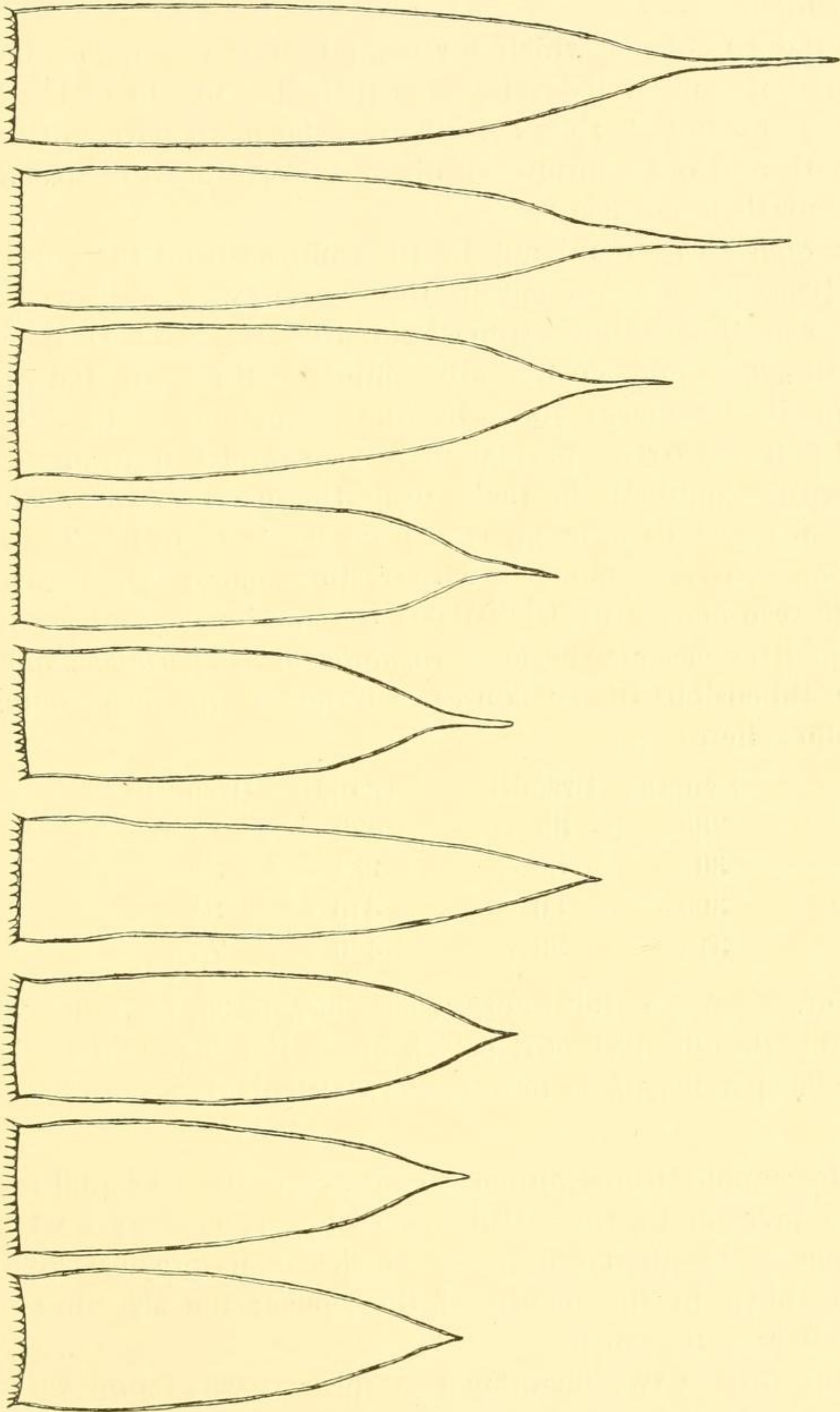


Fig. 3. *Cyttarocylis denticulata* Ehrbg. var. *typica* Jørg. 250 t. m.

a great variability; all the specimens given in the fig. 3 are from one sample (Danmarks Havn, Aug. 15th 1907) with exception of the

largest one (placed most at right). If we compare the specimens with the figures quoted above from JØRGENSEN'S and BRANDT'S papers, we shall find a close resemblance. The smaller specimens answer to JØRGENSEN'S *f. acuta* (1901, p. 12), the larger ones to his *f. caudata* (1901, p. 12), but I have not succeeded in finding any definite limit between them.

All the specimens which I reckon to the var. *typica* have in common: long and well-developed teeth in the mouth of the house, the lower end not sharply set off from the main part, but of variable length and often forming a distinct "Fortsatz"; the structure of the house-wall is not coarse.

Var. *typica* was dominant in the samples from the pack-ice in August 1906, but not present in the coastal water. It was found sparingly in the samples from Danmarks Havn in October 1906 (under the ice), but mostly only empty houses. In 1907 it was dominant in Danmarks Havn in Aug.—September. In July—August 1908 it occurred sparingly in the samples from the coastal water, while dominant in those from the pack-ice and again rare outside this, when the temp. rose from 0°—2° C. to 6°—7°. In the last region where I found it with resting spores (cfr. LAACKMANN, *Wiss. Meeresunters.*, Abt. Kiel, 1906), the specimens were small and approached the oceanic species *C. edentata* Bdt. (*f. parumdentata* Bdt.).

The dimensions of the houses of some of the measured specimens follow here:

| Length | Breadth | Length | Breadth |
|-----------|----------|-----------|----------|
| 265 μ | 85 μ | 320 μ | 75 μ |
| 300 - | 80 - | 384 - | 84 - |
| 305 - | 80 - | 416 - | 84 - |
| 312 - | 80 - | 440 - | 75 - |

b. var. *gigantea* (Bdt.) Jørgensen, 1899, p. 35, pl. 3, figs. 26—28; 1901, p. 14; Brandt, 1906—07, p. 233, pl. 38, figs. 2, 3, 8, 9; *C. gigantea* Brandt, 1896, p. 63, pl. 3, figs. 21—24; Ostensfeld, l. c., 1899, p. 62. (Fig. 4).

In the samples from Danmarks Havn, Sept. 1907, I found together with the preceding form a still larger one, which agrees well with var. *gigantea*. It differed from var. *typica* in its greater length and the short teeth in the mouth of the house; the structure of the house-wall was the same.

Besides in the two mentioned samples, it was found very sparingly in July 1908 in and off Danmarks Havn (two samples) and in the pack-ice (two samples). It was not always easy to distinguish it from var. *typica*.

Dimensions (in μ): Length and Breadth 615×78 and 650×80 .

c. var. *robusta* Jørgensen, 1901, p. 13, pl. 3, fig. 22; 1905, p. 144; Brandt, 1906–07, p. 234, pl. 38, figs. 4, 10. (Fig. 5).

In many samples where var. *typica* was present, another probably well-distinguished form also was found. It had about the same

size as that, but differed in the rather sharply set-of "Fortsatz", the small and broad teeth of the mouth and in the much coarser wall of the house-wall. The latter character was very easily seen under low power of magnification as the transparency of the wall was quite another. No doubt it is the var. *robusta* of JØR-

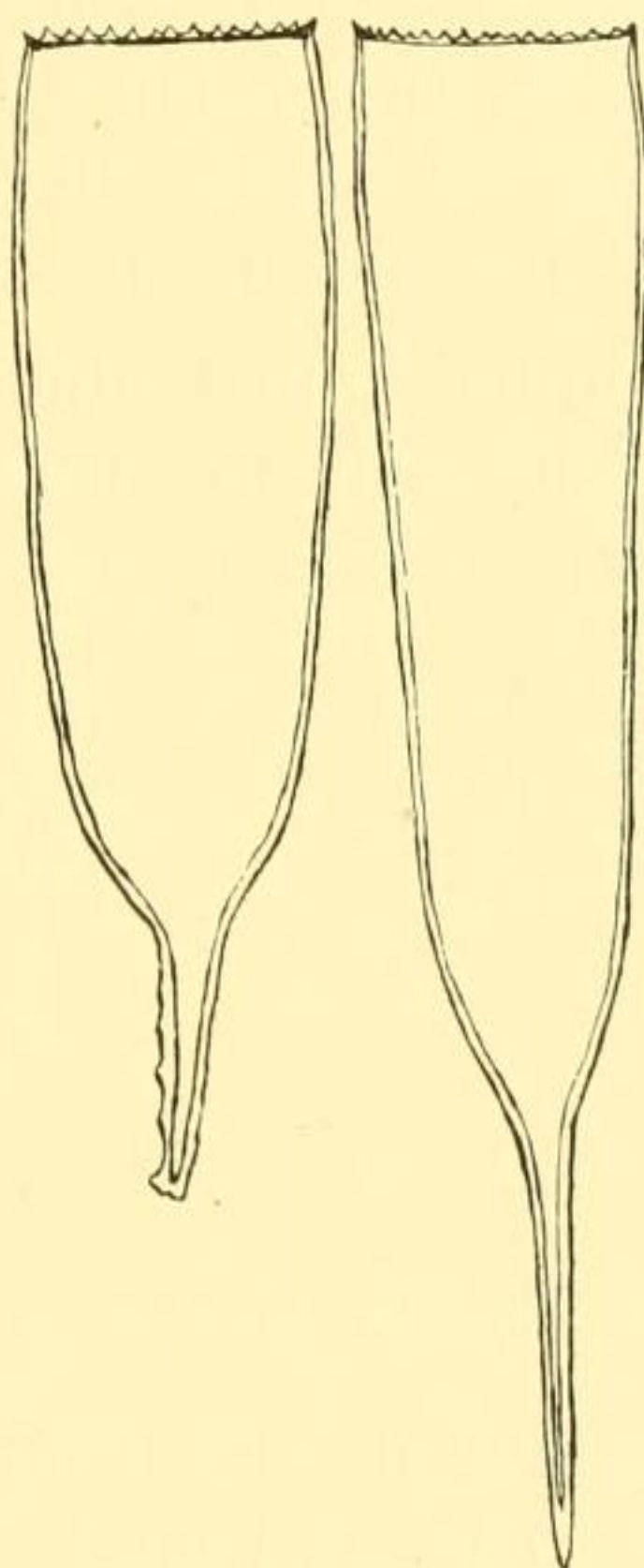
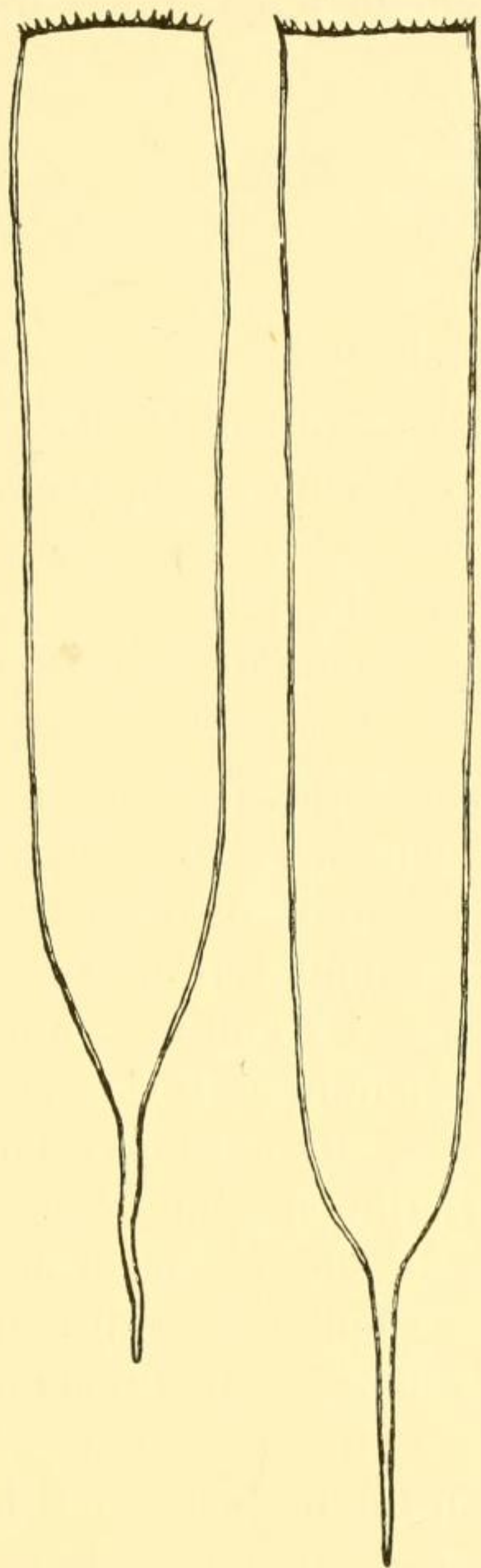


Fig. 4. *Cyttarocyclus denticulata* Ehrbg.
var. *gigantea* (Bdt.) Jørg. 250 t. m.

Fig. 5. *Cyttarocyclus denticulata*
Ehrbg. var. *robusta* Jørg. 250 t. m.

GENSEN (l. c.), as my fig. 5 will prove. Sometimes specimens were found which had not the well-developed "Fortsatz", but elsewhere agreed with the var. *robusta*; these may be named f. *subrotundata* Jørg. (1899, p. 34, pl. 2, figs. 20–21, pl. 3, figs. 22, 25, 29; Brandt, 1906–07, p. 235, pl. 37, figs. 12–14), which I subordinate under var. *robusta*.

The variety was dominant, together with var. *typica*, in the

samples from the pack-ice in August 1906 and disappeared together with it when reaching the coastal water, but more slowly (the empty houses are perhaps more persistent than those of var. *typica*). It was present together with var. *typica* in Aug.—Sept. 1907 in Danmarks Havn, but not common. In 1908 (July—August) it was not present in the coastal water, but appeared in the pack-ice (probably only empty houses) and became common in the samples from the outer margin of and outside the ice.

Dimensions (in μ): 325×80 , 420×80 .

Distrib. (of *C. denticulata*): Neritic northern species of wide distribution, known along the coasts from New Foundland north- and eastwards to the Baltic Sea.

Ptychocylys Brandt, 1886.

5. *Ptychocylys obtusa* Brandt, 1896, p. 59, pl. 3, figs. 13, 15; 1906—07, p. 310, pl. 57, fig. 8; *P. urnula*, var. *obtusa* Jørgensen, 1901, p. 18, pl. 3, fig. 32; *P. Drygalskyi* Brandt, 1896, p. 59, pl. 3, fig. 14; *P. obtusa*, var. *Drygalskyi* Bdt., 1906—07, p. 312, pl. 55, figs. 1—3; pl. 56, figs. 3, 4; pl. 57, fig. 10; *P. urnula* var. *digitalis*, Jørgensen 1901, p. 17, pl. 2, figs. 29, 30, pl. 3, fig. 31; 1905, p. 143. (Fig. 6).

In samples from Danmarks Havn, Aug.—Septm. 1907, *P. obtusa* was found in some numbers, but not common; further it was pre-

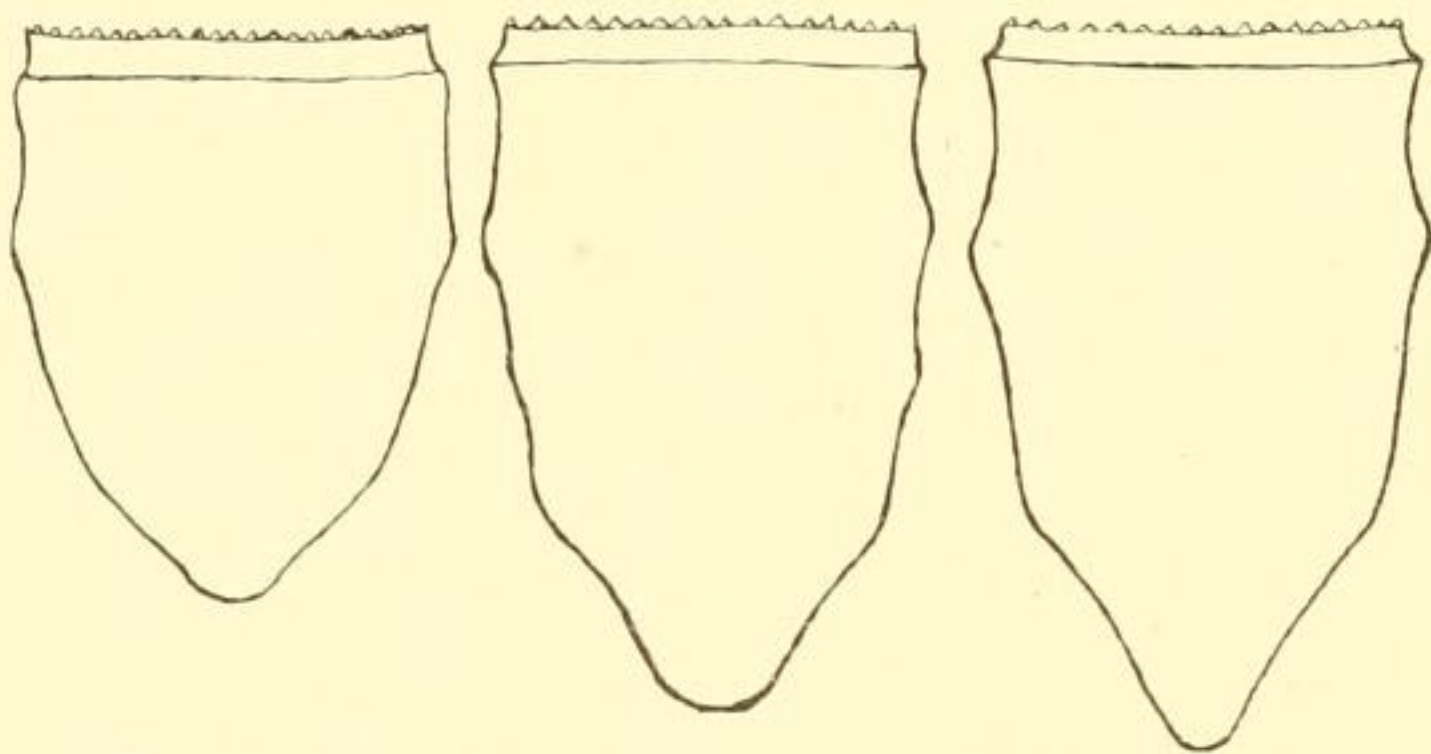


Fig. 6. *Ptychocylys obtusa* Brandt. 250 t. m.

sent in July 1908 in some samples from the coastal water and here not so uncommon. It was with some hesitation that I named all the specimens examined *P. obtusa*, as at least the smaller ones also may be named var. *Drygalskyi*, but it has been impossible to

me to find any distinct boundary between the main species and the so-called variety. To me it seems, as if var. *Drygalskyi* is only the smaller individuals of *P. obtusa*; and the annexed sketches will show my meaning. Therefore I name them all *P. obtusa*.

Distrib. Arctic neritic species known from Davis Strait, Labrador Stream, Norwegian Sea, Norway, Spitsbergen.

6. *Ptychocylys urnula* (Clap. & Lachm.) Bdt., var. *acuta* Brandt, 1906, p. 28, pl. 56, figs. 1, 2, 6; pl. 57, fig. 7; *P. acuta* Brandt, 1896, p. 59, pl. 3, fig. 16.

In two samples from the outer part of the pack-ice in August 1906 a few specimens of a *Ptychocylys* were observed which I refer

to the arctic variety of *P. urnula* characterized (in spite of its name) by a less acute lower end of the house and smaller size. It forms a transition to the above mentioned species.

Distrib. (of var. *acuta*) Davis Strait; (main species) northern oceanic species.

Tintinnus Schrank, 1803.

7. *Tintinnus acuminatus* Clap. & Lachm., var. *secatus* Brandt, 1906, p. 32, pl. 66, fig. 5; 1907, p. 389; *T. secatus* Brandt, 1896, p. 51, pl. 3, fig. 12.

Only found once in a sample from the outer part of the pack-ice (Aug. 1906).

Distrib. (of var. *secatus*) Karajak Fjord, Davis Strait, Labrador Stream; (main species) northern oceanic species of wide distribution.

8. *Tintinnus norvegicus* (Daday) Brandt, var. *gracilis* Brandt, 1906, p. 30, pl. 62, figs. 2, 7; 1907, p. 407; *T. gracilis* Brandt, 1896, p. 54, pl. 3, fig. 7.

The form of the group *T. norvegicus* present in the area has the cylindrical shape of the house and the well-developed teeth of the mouth, characterizing BRANDT'S *T. gracilis*.

It was found in the samples from the pack-ice in August 1906 and in July 1908 and further outside the ice in August 1908; it was always rather rare, but because of its small size it is only to a small degree kept by the nets.

Distrib. (of the var. *gracilis*): Karajak Fjord, Davis Strait; (of the main species) Davis Strait, Labrador Stream, North Atlantic, off Bergen.

9. *Tintinnus vitreus* Brandt, 1896, p. 54, pl. 3, figs. 8—9; 1906—07, p. 438, pl. 66, fig. 7. (Fig. 7).

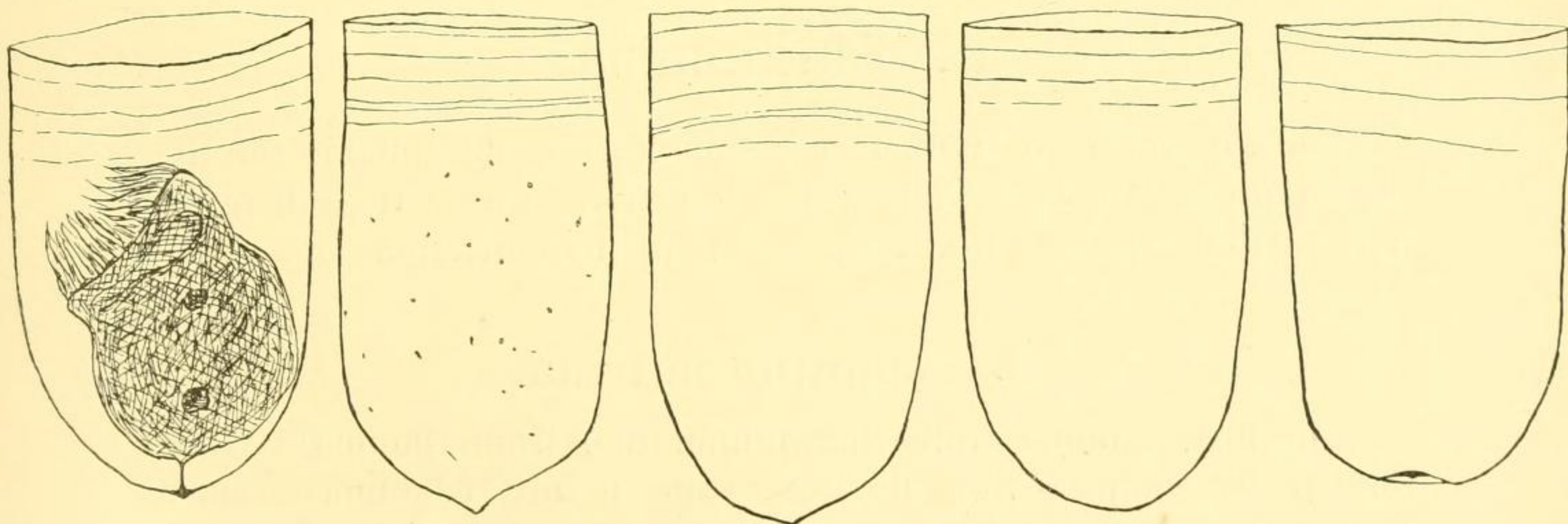


Fig. 7. *Tintinnus vitreus* Brandt. 250 t. m.

In his paper on the *Tintinnodea* from VANHÖFFEN'S material from Karajak Fjord BRANDT has described a rare *Tintinnus* which

has not been seen since then. This species I have found not rarely in a single sample from Danmarks Havn, Aug. 15th 1907, and I have been able to study it a little more in details. A single specimen was further found in a sample from the coastal water off Cape Amelie in Aug. 1906.

My specimens differ in some points from BRANDT's description, but I think it correct to retain them under his species. The houses are 210—240 μ long (BRANDT gives 0,14—0,15 mm.) and 120—140 μ broad. The lower end has mostly a small tip, more rarely it is rounded as in BRANDT's figure; and near the mouth a varying number of rings are seen, but they are very fine and often difficult to observe. The wall of the cylindrical house is hyaline and with high power of magnification the fine "Primärwaben" are discernible; sometimes very small foreign bodies are sparingly fixed upon the wall. The animal itself has two nuclei and a large vacuole; it is adherent to the innerside of the tip of the house by means of a stalk, — as far as preserved material (in alcohol) allows to judge.

The species seems to have a very short time of plankton life; it was present in Danmarks Havn in one sample from Aug. 15, but not in samples from Aug. 4th or 24th of 1907, and further in one sample from Aug. 15th 1906; temperature of the water was + 0,4° and \div 0,4° C. respectively.

Distrib. Arctic neritic species, hitherto only known from Karajak Fjord (March) and in our area (August).

II. Radiolaria.

As said above (p. 290), surface samples are not suitable for Radiolarians, and besides arctic waters have few species; it is then but natural that very few forms were seen in the collection.

A. Acanthometrida.

In three samples from the autumn 1907 from Danmarks Havn and in five samples from the coast water in July 1908 undetermined forms of *Acanthometrida* were seen. As far as I could find, the transverse section of the spines was quadrangular and no basal wing-cross was developed; it may then have been a species of *Acanthonia*, most probably *A. ligurina* Hæckel (cfr. Popofsky 1905).

B. Nassellaria, Dicyrtida.

Amphimelissa Jørg., 1905.

Amphimelissa setosa (Cleve) Jørgensen, 1905, p. 137, pl. 18, fig. 109; *Botryopyle setosa* Cleve, 1899, p. 27, pl. 1, fig. 10.

Two specimens of the group *Dicyrtida* were seen in a sample from Danmarks Havn, Aug. 15th 1907, and they agreed well with the species here quoted.

Distrib. West of Norway; fjords of northern Norway; north and west of Spitsbergen; East Greenland Sea at 71°—72° N. Lat.; Atlantic 45° N. Lat. 49° W. Long.

III. Foraminifera.

In a single sample from the inner part of the pack-ice, July 1908, I found a few specimens of *Globigerina*, most probably *G. bulloides* d'Orb., a well known, widely distributed oceanic plankton organism.

IV. Incertae sedis.

In his famous work on plankton HENSEN (1887) has mentioned and figured an obscure organism which he named "Sternhaarstatoblast", as occurring in the Baltic; this organism was found in a sample from September 10th 1907 from Danmarks Havn, but very rare.