

XI.

MARINE PLANKTON

FROM

THE EAST-GREENLAND SEA

(W. OF 6° W. LONG. AND N. OF 73° 30' N. LAT.)

COLLECTED DURING THE "DANMARK EXPEDITION" 1906—1908

I. LIST OF DIATOMS AND FLAGELLATES

BY

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1910

INTRODUCTION

During the outward and homeward voyages of the Danmark-Expedition in 1906 and 1908 to and from N. E. Greenland the botanical collector Mr. A. LUNDAGER has procured a large series of samples of surface plankton by means of using tow-nets with fine-meshed silk-gauze (Millergauze No. 20). Also during the stay in Danmarks Havn (Denmark Harbour), Germania Land, $76^{\circ}46'$ N. Lat., $18^{\circ}43'$ W. Long., some collections were made.

Of late years several expeditions have crossed the Greenland Sea and brought home collections of plankton. Therefore it was not likely that the plankton samples of the Danmark Expedition should give much new, especially not with regard to the samples taken in the open Greenland Sea east and south of the pack-ice (drift-ice). The main interest must lie in the samples from the pack-ice itself and from the coastal water inside it, and further in the samples from Danmarks Havn. I have consequently limited my examination to the samples taken in these regions and have not wasted my time by examining the other samples which would have given only a feeble and chance knowledge of the plankton of the open Greenland Sea, based, as it must have been, upon material from two crossings alone and both in July—August.

It would have been of the highest value if the Expedition had taken samples at regular intervals, e. g. fortnightly, during the whole time of the stay in Danmarks Havn from August 1906 to July 1908, as we know very little of the seasonal changes in arctic coast-plankton. The only source is VANHÖFFEN's investigations from Karajak Fjord in West Greenland, ca, 70° N. Lat., (Drygalski Expedition 1892—93), and it is easily understood that a comparison with those would have been much appropriate. Unfortunately the collection from Danmarks Havn is very incomplete; it consists of some samples from the time between June 15th and September 10th 1907 and a couple from July 21st 1908 when the steamer left the harbour. There is here lost a chance which, perhaps, will not come again for years.

As to the samples collected before and after the stay in Danmarks Havn, we have (1°) a fair collection from August 1906 and July 1908 taken in the more or less ice-filled water along the coast from off Koldewey Island (ca. 76°30' N. Lat.) to ca. 78° N. Lat., and further (2°) an interesting collection from the traversing of the pack-ice in both years (July—August). During the homeward voyage in July 1908 the samples from the coastal water and the pack-ice were taken with intervals of only one or a few hours, and a preliminary examination soon showed that it was not necessary to work out more than a selected number. In the following list I have enumerated the species of Diatoms and Flagellates, in another paper Mr. OVE PAULSEN will treat of the Peridinians. With regard to the Zooplankton the collecting method with small open conical nets of fine-meshed silk-gauze is not well adapted to the capture of the larger organisms, metazoa; other samples taken by the Expedition with larger coarse-meshed nets and at different depths give better results; they will form the subject of papers by zoologists; it will, therefore, not be necessary to undertake a closer examination of the surface samples in this respect. On the other hand, the Protozoa, at least the Tintinnodea, require fine-meshed nets for catching, and in a little separate paper I shall enumerate the species of protozoa found in the samples.

Finally Mr. PAULSEN and I in common will write on the surface plankton samples as a whole describing the general character of the plankton, the supposed origin of the organisms, etc. under comparison with the hydrographical conditions and using the papers published by other planktologists on the plankton of the East Greenland Sea.

The list here given contains the names of all the plankton Diatoms and Flagellates determined from the samples, with quotations of the first description, of the more important synonyms and figures, as well as of the general works (e. g. GRAN'S Diatoms in Nordisches Plankton). Critical remarks elucidated by figures are annexed to several species. The list further gives the occurrence in the region, divided into the three above mentioned areas: Danmarks Havn, the coastal water and the pack-ice, and the time for the presence in the plankton, as far as the scanty data allow it. At last the area of distribution is given summarily. The examination did comprise 64 samples.

The littoral diatoms and the diatoms of the ice-floes are determined by Mr. E. ØSTRUP who publishes his results together with a treatment of the freshwater diatoms.

The following papers deal with the phytoplankton from the East Greenland Sea:

- BROCH, HJ., (1909): Plankton-tables, in D. Damas et E. Koefoed, *Le Plankton de la Mer du Grønland*. — Duc d'Orleans: Croisière Océanographique accomplie à bord de La Belgica dans la Mer du Grønland 1905. Bruxelles.
- CLEVE, P. T., (1900): Report on the Plankton collected by the Swedish Expedition to Greenland in 1899. — *K. Svenska Vet. Akad. Handl.*, Bd. 34, Nr. 3. Stockholm.
- ØSTRUP, E., (1895): *Marine Diatoméer fra Øst-Grønland*. — *Medd. om Grønland*, XVIII, København.

Hereto the two general works may be added:

- GRAN, H. H., (1904): *Die Diatomeen der arktischen Meere. I. Teil: Die Diatomeen des Planktons* — *Fauna Arctica*, herausgegeben von F. Römer u. F. Schaudinn, Bd. III, Heft 3. Jena.
- (1905): *Diatomeen*. — *Nordisches Plankton*, herausgegeben von K. Brandt. XIX. Kiel u. Leipzig.
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I. Bacillariales (Diatoms).

A. Centricæ.

Melosira Ag., 1824¹.

1. *Melosira hyperborea* (Grun.) Schütt, in Engler & Prantl, Nat. Pflanzenfam., I. 1 b, 1896, p. 59; Gran, Norweg. North Polar Exp., Scientif. Results, vol. 4, No. 11, 1900, p. 52. pl. 3, figs. 11—15. *M. nummuloides*, var.? *hyperborea* Grunow in V. Heurck, Synopsis, pl. 85, figs. 3—4.

The species is one of the most characterizing diatoms from the ice-floes. It often occurs in practically pure mass cultures in holes in the ice-floes and in spaces between them. Both in 1906 and in 1908 several samples from the pack-ice had this species as their main organism. In most samples from July and August it had resting spores, answering well to the excellent figures in GRAN'S paper quoted above. In October 1906 the samples from Danmarks Havn contained a few empty frustules, and in September 1907 the case was nearly the same, i. e. at that time the vegetation period was over. In June (15th) 1907 a sample collected in a crack of the land-ice shows us the species in full growth, the chains consisting of frustules in rapid division and with no trace of resting spores. In the later half of July 1908 most of the samples from the coastal water and some from the inner part of the pack-ice contained it, in several of them even as common, and in nearly all samples resting spores were present. Thus we get an idea of its life-cycle, as we must suppose that it winters as resting spores, probably frozen in the ice.

Distrib. Arctic neritic species known from the arctic coast regions and from the inner Baltic.

Thalassiosira Cleve, 1873.

2. *Thalassiosira Nordenskiöldii* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. I, No. 13, 1873, p. 6, pl. II, fig. 1; Gran, Norske Nord-

¹ I have followed the consecutive order of genera and species given in GRAN, Nord. Plankton XIX.

havs-Exp., Protophyta, 1897, p. 28, pl. IV, fig. 59; Nord. Plankton XIX, 1905, p. 16, fig. 9.

This species is rather rare in the collection; it has been found in a single sample from the pack-ice in 1906, in some samples from Danmarks Havn in 1907 and 1908, and in several ones from the coastal water and the pack-ice in 1908, but never commonly. The time where it "flowers" must be very short in these high latitudes as it has not been present in the June and July (first half) samples from Danmarks Havn. No resting spores were seen. July—September.

Distrib. Northern neritic species widely distributed along the coast regions of the northern countries.

3. **Thalassiosira decipiens** (Grun.) Jørgensen, Bergens Museums Skrifter, 1905, p. 96, pl. 6, fig. 3; Gran, Nord. Plankton, 1905 XIX, p. 17, fig. 10; Ostenfeld, Wiss. Ergeb. Aral See Exp., VIII, 1908, p. 144, pl. 6, figs. 6—8; *T. gelatinosa* Hensen, 5. Ber. Komm. Deutsch. Meere, 1887, p. 87; *Coscinodiscus excentricus*, var.? *decipiens* Grunow, Sitzungsber. naturw. Ges. Isis, Dresden, 1878, p. 28, pl. 6, fig. 18; *C. decipiens* Grunow in Van Heurck, Synopsis, 1883, pl. 91, fig. 10.

Found sparingly in four samples from the outer margin of the pack-ice in 1906, not elsewhere. July—August.

Distrib. Northern temperate species known from the coast regions of North and West-Europe, further from the Caspian and Aral Seas; not formerly found in arctic water, where it has not its home.

4. **Thalassiosira hyalina** (Grun.) Gran, Bibliotheca bot. Heft 42, 1897, p. 4, pl. 1, figs. 17—18; Nord. Plankton XIX, p. 17; E. Jørgensen, Bergens Museums Skrifter, 1905, p. 96, pl. VI, fig. 5; *Th. Clevei* Gran, Norske Nordhavs Exp., Protophyta, 1897, p. 29, pl. 4, figs. 60—62; *Coscinodiscus hyalinus* Grun. in Cleve & Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 113, pl. 7, fig. 128; Grunow, Diat. v. Franz Josefs Land, 1884, p. 30, pl. C, fig. 28.

It is rather curious that I have found this species, so characteristic for the ice-floes, only very rarely and in a few samples from the pack-ice in August 1906.

Distrib. Arctic-neritic species known from the ice-floes and the coasts of the arctic Sea (reaching as far south as Stadt in Norway).

5. **Thalassiosira gravida** Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 3, No. 4, 1896, p. 12, pl. 2, figs. 14—16; Gran, Norske Nordhavs-Exp., Protophyta, 1897, p. 28, pl. 4, figs. 57—58; Nord. Plankton XIX, p. 18, fig. 12; *Coscinodiscus subglobosus* Cleve & Grun. in Grunow, Diat. v. Franz Josefs Land, 1884, p. 32, pl. D, figs. 19—20.

In the samples from 1906 this species was only found twice and in very few specimens; also in 1907, in the samples from Danmarks Havn it was rare. In 1908, on the other hand, it was common in many of the samples on the whole way from Danmarks Havn through the pack-ice. In several samples the cells were very small, so-called hunger-specimens. The resting spores (*Coscinod. subglobosus*) were present in two samples (Septm. 1907, July 1908). July—August—September.

Distrib. Northern neritic species widely distributed along the coast bordering the Arctic and North Atlantic Oceans and their tributaries.

6. **Thalassiosira bioculata** (Grun.) Ostenfeld, Bot. of the Færøes, vol. 2, 1903, Copenhagen, p. 564, figs. 120—121; Gran, Nord. Plankton XIX, p. 19, fig. 14; *Coscinodiscus b.* Grunow, Diat. v. Franz Josefs Land, 1884, p. 30 et 56, pl. C, fig. 30, pl. D, figs. 1—2.

Single individuals were found in several of the samples from Danmarks Havn, the coast water and also in the pack-ice. Chains are not seen and the species was not found in stage of strong growth. July—August—September.

Distrib. Northern neritic species known from the coast regions of the northern countries bordering the Davis Strait, northern Atlantic and Arctic Oceans.

Bacterosira Gran, 1900.

7. **Bacterosira fragilis** Gran, Nyt Mag. Naturvid., Christiania, 38, 1900, p. 114; Nord. Plankton, 1905, XIX, p. 21; *Lauderia f.* Gran, Bibliotheca botanica, Heft 42, 1897, p. 18, pl. 1, figs. 12—14.

Found very sparingly in samples from Danmarks Havn and the coast-water, not in the pack-ice. July—August.

Distrib. Arctic neritic species known from the coasts of the arctic Sea (West- and East-Greenland, Spitsbergen, Nova Zembla) and from the northern coast of Norway.

Lauderia Cleve, 1873.

8. **Lauderia glacialis** (Grun.) Gran, Nyt Magaz. Naturvid., Christiania, Bd. 38, 1900, p. 111, pl. 9, figs. 10—14; Nord. Plankton, XIX, p. 23; *Podosira hormoides*, var. *glacialis* Grunow, Diat. Franz Josefs Land, 1884, p. 56, pl. C, fig. 32; *P. glacialis* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 3, No. 4, 1896, p. 12, pl. 2, figs. 17—20; *Porosira g.* Jørgensen, Bergens Museums Skrifter, 1905, p. 97, pl. 6, fig. 7.

Rare in the samples, found in Danmarks Havn and in the coast water, not in the pack-ice. July—August.

Distrib. Northern (subarctic) species known from the coastal regions of the arctic Sea and along the coasts of North-Europe (in winter).

Hyalodiscus Ehrbg., 1845.

9. **Hyalodiscus laevis** Ehrbg., Monatsber. Berlin. Akad. Wissensch. 1845, p. 78; Cleve u. Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 116; Peragallo, Diatom marin. de France, pl. 119, fig. 20; *H. subtilis* Bailey, Smithson. Contrib. to knowledge, vol. 7, 1854, p. 10, fig. 12; W. Hendry, Quart. Journ. Microsc. sc., 1861, p. 179; Cleve u. Grunow, l. c.; Gran, Bibliotheca botanica, Heft 42, p. 5, pl. 1, fig. 19; Peragallo, l. c., pl. 119, fig. 7. Cfr. Stockmayer, Annal. k. k. naturh. Hofmuseum, Wien, XXIII, 1909, p. 69.

In some samples from Danmarks Havn I found sparingly a large species ($150+170\mu$ in diameter of the valve) of *Hyalodiscus* which, I think, is identical with GRAN'S *H. subtilis* from Karajak Fjord. On the other hand I cannot find any difference of valve between *H. laevis* Ehrbg. and *H. subtilis* Bail. Already HENDY (l. c.) has suggested that the distinctive marks in the proportion between the entire valve and the central part (*umbilicus*) as well as in the structure of the "*umbilicus*" are value-less, and my here given figures (Fig. 1) which

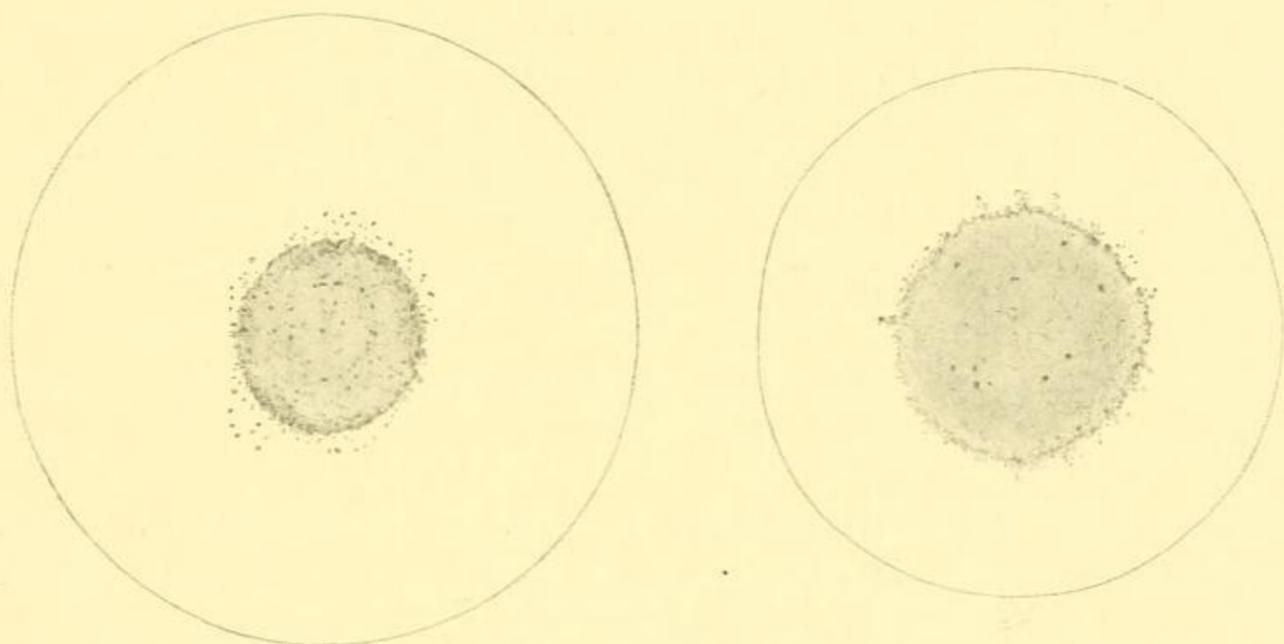


Fig 1. *Hyalodiscus laevis* Ehrbg. 250 t. m.

are chosen as extremes will, taken together with the figures by PERAGALLO, show that these characters are subject to great variability. Therefore, I find it necessary to unite the two species in one to which *H. scoticus* (Kutz.) Grun. must be referred as a dwarfy variety. — July—September.

Distrib. Coast-species, not true plankton form, found scattered over the earth, especially in colder regions; often found in fossil depots.

Coscinodiscus Ehrbg., 1838.

10. **Coscinodiscus centralis** Ehrbg., Abhandl. Berl. Akad., 1838, p. 129; Mikrogeologie, pl. 18, fig. 39. pl. 22, fig. 1; Jørgensen, Bergens Museums Skrifter, 1905, p. 93, pl. 6, fig. 1; Gran, Nord. Plankton XIX,

1905, p. 33, fig. 33; Ostenfeld, *Wiss. Ergebn. Aral-See Exped.*, VIII, St. Petersburg, 1908, p. 149, pl. 7, figs. 4—5.

In a sample from the outer part of the pack-ice a single dead frustuce of this species was found. August 1906.

Distrib. Widely distributed oceanic species, according to GRAN common, especially during winter, in the Gulf-Stream area of the Norwegian Sea and in the North Atlantic; not at home in arctic water.

11. *Coscinodiscus subbuliens* Jørgensen, *Bergens Museums Skrifter* 1905, p. 94, pl. VI, fig. 2; Gran, *Nord. Plankton* XIX, 1905, p. 32, fig. 32; *C. oculus iridis* Gran, *Fauna Arctica*, III, Lief. 3, 1904, p. 519, pl. XVII, figs. 17—19.

The species which I refer to JØRGENSEN'S *C. subbuliens* is very common in some of the samples from the autumn, indeed forming the main part of the phytoplankton.

Owing to the abundance of material I have been able to add some points to the descriptions given by JØRGENSEN and GRAN. As to the size of the species JØRGENSEN gives a diameter of "usually 50—100 μ ", and GRAN says 65—150 μ , while my measurements extend it to 240 μ (185 μ as mean of 20 measurements) for the normal vegetative cells. The valves are coarsely areolated in a radiate manner, and in contradistinction to the descriptions of the two quoted authors I have found that, at a certain adjustment, a single row of very small points or *apiculi* are discernible a little inside the margin and further, asymmetrically among them, two larger *apiculi* or knots, at a distance from one another of between 120° and 150°. The *apiculi* which are difficult to see, best upon ignited material mounted in styrax-balsam, stand rather closely, as between two usually 3—4 radii of areoles originate. The existence of the two larger *apiculi* shows that *C. subbuliens* must be referred to the Group *Biapiculati* created by me in 1908 (*Wiss. Ergebn. d. Aralsee-Exp.*, Lief. VIII, St. Petersburg, 1908, p. 147). Further investigations must decide, if all species of the sectio *Radiati* Rattr. possess these two *apiculi*; hitherto they have been found in *C. biconicus* Van Breem., *C. aralensis* Ostf., *C. Granii* Gough, *C. centralis* Ehrbg. and *C. concinnus* W.

GRAN (1904, fig. 19) has figured the construction of the girdle of a specimen which just has divided into two daughter-cells and where the matter is more complicated than in the ordinary cells. Therefore I have given a figure (Fig. 2) showing the girdle of a normal cell¹. This figure represents only a part of the girdle, but it is seen distinctly, that in the connecting part of each valve two structure-lines

¹ The fig. 32 c in GRAN'S paper of 1905 is not quite clear in this respect.

run parallel to its margins, one thin line near the margin and one much coarser line situated more or less half way between the margin and the margin of the valve. The first named line makes a deviation from the parallel in one place, where it bends rather abruptly towards the coarse line and merges into it on a very short way, thus forming a V-shaped figure with the tip cut off; in this place the line is coarser than elsewhere and coarsest where it disappears in the

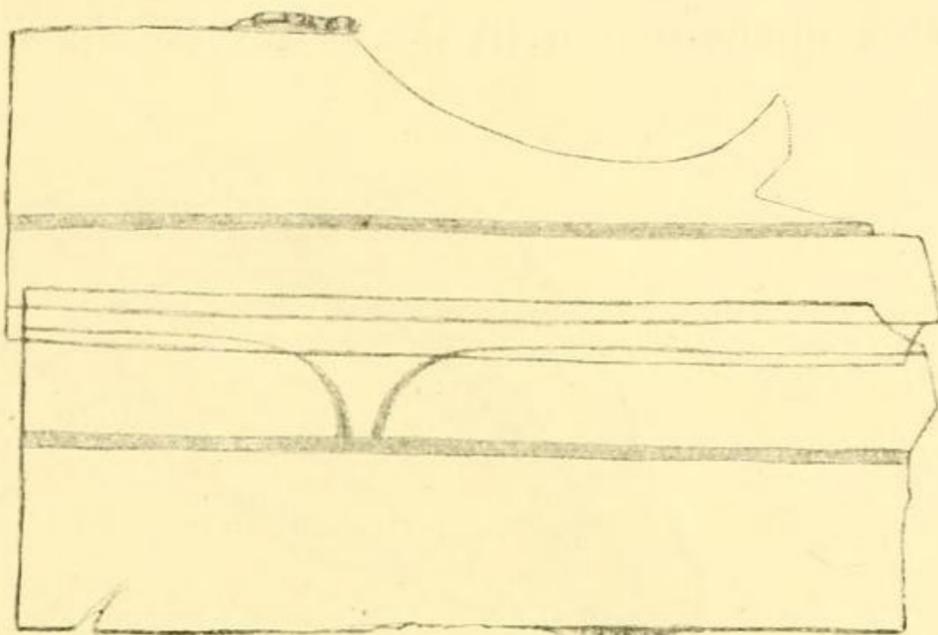


Fig. 2. *Coscinodiscus subbuliens* Jørg. An empty and partly broken frustule. Height 85 μ . 500 t. m.

other line. The V-shaped places of the two connecting parts of a cell never face each other, oftenest they are on the opposite halves of the girdle, but sometimes rather near each other, as e. g. shown in fig. 3, to the right. The narrow part of the V is always directed towards the corresponding valve.

In two samples from August—September 1907 where *Cosc. subbuliens* was dominant, I happened to find among the numerous normal cells some few auxospores or more correctly cells developed from auxospores.. Figs. 3—4 represent such cases: A large cell (dia-

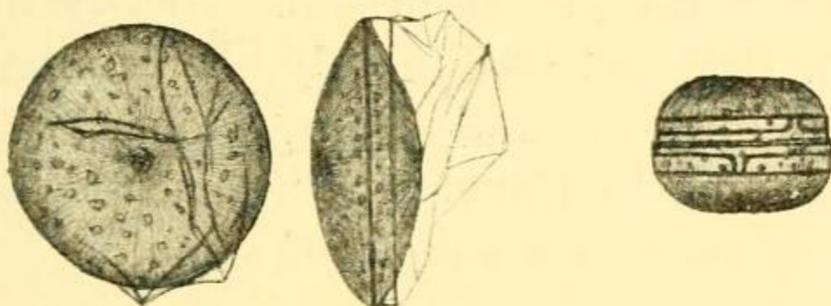


Fig. 3. *Coscinodiscus subbuliens* Jørg. The two figures to the left represent the same cell. All 71 t. m.

meter in a few measured specimens 280—320 μ) carries on the one valvar side the folded and crumpled rest of the *perizonium*; the cell itself is very young which is seen from the absence of a distinct girdle-part; the nucleus is situated close to the innerside of that

valve, which turns away from the *perizonium*. I did not succeed in finding other stages, but the knowledge at hand is sufficient to show that the auxospore formation probably goes on in the same manner as in *Thalassiosira gravida* (GRAN, Norske Nordhavs-Exp., Protophyta 1897) or in *Melosira* (see f. i. G. KARSTEN, Wissenssch. Meeresunters., 1899, p. 183), with the difference that follows from the fact that the cells of *Cosc. subbuliens* occur solitary, not in chains. Hence it results that the auxospores immediately become separated from their mother-cells, which makes it difficult to observe them.

G. KARSTEN (l. c., p. 185) reports that he has found auxospores in *Cosc. radiatus* and KLEBAHN in *Cosc. excentricus*, but closer informations are not, as far as I know, given concerning the occurrence of this phenomenon in the genus *Coscinodiscus*.

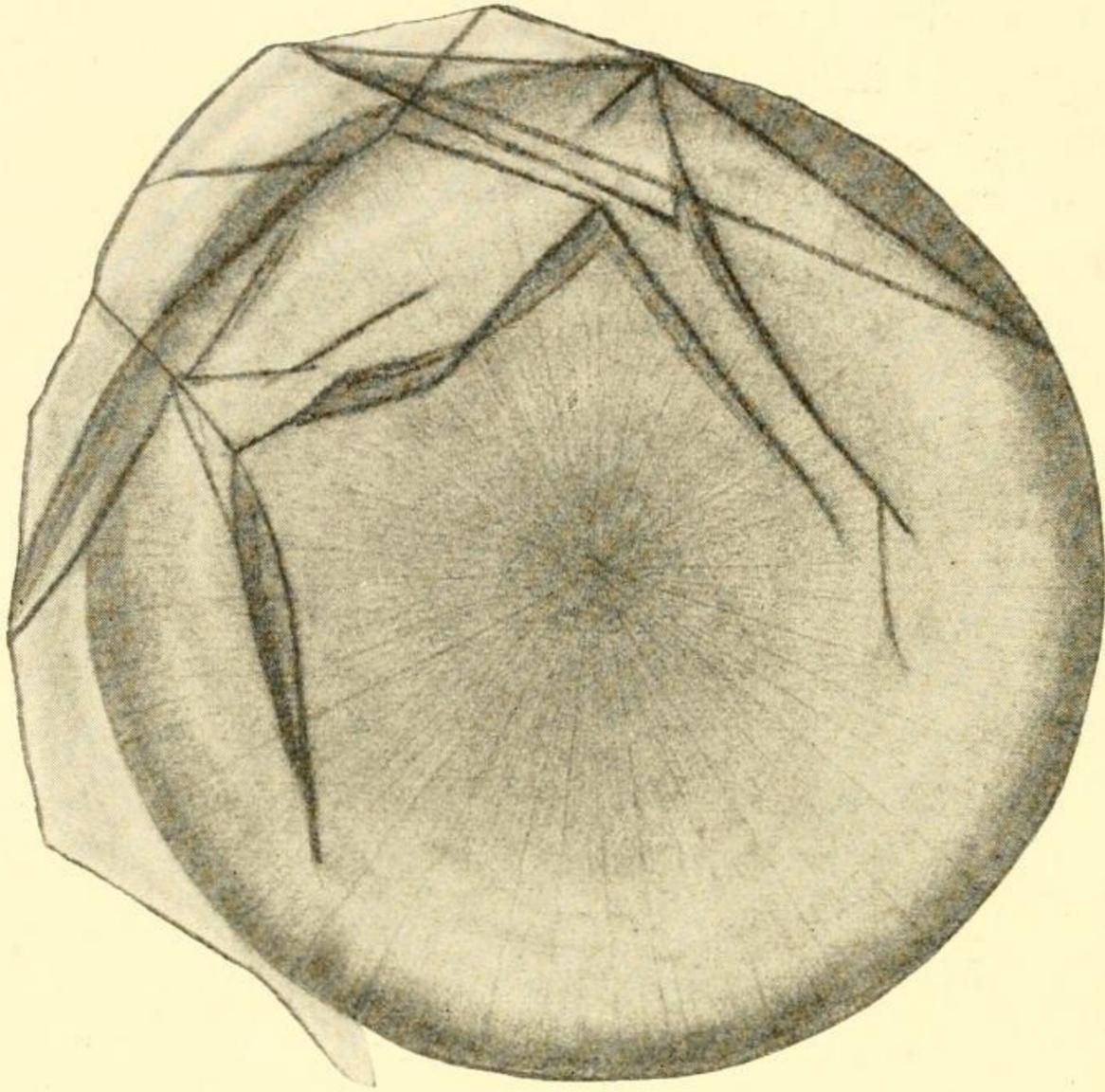


Fig. 4. *Coscinodiscus subbuliens* Jørg. 250 t. m.

Cosc. subbuliens was dominant in samples from Danmarks Havn and from the coast water in 1906, 1907 and 1908 in July—September. Few living specimens were present in two samples from October 1906 taken in cracks in the ice of Danmarks Havn. In the pack-ice it was very rare, only few specimens seen in a couple of samples.

Distrib. According to GRAN a boreal species occurring especially in the regions where polar and atlantic currents meet, often in large quantities.

12. ***Coscinodiscus marginatus*** Ehrbg., Abhandl. Berlin. Akad. Wissensch., 1841, p. 142; A. Schmidt, Atlas Diatom.-Kunde, pl. 62, figs. 1—5, 9—11; pl. 59, fig. 11; *C. fimbriato-limbatus* A. Schmidt, l. c., pl. 65, figs. 3—6; pl. 113, fig. 2; *C. limbatus* A. Schmidt, l. c., pl. 63, fig. 7; Ostenfeld & Paulsen, Medd. Grønland, XXVI, 1904, p. 160.

Som few empty frustules of this coarsely areolated species were found in a sample from the outer part of the pack-ice in August 1906.

Distrib. Oceanic temperate species known from the plankton of the North Atlantic west of 26° W. Long., not at home in arctic water.

13. *Coscinodiscus curvatulus* Grun. var. *karianus* Cleve et Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 113, pl. 7, fig. 129; *C. curvatulus*, var. *genuina* Grun., Diat. v. Franz Josefs Land, 1884, p. 31, ex parte, pl. D, fig. 13 (non fig. 14); *C. curvatulus* Gran, Nord. Plankton XIX, p. 35, ex parte, fig. 37 a.

In two samples from the pack-ice, taken in July 1908, I found rather sparingly a *Coscinodiscus* which agrees well with the form quoted above, var. *karianus* of *C. curvatulus*, and to this form I also refer the fig. 13 by GRUNOW's diatoms from Franz Josefs Land. It has a single row of distinct *apiculi*.

GRAN has pointed out that probably several species are included in GRUNOW's *C. curvatulus*. He gives figures of a form from the Norwegian Sea which has no *apiculi* and in which the low girdle consists of the two connecting parts and a plain intercalary hoop. Our form has a somewhat higher girdle in which each connecting part has an intercalary hoop and the line between the connecting part and the intercalary part is elevated and with a V-shaped curvature, see fig. 5. I think that it is a distinct arctic species, but my material is too scanty to decide the question.

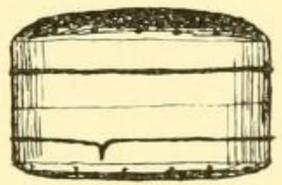


Fig. 5. *Coscinodiscus curvatulus* Grun., var. *karianus* Cl. & Grun.

Distrib. (of var. *karianus*): Arctic Sea, in pack-ice; (of the main species): widely distributed both in colder and warmer seas.

14. *Coscinodiscus Joergensenii* nom. nov.; *C. polyacanthus*, var. *intermedius* Grunow, Diat. v. Franz Josefs Land, p. 29, pl. C, fig. 25; Jørgensen, Bergens Museums Skrifter, 1905, p. 92; non *C. intermedius* Ehrbg.

In some samples from the pack-ice (July—August 1906 and 1908) and from Danmarks Havn (October 1906, August 1907) I have found rather scattered, specimens of a fasciculate *Coscinodiscus* of the *subtilis*-group, which agrees well with GRUNOW's quoted description and figure. As JØRGENSEN (l. c.) has suggested, it is distinct from the true *C. polyacanthus* Grun. by having one row of small interfasciculate *apiculi* and is closely related to *C. curvatulus* (at least to var. *karianus*) from which it differs e. g. by a finer structure and straight *fasciculi*. On the other hand it is allied to *Thalassiosira bioculata* from which it is easily recognised by having only one (not two) central areole and by a less fine structure. I have not succeeded in finding out the construction of the girdle exactly, but it has not the many intercalary connecting parts of *Th. bioculata* and the cells are not high.

My figures Fig. 6 will show the structure of the valves and the number of *apiculi* which is considerably lower than in *C. polyacanthus*.

GRUNOW (l. c.) gives the size to 60μ , I have found it ranging from 50 til 80μ .

In the samples from Danmarks Havn in October 1906 I found

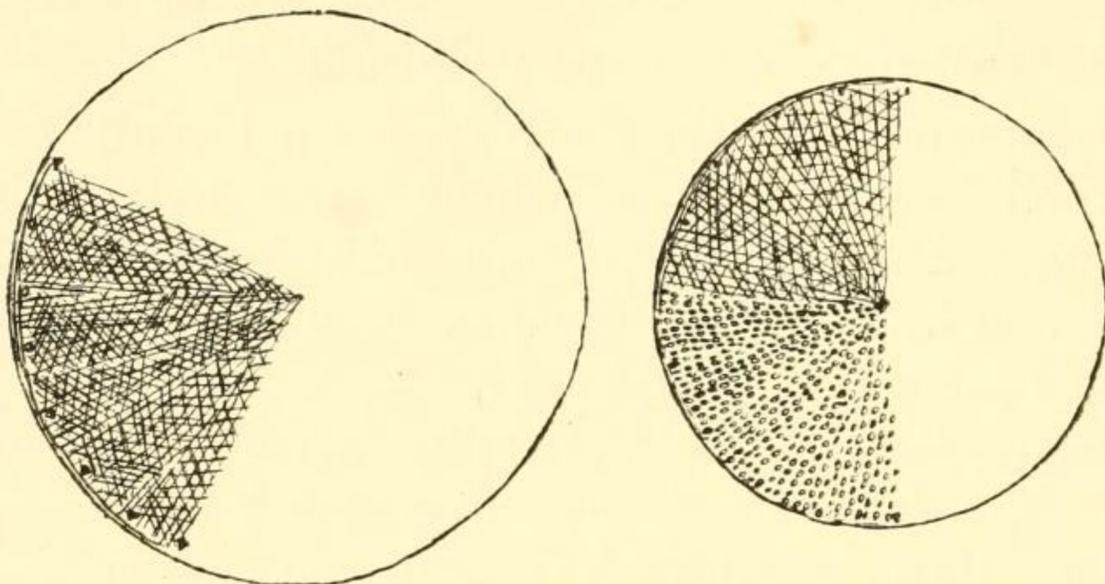


Fig. 6. *Coscinodiscus Joergensenii* n. nom. 500 t. m.

two specimens just coming from the auxospores and having one valve developed while the other half of the cell had the *perizonium* wall kept; and in the same samples I also found some globular bodies

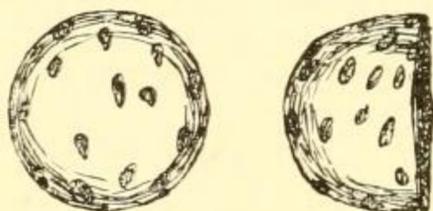


Fig. 7. Auxospore of *Coscinodiscus Joergensenii* n. nom.

of just the same size and with the same contents of chromatophores, etc.; these globules I consider as the auxospores of this species. In the figures 7 I have given such a globule and the auxospore-cell at the same magnification. As the cells seem to live solitary, the mature auxospore — as in *C. subbuliens* — does not

occur adherent to its mother-cell.

Distrib. Probably arctic neritic species, known from Cape Wankarema (Grunow) and Arctic Norway (Jørgensen).

Note. It has been said many times before, but I cannot help repeating that the genus *Coscinodiscus* is in a great confusion and that the limits of the species are very indistinct. It is to be hoped that a monographer will be found who may have a happy hand to clear up this difficult matter.

Asteromphalus Ehrbg., 1844.

15. **Asteromphalus Hookeri** Ehrbg., Monatsber. Berlin. Akad. Wissensch., 1844, p. 200, fig. 3; Gran, Nord. Plankton, 1905, XIX, p. 45, fig. 50; *A. Brookei* Bail., var., Cleve Bih. K. Svenska Vet. Akad. Handl., Bd. 1, 1873, p. 10, pl. 4, fig. 19; *A. atlanticus* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 3, No. 4, 1896, p. 5; K. Svenska Vet. Akad. Handl. Bd. 34, No. 1, 1900, p. 19, pl. 8, figs. 7—9.

A single specimen was met with in a sample from the outer part of the pack-ice; August 1906.

Distrib. Northern-temperate, oceanic species, known from the North-Atlantic and the Antarctic.

Rhizosolenia (Ehrbg.) Brightw. 1858.

16. **Rhizosolenia styliformis** Brightw., Quart. Journ. Microsc. Science, VI, 1858, pl. V, fig. 5; Peragallo, in *Le Diatomiste*, vol. I, 1892, p. 111, pl. 4, figs. 1—5; Gran, Rep. Norweg. Marine- and Fishery-Investig., vol. 2, No. 5, 1902, pl. 1, figs. 1—9; Nord. Plankton, 1905, XIX, p. 54.

Found in Danmarks Havn (September—October 1906, August 1907) and in the coastal water (1906 and 1908), but nearly absent from the pack-ice. It occurs in most samples very rarely, but in a single one not uncommon.

Distrib. Widely distributed oceanic species. often character organism over large areas of water, mostly a temperate species, but here and in some other exceptional cases behaving as an arctic organism.

17. **Rhizosolenia hebetata** Bailey, American Journ. of Sc. and Arts, Ser. 2, vol. 22, 1856, pl. 1, figs. 18, 19; Cleve, Vega-Exp. vetensk. iakttag., Bd. 3, 1883, pl. 6, fig. 69; Gran, Fauna Arctica, Bd. 3, Lief. 3, 1904, p. 524; Nord. Plankton 1905, XIX, p. 55, fig. 67.

f. **semispina** (Hensen) Gran, l. c., p. 55; *Rh. semispina* Hensen, V. Ber. Komm. Unters. Deutschen Meere, 1887, p. 84, pl. 5, fig. 39.

Only found in the pack-ice and here — especially in August 1906 — the dominant species in some samples. In July—August 1908 not so common.

Only the f. *semispina* was seen.

Distrib. Northern oceanic species of wide distribution.

18. **Rhizosolenia obtusa** Hensen, V. Ber. Komm. Unters. Deutschen Meere, 1887, p. 86, pl. 5, fig. 41; Gran, Nord. Plankton XIX, p. 56; *R. alata*, var. *truncata* Gran, Norske Nordhavs Exp., Protophyta, 1897, p. 6, pl. 4, fig. 67.

Only found in the pack-ice and in the same samples where *R. hebetata*, f. *semispina* was present. Dominant in some samples from August 1906, not common in 1908.

Distrib. Northern oceanic species known from the colder parts of the North Atlantic and the Norwegian Sea, etc.

Eucampia Ehrbg., 1839.

19. **Eucampia groenlandica** Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 12, afd. 3, No. 4, 1896, p. 10, pl. 2, fig. 10; Jørgensen, Bergens Museum Skrifter, 1905, p. 99, pl. 6, fig. 8; Gran, Nord. Plankton, XIX, 1905, p. 99, fig. 127.

Single chains were found in four samples of July 1908 from Danmarks Havn and the coastal water, not in the pack-ice.

In some cases the chains were like GRAN's f. *atlantica* (fig. 127 d),

in others they stand intermediate and in others again they were typical (fig. 127 c); thus the f. *atlantica* has probably a very restricted value.

Distrib. Arctic neritic species; known from the coasts of arctic countries; also (rarely) found at Bohuslen, Scotland and in the Norwegian Sea.

Chætoceras Ehrbg., 1844.

20. **Chætoceras atlanticum** Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. I, No. 13, 1873, p. 11, pl. 2, fig. 8; Gran, Nord. Plankton, XIX, 1905, p. 64, fig. 74.

This species is found in several samples from Danmarks Havn, the coast water and the pack-ice, but always in single specimens. July—September 1906—1908.

Distrib. Widely distributed in the Atlantic Ocean and its tributaries, also in the Antarctic Ocean; oceanic species.

21. **Chætoceras convolutum** Castracane, Report of the Challenger Exp., Botany, II, 1886, p. 78; Gran, Fauna Arctica, III, Heft 3, 1904, p. 530, fig. 1; Nord. Plankton XIX, 1905, p. 69.

In the pack-ice this species was dominant in some samples from August 1906; in 1908 it was also present, but not in greater quantities. It was further found in samples from the coastal water and from Danmarks Havn, but only sporadically and in single specimens.

Distrib. Northern oceanic species, known from the North Atlantic and the Antarctic Oceans.

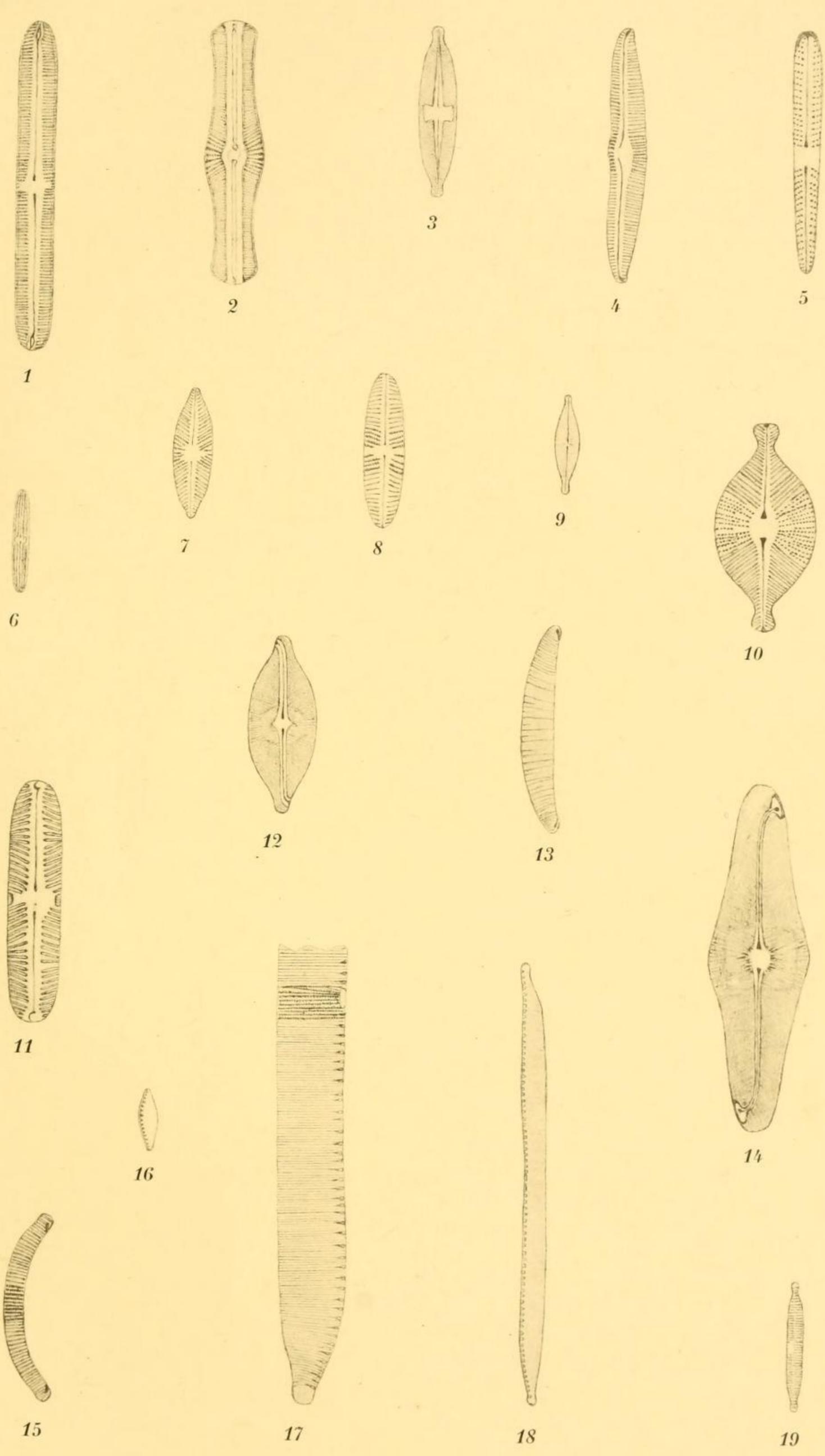
22. **Chætoceras criophilum** Castracane, Report of the Challenger Exp., Botany, II, 1886, p. 78; Gran, Fauna Arctica, III, Heft 3, 1904, p. 532, fig. 3; Nord. Plankton XIX, 1905, p. 71.

If we follow GRAN (l. c.) in the distinctive marks between this and the foregoing species, i. e. *C. criophilum* has none or a very rudimentary connecting zone and *C. convolutum* a well developed one, it results that this species is very rare in the area, only some solitary specimens were found in two samples from the pack-ice, one in 1906 and one in 1908. It is rather unexpected that it is so rare, as it is one of the characteristic and dominant species of the sea between Iceland and Jan Mayen.

Distrib. Northern oceanic species, widely distributed in the northern parts of the Atlantic and its tributaries, further known from the Antarctic.

23. **Chætoceras boreale** Bailey, Smithsonian Contrib. to knowledge, vol. 7, 1854, p. 8, figs. 22—23; Gran, Fauna Arctica, III, Heft 3, 1904, p. 533, fig. 5, Nord. Plankton XIX, p. 73.

One of the most common species in the area. Both in 1906 and 1908 it was the dominant species in many samples from the



coastal water and present also both in Danmarks Havn and in the inner border of the pack-ice. In August 1906 it was not uncommon at ca. 13° W. Long., and dominant in the samples taken along the coast from Koldewey Island to Cape Amélie; in October 1906 some specimens were found in Danmarks Havn, but mostly empty frustules. In August—September 1907 single specimens occurred in the samples from Danmarks Havn. In July 1908 it was dominant in Danmarks Havn and from that place northwards along the coast until ca. 78° N. Lat., and it was further found in some samples a little more eastwards, until ca. 11° W. Lat.

In some of the samples from August 1906 and July 1908 taken in the coastal water (the temperature of the water being between $\div 0,5$ and $4,2^{\circ}$) I often found chains in which the awns of many of the cell-walls had aborted. As the fig. 8 shows, such a chain gets a rather curious aspect: The two latest divisions of the chain figured have produced new cells which bear no awns from the valves while the oldest division has given normally developed awns of which only the bases have been drawn. At the places of the awns we find only small protuberances on the valves, and the protuberances of two cohering valves correspond to each other. It looks as if the cell-division has stopped too early, when only the division of the contents has been fulfilled and the development of the foramen has begun. In some cells I found very short and curved awns in stead of the protuberances, thus showing the reduction in a somewhat less degree.

I have no real explanation of the phenomenon. Perhaps it shows that the cell-division takes place very rapidly, or perhaps it designates a state of hunger, or perhaps it has something to do with microspore formation, as it occurred in the some samples in which microspore formation in *Ch. decipiens* was observed (but no microspores were found in *Ch. boreale*!). K. OKAMURA (Bot. Magaz., Tokyo, XXI, 1907, pl. III, fig. 36) has figured the same phenomenon in a chain of *Ch. criophilum*, but has no remarks on it in the text, while in the explanation of the figures he says (p. 105): "One of the cells of another chain many times divided".

Also G. KARSTEN (Valdivia-Exp., Phytoplankton des antarkt. Mee-

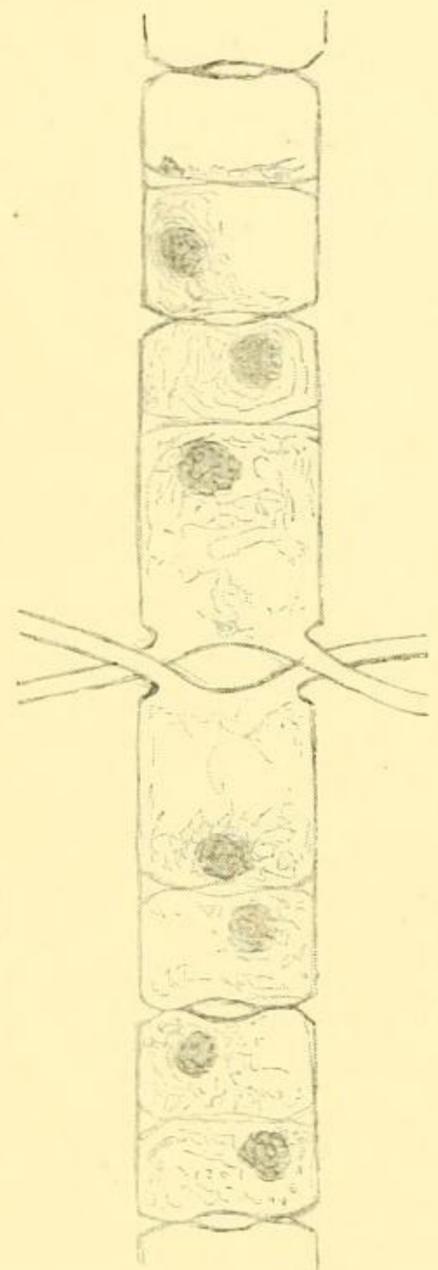


Fig. 8. *Chaetoceras boreale* Bail. with aborted awns.
500 t. m.

res, 1905, p. 118, Pl. 15, figs. 8 d, e) has found *Ch. criophilum* in the antarctic ocean with aborted awns. He tells that the chains of this abnormal aspect occur in depths of 100—80 m. and supposes that the phenomenon is connected hereto: „Darin ist eine Minderung des Formwiderstandes gegeben . . . Diese Zellen resp. Zellreihen schweben dementsprechend in tieferen Wasserschichten; . . .“ But this explanation does not hold good in our case where the abnormal chains occur in the surface layers of the water.

Distrib. Widely distributed species of northern Oceanic character, known from all Oceans.

24. ***Chætoceras decipiens*** Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. I, No. 13, 1873, p. 11, pl. 1, fig. 5; Gran, Norske Nordhavs-Exp., Protophyta. 1897, p. 13, pl. 1, figs. 2—3, pl. 3. fig. 34; Fauna Arctica, III, Heft 3, 1904, p. 535, pl. 17, figs. 1—6; Nord. Plankton XIX, p. 74, fig. 88.

As *C. boreale* one of the most common species in the area. It was rather rare in the pack-ice both in 1906 and in 1908, but dominant in both years in the whole series of samples from the coastal water (July—August) and in 1908 in Danmarks Havn. At the last named place it was also observed in October 1906, some of the frustules being empty, and in July--September 1907, but not in larger quantities. It seems thus as if the species has its real place of thriving in our area in the coastal water between the coast and the pack-ice. In a number of samples, especially in the samples from July 1908 the terminal awns had the peculiar structure which is characteristic for *C. Lorenzianum* Grun.; and also in the coarser awns from the other cells of the chains the structure was discernible, but more difficult to see. In other respects the specimens were quite typical, e. g. the awns being coherent at a part of their length, the terminal awns making the curvature at their proximal ends and then slightly divergent or nearly parallel. It is then not possible to refer our specimens to *C. Lorenzianum* Grun., nor to the arctic species *C. mitra* (Ehrbg.) Cleve. More probably a closer examination of the coarser specimens of *C. decipiens* from other regions will result in finding the same structure of the awns.

Besides this observation, another matter of some interest was found:

In two samples from August 1906 and in two from July 1908 I have found *microspore formation* in the cells. All these samples have been taken in the ice-filled coastal water north of 77° N. Lat. the temperature of the water being between $\div 0,5^{\circ}$ and $1,4^{\circ}$. The examination of this microspore development does not give much

new, as we have the excellent description and drawings of this processus in *Chaet. decipiens* by GRAN (1904). I have only to refer the reader to this paper and to GRAN's paper of 1902 (Rep. Norweg. Mar. Fish. Investig., vol. 2, No. 5) in which the microspore formation in *Rhizosolenia styliformis* was described and where considerations on the microspore problem in general were put down. Similar considerations embracing all the known cases of microspore formation, are given by G. KARSTEN (Valdivia-Exp., Phytoplankton d. Atlant. Meeres, 1908).

The annexed figures (Fig. 9) show the different stages in the development of the microspores; they correspond rather closely to GRAN's figures (1904).

In the left drawing we find a chain the end cell of which is a normal cell in rest and contains but one nucleus, while the two other cells have fulfilled the division of the nucleus into two daughter nuclei. It might be supposed that this stage could illustrate the beginning of an ordinary cell-division as well as the beginning of the microspore formation, but this is not right as there is a great difference which will be clear if we compare this drawing with the fig. 1 by GRAN (1904); this author gives here the corresponding stage of an ordinary cell-division, and his drawing shows that contemporaneously with the division of the nucleus a fissure in the plasma appears as the first beginning of the future foramen between two cells. This fissure does not exist in my case, whereby it is proved that we have here the first stage of microspore formation.

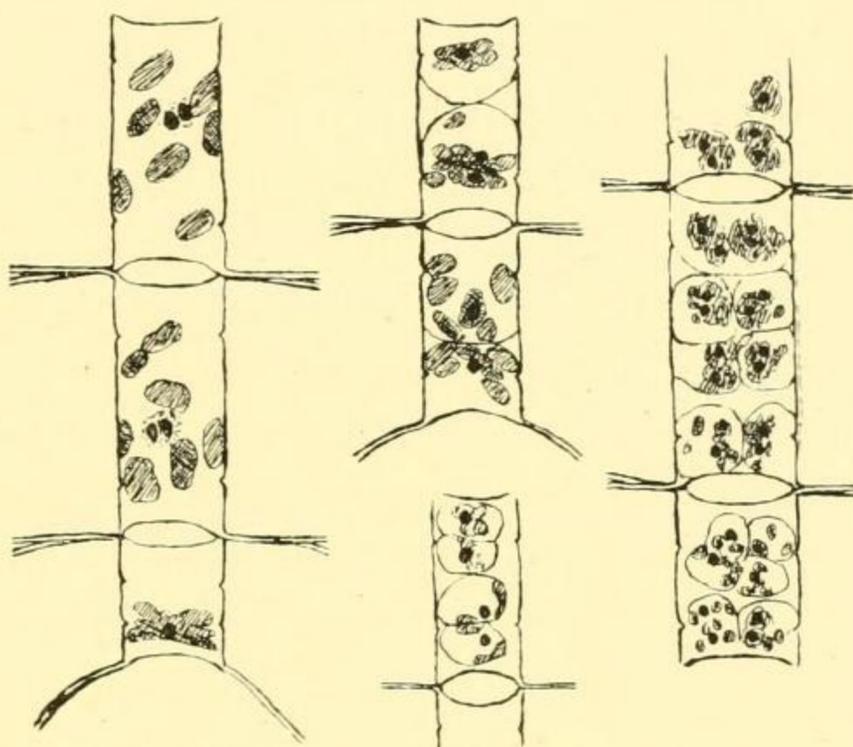


Fig. 9. *Chaetoceras decipiens* Cl. Cells in microspore-formation. 250 t. m.

The other figures show stages with 2, 4, 8 and 16 daughter nuclei corresponding rather well to the figures by GRAN, but his material has been better stained than mine. Perhaps we have herein the explanation of the following difference, viz.: that the division of the nuclei in my material goes on a good time before the division of the plasma, thus e. g. in the figure to the right we have 16 nuclei, but only (7—)8 plasma-lumps each containing 2 nuclei. With regard to the further fate of the microspores preserved material does not allow observations, and to the theoretical considerations set forth by GRAN, BERGON and KARSTEN I have nothing

to add. Only one new case of microspore formation has been discovered since KARSTEN'S paper, viz. the microspore formation in *Chæt. Lorenzianum* Grun. found by J. SCHILLER (Ber. Deutsch. Bot. Ges., XXVII, 1909, p. 352) in the Gulf of Triest. The formation described corresponds rather well to the manner of sporulation found by GRAN in *Chæt. decipiens* and by GEORGE MURRAY (Proc. Roy. Soc. Edinburgh, XXI, 1896, p. 207) in *Chæt. boreale*; as to the hypothesis advanced by the author on the cause of the rarity of microspores — viz.: that the microspore formation in most species should take place by the germination of the resting cysts —, I have only to say that it is a purely theoretical supposition, for which we have no basis as long as we do not know a single case of germination of a resting spore. It is a very remarkable fact that in spite of the numerous studies on the plankton diatoms during the last two decennia, nothing has been discovered with regard to this important matter. It is to be hoped that we may soon get this mystery solved.

Distrib. Oceanic species of a northern character, a dominant species over wide areas of the North Atlantic and its tributaries.

25. **Chætoceras diadema** (Ehrbg.) Gran, Norske Nordhavs Exp., Protophyta, 1897, p. 20, pl. 2, figs. 16—18; Nord. Plankton XIX, p. 84; *C. groenlandicum* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 2, No. 4, 1896, p. 7, pl. 2, figs. 3—5; *Syndendrium diadema* Ehrbg. Mikrogeologie, pl. 35, A, XVIII, 13.

Found sparingly in one sample (Aug. 1906) in the pack-ice, rather sparingly in some samples from the coastal water (July 1908) and not uncommon in samples from Danmarks Havn in August—September 1907 and here with resting spores.

Distrib. Northern neritic species of wide distribution.

26. **Chætoceras Wighami** Brightw., Quart. Journ. Microsc. Science, IV, 1856, p. 108, pl. 7, figs. 19—36; Gran, Nord. Plankton, XIX, 1905, p. 88; Ostensfeld, Wiss. Ergebn. Aralsee-Exp., Lief. VIII, St. Petersburg, 1908, p. 153, pl. 5, figs. 9—12; *C. bottnicum* Cleve in Aurivillius, Bih. K. Svenska Vet. Akad. Handl., Bd. 21, afd. 4, No. 8, 1896, p. 14, pl. 1.

Found rather sparingly in Aug.—Septm. 1907 in Danmarks Havn; rather often occurring in the coastal water in July 1908 and here common in a few samples; further single chains found in a sample from the pack-ice (July 1908).

Distrib. Euryhaline neritic species, known from the coasts of Europe and Arctic countries, further from the Caspian and Aral Seas.

27. **Chætoceras debile** Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 20, afd. 3, No. 2, 1894, p. 13, pl. 1, fig. 2; Østrup, Medd. om Grøn-

land, XVIII, 1895, p. 456, pl. 7, fig. 89; Gran, Norske Nordhavs Exp., Protophyta, 1897, p. 23, pl. 2, figs. 14—15; Nord. Plankton XIX, 1905, p. 92.

Rare in the collection, only found in three samples from Danmarks Havn in Aug.—Septm. 1907, and, in a dwarfy state, in two samples from the pack-ice in July 1908.

Distrib. Northern neritic species, known from the coasts of Europe and Arctic countries, further from Japan.

28. **Chætoceras furcellatum** Bail., American Journ. of sc. & arts, ser. 2, vol. 22, 1856, pl. 1, fig. 4; Cleve u. Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 120, pl. 7, figs. 136—137; Gran, Bibliotheca Botanica, Heft 42, 1897, p. 7, pl. 1, figs. 15—16; Nord. Plankton, XIX, 1905, p. 95.

Occurs as one of the characterizing species in a group of samples from the inner part of the pack-ice, in July 1908. Further some *Chætoceras*-chains in samples from Danmarks Havn in 1907 and in the coastal water in 1908 may perhaps be referred to this species, but the determination is not sure.

Distrib. Arctic neritic species, known from the Arctic Seas, reaching along the Norwegian coast as far southwards as Cape Stadt.

29. **Chætoceras sociale** Lauder, Transact. Microsc. Soc., vol. 12, N. S., 1864, p. 77, pl. 8, fig. 1; Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 3, No. 4, 1896, p. 9, pl. 2, fig. 9; Gran, Nord. Plankton XIX, 1905, p. 96, fig. 123.

Occurs in great quantities in samples from Danmarks Havn in Aug.—Septm. 1907, and with resting spores. Further common in some samples from the coastal water in July 1908 and rare in others; also here mostly with resting spores.

Distrib. Northern neritic species known from the coasts of Europe, Iceland, Arctic countries and Hongkong.

30. **Chætoceras gracile** Schütt, Ber. Deutsch. bot. Ges., 1895, p. 42, pl. 5, fig. 13; vix Paulsen, Medd. Komm. Havundersøg., Plankton I, 3, 1905. København, p. 5, figs. 6—7; non Apstein, Wiss. Meeresunters., Abt. Kiel, N. F., Bd. 11, 1909, p. 135, fig. 1; *C. septentrionale* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 3, No. 4, 1896, p. 9, pl. 2, fig. 8; vix Østrup, Medd. Grønland, XVIII, 1895, p. 457, pl. 7, fig. 88.

In two samples from Danmarks Havn, August 1907, and in one sample from the coast water, July 1908, I found a small solitary *Chætoceras* with resting spores. As my figures (Fig. 10) show, it must be identified with CLEVE'S *C. septentrionale* from Baffin Bay, but hardly with ØSTRUP'S original species of that name. On the

other hand it is probable that *C. gracile* Schütt is the same species, because if we compare SCHÜTT's figures of cells with chromatophores with my fig. 10, we will find a close resemblance; on the contrary his figures of resting spores differ from mine, but he has not drawn these spores in situ within cells, and it is perhaps permitted to doubt, if they belong to the species in question.

PAULSEN (l. c.) has given figures from ØSTRUP's original material and considers his form as identical with SCHÜTT's *C. gracile*, but I

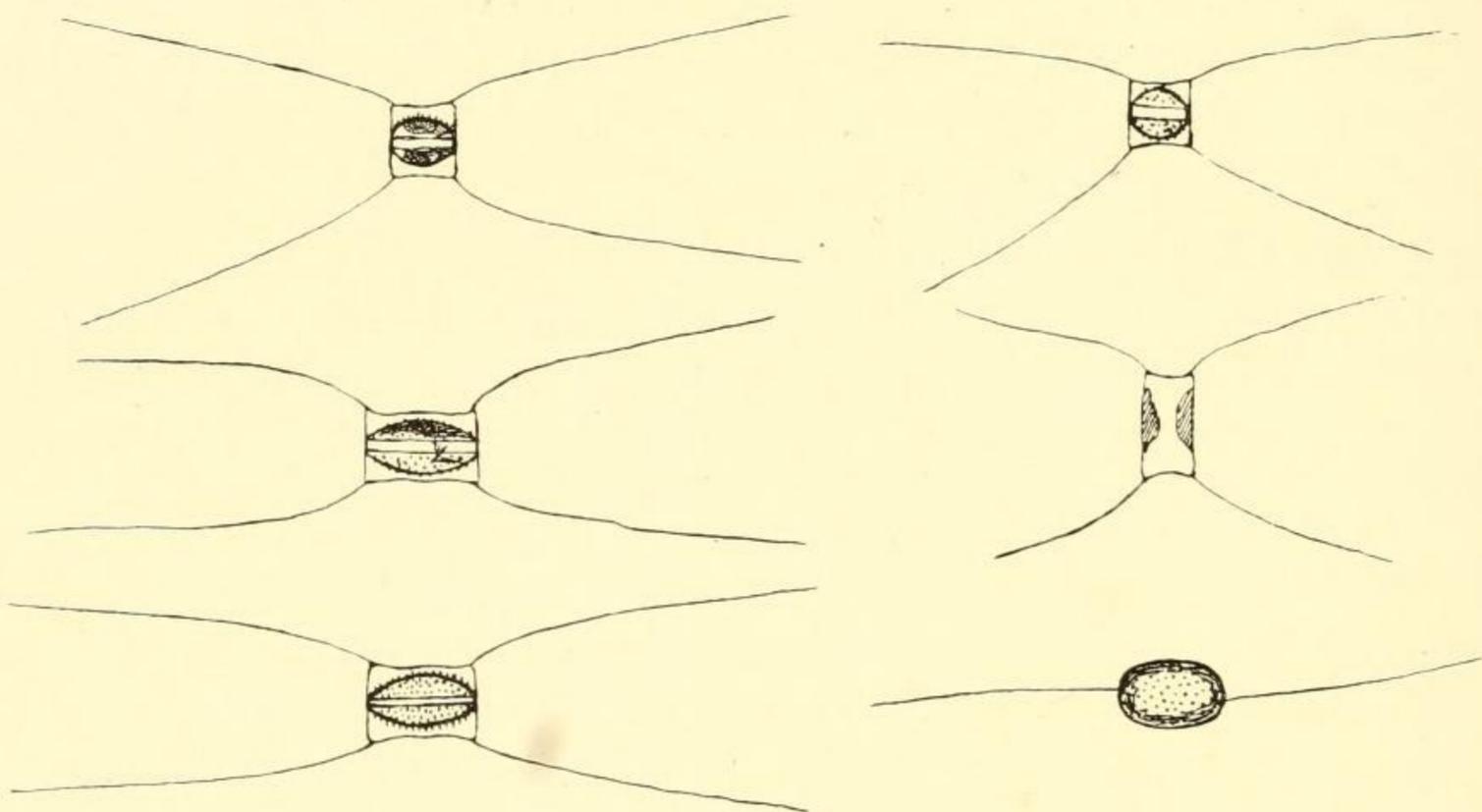


Fig. 10. *Chætoceras gracile* Schütt. 500 t. m.

doubt if he is right in doing so. The question is a much intricate one.

The latest note by APSTEIN about these small solitary species contains drawings of a species from the Baltic — the locality of SCHÜTT's species — which the author names *C. gracile* but, I think, hardly correct; I myself know APSTEIN's form from the Belt Sea (Baltic) and have found it with resting spores which differ considerably from those of *C. gracile*; they have two rather large spines on the primary spore-valve (in the same manner as the spores of *C. debile*) and often also small spines, while the secondary valve is smooth. The species has only one chromatophore, as also drawn correctly by APSTEIN, and the corners of the cell in side view are not contracted; all these distinctive marks separate it from the true *C. gracile*, and I propose to name it *C. ceratosporum* nov. sp.; it is only known from the Baltic, where it occurs in the spring and seems to have its true home in the inner part, as I have seen it in samples kindly sent me by Dr. K. M. LEVANDER of Helsingfors.

Anyhow the small solitary *Chætoceras* species require a revision,

as the treatment given by LEMMERMANN (Arkiv f. Botanik, Stockholm, Bd. 2, No. 2, 1904) is not a good one.

Distrib. (of *Ch. gracile. sens. lat.*): Euryhaline neritic species known from coasts of Greenland and Europe.

Biddulphia Gray, 1831.

31. **Biddulphia arctica** (Brightw.) Boyer, Proc. Acad. of Nat. Sc., Philadelphia, 1900, p. 714; Gran, Nord. Plankton, XIX, 1905, p. 109, fig. 143; *B. balæna* Brightw., Quart. Journ. Microsc. Sc., vol. 8, 1859, p. 181, pl. 9, fig. 15; *Triceratium arcticum* Brightw., ibid, vol. 1, 1853, p. 250, pl. 4, fig. 11.

Found sparingly in three samples from Danmarks Havn, Aug.—Septm. 1907.

Distrib. Littoral form (not true plankton form) from the Arctic coasts.

B. Pennatæ.

Fragilaria Lyngb., 1819.

32. **Fragilaria islandica** Grun. in V. Heurck, Synopsis, 1883, pl. 45, fig. 37; Jørgensen, Bergens Museums Skrifter 1905, p. 102, pl. 6, fig. 10; Gran, Nord. Plankton. XIX, 1905, p. 114, fig. 153.

Only found in Danmarks Havn, where it was present in the plankton, although only scattered, in all three years. July—October.

Distrib. Arctic neritic species, known from the coasts of the European Arctic sea; probably not a real plankton form.

33. **Fragilaria oceanica** Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 1, No. 13, 1873, p. 22, pl. 4, fig. 25; Grunow, Diat. v. Franz Josefs Land. 1884, p. 55, pl. 2, fig. 14; Gran, Bibliotheca Botanica, Heft 42, 1897, p. 20, pl. 1, figs. 6—9; Nord. Plankton XIX, 1905, p. 114, figs. 154—155.

In 1906 only very few samples contained this species, and only in few specimens, while in 1907 and 1908 it was a dominant feature in July and August samples from Danmarks Havn and the coastal water. In the pack-ice it was not at home, recorded in few specimens from three samples (two in 1906 and one in 1907). July—October.

Several of the forms distinguished by GRAN (1905) according to the curvature and twisting of the chains, were seen. In all samples from 1907 and 1908 resting spores were present, often in large quantities.

Distrib. Arctic neritic species known from Davis Strait and the European Arctic Sea and a little more southwards.

34. *Fragilaria cylindrus* Grunow, Diat. v. Franz Josefs Land, 1884, p. 55, pl. 2, fig. 13; Gran, Bibliotheca Botanica, Heft 42, 1897, p. 20, pl. 1, figs. 4—5; Nord. Plankton, XIX, 1905, p. 115; Jørgensen, Bergens Museums Skrifter, 1905, p. 102, pl. 6, fig. 9.

This species resembles the foregoing one very much, and it is only possible to distinguish them when the ignified frustules are seen in valvar view. Hence it may be that some of the records of *F. oceanica* include this species of which I have seen sure specimens only in one sample from Danmarks Havn, July 1908.

Distrib. Arctic neritic species of about the same distribution as the foregoing, but often overseen.

Thalassiothrix Cleve et Grun., 1880.

35. *Thalassiothrix longissima* Cleve et Grun., K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 108; G. Karsten, Wiss. Meeresunters., Abt. Kiel, N. F., Bd. 4, 1899, p. 28, fig. 11; Gran, Nord. Plankton, XIX, 1905, p. 116; *Synedra thalassiothrix* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 1, No. 13, 1873, p. 22, pl. 4, fig. 24.

Only a single specimen found in a sample from the pack-ice in Aug. 1906.

Distrib. Northern oceanic species, often occurring in great quantities, e. g. in Denmark Strait and Irminger Sea.

Achnanthes Bory, 1822.

36. *Achnanthes tæniata* Grun. in Cleve et Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 22, pl. 1, fig. 5; Gran, Bibliotheca Botanica, Heft 42, 1897, p. 9, pl. 1, fig. 10; Nord. Plankton, XIX, 1905, p. 122, fig. 165; Jørgensen, Bergens Museums Skrifter, 1905, p. 105, pl. 8, fig. 27.

As GRAN (1905, l. c., in nota) has pointed out, GRUNOW'S and JØRGENSEN'S figures represent chains with resting spores, while in GRAN'S two quoted papers we find the normal vegetative chains.

Found in three samples from Danmarks Havn (Aug. 1907 and July 1908) and, with resting spores, in one sample from the pack-ice (July 1908). Perhaps overseen in other samples, as it resembles *Fragilaria oceanica* and *Navicula septentrionalis* very much.

Distrib. Arctic neritic species known from the Arctic Sea and the inner Baltic (in spring).

Navicula Bory, 1826.

37. *Navicula septentrionalis* (Grun.) Gran, Bibliotheca Botanica, 1897, Heft 42, p. 9; Nord. Plankton, XIX, 1905, p. 124, fig. 167; *Stauroneis septentrionalis* Grunow, Diat. v. Franz Josefs Land, 1884, p. 105,

pl. 1, fig. 48; Jørgensen, Bergens Museums Skrifter, 1905, p. 106, pl. 7, fig. 24; *Libellus (?) septentrionalis* Østrup, Medd. om Grønland, 1895, p. 439, pl. 8, fig. 97.

Found in some samples from Danmarks Havn and the coastal water, in 1906—1908, but scattered, and perhaps, as said under *Achnanthes*, sometimes not distinguished from the other band-like species.

Distrib. Arctic neritic species, known from the coasts of Greenland, from Barent and from Murman Sea.

38. **Navicula Vanhöffenii** Gran, Bibliotheca Botanica, Heft 42, 1897, p. 9, pl. 1, figs. 1—3; Nord. Plankton, XIX, 1905, p. 124; Jørgensen, Bergens Museums Skrifter, 1905, p. 105, pl. 7, fig. 22; *N. septentrionalis* Cleve, Bih. K. Svenska Vet. Akad. Handl., Bd. 22, afd. 3, No. 4, 1896, p. 11, non Østrup, nec Grunow.

Recorded from four samples from Danmarks Havn (Aug.—Septm. 1907, July 1908), but rare, and perhaps overseen.

Distrib. Arctic neritic species, known from the coast of Greenland and arctic Norway, from Barent and Murman Seas, further from the inner Baltic (in spring).

Amphiprora Ehrbg., 1843.

39. **Amphiprora hyperborea** (Grun.) Gran, Bibl. Botanica, Heft 42, 1897, p. 10; Fauna Arctica, III, 3, 1904, p. 543, pl. 17, fig. 14; Nord. Plankton, XIX, 1905, p. 127; *A. paludosa*, var.? *hyperborea* Grun. in Cleve et Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 62, pl. 5, fig. 86.

In 1906 only found in one sample from the pack-ice and in 1907 in two samples from Danmarks Havn, in 1908 found scattered over the whole area from Danmarks Havn to the outer part of the pack-ice; always in few specimens. June—September.

Distrib. Arctic neritic species known from Greenland, arctic Norway, Barent and Murman Seas.

Nitzschia Hassall, 1845.

40. **Nitzschia frigida** Grun., in Cleve et Grunow, K. Svenska Vet. Akad. Handl., Bd. 17, No. 2, 1880, p. 94, pl. 5, fig. 101; Gran Bibl. botanica, Heft 42, 1897, p. 10, pl. 1, fig. 11; Nord. Plankton, XIX 1905, p. 129.

Found scattered in three samples from Danmarks Havn (Aug. 1907) and in three samples from the coastal water (Aug. 1906, July 1908).

Distrib. Arctic coast species, not true plankton form, known from the Arctic coast and the inner Baltic.

41. *Nitzschia seriata* Cleve, Vega Exp. vetensk. iakt., Bd. 3, 1883, pl. 38, fig. 75; Gran, Nord. Plankton, XIX, 1905, p. 129, fig. 174; *N. fraudulenta* Cleve, 15. Ann. Rep. Fishery Board for Scotland, part III, 1897, p. 300, fig. 11; *Synedra Holsatiæ* Hensen, 5. Ber. Komm. Unters. Deutschen Meere, 1887, p. 91, pl. 5, fig. 50.

Only found in Danmarks Havn (Aug. 1907, July 1908) in four samples, but mostly rare.

Distrib. Widely distributed in open seas and along the coasts, probably a neritic species of northern, but not arctic character.

42. *Nitzschia delicatissima* Cleve, A Treatise of Phytoplankton, 1897, p. 24, pl. 2, fig. 22; Gran, Nord. Plankton, XIX, 1905, p. 130.

Found together with the preceding species in two samples from Danmarks Havn, Aug. 1907.

Distrib. Much like the preceding, but more restricted.

Nitzschiella Rabenh., 1864.

43. *Nitzschiella closterium* (Ehrbg.) Rabenh., Fl. Europ. Algar., I, 1864, p. 163; *Ceratoneis closterium* Ehrbg., Kreidethierchen, 1840, p. 64, pl. 4, fig. 7; *Nitzschia closterium* W. Smith, Syn. British Diatoms I, p. 42, pl. 15, fig. 120; Gran, Nord. Plankton, XIX, 1905, p. 129, fig. 172.

Found together with the preceding in two samples from Danmarks Havn (Aug. 1907) and further in one sample from the coastal water (July 1908); a littoral species which sometimes occurs in plankton as it often inhabits mucilage of other organisms.

Distrib. Ubiquitous along the coasts.

II. Flagellatæ.

A. Chrysomonadineæ.

Dinobryon Ehrbg., 1838.

1. **Dinobryon pellucidum** Levander, Acta Soc. Fauna & Flora Fenn., 12, No. 2, 1894, p. 31, pl. 2, fig. 1; *Dinodendron balticum* Schütt; *Dinobryon b.* Lemmermann, Ber. Deutsch. bot. Ges., 1900, p. 514, pl. 18, figs. 9—10; Nord. Plankton, XXI, p. 4, figs. 13—14.

Single specimens occurred in a sample from Danmarks Havn in 1906, but besides that the species was distributed in the outer parts of the pack-ice, east of ca. 12° W. Long., in some samples it was common, especially in 1908 (in 1906 found only in two samples). When the temperature rose above 7° and the salinity over 34 ‰ it disappeared. July—August.

Distrib. A boreal neritic species, known from the coastal waters of Greenland, Iceland, Spitsbergen, Norway, Færøes and the Baltic.

Phæocystis Lagerheim, 1893.

2. **Phæocystis Pouchetii** (Hariot) Lagerh., Botan. Notiser, 1893, p. 32; Öfv. K. Sv. Vet. Akad. Förhandl., 1896, p. 277, figs. 1—5; Ostensfeld, Arch. f. Protistenkunde, III, 1904, p. 295, fig. 1.

Found scattered over the area, in two samples of 1908 rather common, but not in great quantities, probably because the season has been too late. Not seen in the samples taken in Danmarks Havn, but only recorded from the coastal water and the pack-ice. July—August.

Distrib. A boreal-arctic neritic species which often plays a conspicuous part in the plankton, f. i. in Davis and Denmark Straits, around Iceland, off northern Norway, etc.

B. Coccolithophoridæ.

Coccolithophora Lohmann, 1902.

3. **Coccolithophora pelagica** (Wallich) Lohmann, Arch. f. Protistenkunde, I, 1902, p. 138; *Coccosphæra p.* Wallich, Ann. Mag. Nat.

Hist., 1877, p. 348, pl. 17; Murray and Blackman, Trans. Roy. Soc., London, Ser. B, 1898, vol. 190, p. 439, pl. 16, figs. 6—10; *C. atlantica* Ostenfeld, Zool. Anzeiger, 22, 1899, p. 436, fig. 1.

It was rather surprising to find a *Coccolithophora* in the plankton from such high latitudes and in such arctic water. It was seen in 1905 in three samples from outside the pack-ice and in 1908 in three samples also outside the pack-ice, but a little more southwards; in two of the latter ones it was rather common, especially in lumps of mucilage. It did not occur in any of the samples west of 11° W. Long. On closer examination it appeared that all the specimens examined were dead, as no nucleus nor chromatophores, etc., were present. July—August.

Disrib. A temperate oceanic organism, very distributed and common in the Atlantic Ocean.

Pontosphæra Lohmann, 1902.

4. *Pontosphæra borealis* nov. sp. *Cellulæ solitariae globosæ, 17—22 μ; coccolithi elliptici, 3—4 μ longi, plani vel leviter concavi, omnes similes; flagella et chromatophori in spec. preservatis non distincti; nucleus adest.* Fig. 11.

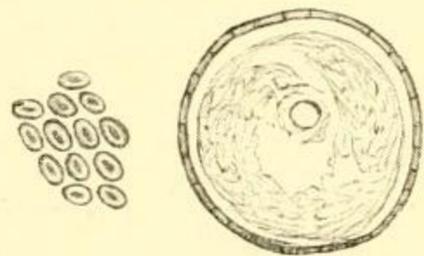


Fig. 11. *Pontosphæra borealis* n. sp. 800 t. m.

In seven samples (three from 1908 and four from 1906) from the outer part of the pack-ice and outside it (i. e. not W. of 11° W. Long.) I found an interesting organism, viz.: a species of the genus *Pontosphæra*. As mentioned above the occurrence of *Coccolithophoridae* in arctic water was a new thing, but the *Coccolithophora* present was dead. It is another matter with the *Pontosphæra*, as its plasma showed that the cells most probably were living when caught. It is then the first record of a species of *Coccolithophoridae* living in arctic water. The species found must be referred to the genus *Pontosphæra*, as it is understood by H. LOHMANN, but I can not identify it with the species hitherto described (LOHMANN, l. c., p. 129—332). The cells are mostly globose, rarely of a more oblong form, the coccoliths are plane or slightly concave, all of the same shape, elliptic and lying closely together, covering the whole surface of the cell. As only preserved material was examined no flagella were found, and it was not possible to discover chromatophores, whereas a nucleus was seen. By using acids the coccoliths disappeared immediately.

The new species resembles *P. inermis* Lohm., but has not the distinct naked pole (“Geisselpol”) for the flagella. July—August.

In most of the samples it occurred together with *Cocc. pelagica*, but it did not occur in greater quantities, perhaps because it is so small that it is only in a small part caught by the nets.

C. Silicoflagellatæ.

Distephanus Stöhr, 1880.

5. *Distephanus speculum* (Ehrbg.) Haeckel, Challenger Rep., Radiolaria, 1889, p. 1560; Lemmermann, Ber. Deutsch. bot. Ges., 1901, p. 263, pl. XI, figs.; Nord. Plankton, XXI, p. 31, figs. 103—104.

Most of the specimens found in the samples must be referred to var. *septenarius* (Ehbg.) Jørg., f. *regularis* Lemm., l. c., fig. 104.

Found scattered over the area; in 1907 in three samples from Danmarks Havn, in 1908 also in the coastal water, and in 1906 in three samples in the outer part of the pack-ice. As the specimens examined had plasma, they must have been living when caught.

Distrib. (of the form) Karajakfjord in West-Greenland, Baltic; (of the species) oceanic species of worldwide occurrence, but hardly arctic.

Appendix: Pterospermatacæ.

Pterosperma Pouchet, 1894.

Pterosperma Vanhöffenii (Jørg.) Ostenfeld, Vidensk. Medd. Naturh. For., København 1901, p. 151; *Pterosphæra* V. Jørgensen; *Pterocystis* V. Lohmann, Eier u. sogen. Cysten der Plankton-Expedition, 1904, p. 44, pl. 7, fig. 10.

Single specimens found in several samples (10) in 1908, both near the coast (in Danmarks Havn) and in the outer part of the pack-ice. At least some of the specimens were empty. July—August.

Distrib. A temperate oceanic organism, known especially from the North Atlantic.