

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)

III. PERIDINIALES

BY

OVE PAULSEN

1910

The plankton samples collected during the Danmark-Expedition by Mr. A. LUNDAGER may be grouped in the following categories:

1. Samples collected in the open ocean east of the Greenland ice on the way out in 1906 and homeward in 1908. Like Dr. OSTENFELD, who has worked out the Diatoms and Flagellates, I think these samples are of no special interest. All of them have been taken in July--August, and on the way home they were collected with so small intervals that it has been quite sufficient to examine only a selected number of them.

2. Samples collected in the drifting ice (pack-ice) off East Greenland in August 1906 as the "Danmark" went in to the Greenland coast, and in July 1908 when it was homeward bound. On the way out a great many samples were collected, until 12 in a day and a night, and as the speed was moderate and the course very curved they are very close together and many of them quite like each other. Therefore, only a certain number of them has been thoroughly investigated.

3. Samples collected in August 1906 and July 1908 near the coast of East-Greenland, from off Koldewey Island (ca. $76^{\circ} 30' \text{ N. Lat.}$) to ca. $78^{\circ} \text{ N. Lat.}$, thus in the coastal water.

4. Samples collected in Danmarks Havn (Denmark harbour), at $76^{\circ} 46' \text{ N. Lat.}$, $18^{\circ} 43' \text{ W. Long.}$, where the expedition stayed about two years, from August 1906 till July 1908. Unfortunately these samples were not taken with regular intervals but rather occasionally: there is about a dozen of samples from the summer 1907, and in 1908 samples were collected on July 21st when "Danmark" left the harbour.

In the following pages a list is given of all the Peridiniales found in these samples, and some of the species are accompanied by figures and remarks. A general description of the plankton will be given in a concluding paper by Dr. OSTENFELD and the present author.

The following papers deal with the Peridiniales of the East-Greenland sea:

CLEVE, P. T.: Report on the Plankton collected by the Swedish expedition to Spitzbergen in 1898. (K. Svenska Vet. Akad. Handl. 32, 1899).

PAULSEN, OVE: Plankton investigations in the waters round Iceland in 1903 (Meddel. fra Kommis. for Havundersøg. Ser. Plankton. Bd. I. No. 1. 1904). (Cited as: Plankton invest Iceland 1903).

BROCH, HJ.: Plankton tables. In Damas et Koefoed: Le plankton de la mer du Grönland. (Duc d'Orléans: Croisière océanographique accomplie à bord de la Belgica dans la mer du Grönland 1905). Bruxelles 1909.

PAULSEN, OVE: Plankton investigations in the waters round Iceland and in the North Atlantic in 1904. (Meddel. fra Kommis. for Havundersøg. Ser. Plankton. Bd. I. No. 8), 1909.

BROCH, HJALMAR: Das Plankton (Zoologische Ergebnisse der Schwedischen Expedition nach Spitzbergen 1908. Teil I, 2). (K. Svenska Vet. Akad. Handl. 45, No. 9. 1910)¹. (Cited as: Broch, Spitzbergen Plankton).

Yet, for easy reference, by each species the following paper is cited:

PAULSEN, OVE: Peridiniales (Nordisches Plankton, herausgeg. v. Brandt u. Apstein XVIII). Kiel 1908.

Dinophysis Ehrenberg.

1. **Dinophysis norvegica** Claparède & Lachmann, Mém. inst. nat. Génév. 1859, p. 407, tab. XX, fig. 19. Paulsen Nord. Plankton, p. 14, fig. 11—12. Broch Spitzbergen plankton 1910, p. 31, fig. 1, I. *D. acuta* auct. plur., non Clap. Lachm.

Single specimens, agreeing with var. *crassior*, PAULSEN l. c. and also with BROCH's drawing, were found in the outer part of the pack-ice and in the open sea.

Distrib. Seems to be a neritic and boreal but hardly arctic species.

2. **Dinophysis arctica** Mereschkowsky, Archiv f. mikroskop. Anatomie 1879, p. 177, tab. XI, fig. 19. Paulsen Nord. Plankton p. 15, fig. 14 (a bad figure), Broch Spitzbergen plankton p. 31, fig. 1, II. *D. granulata* Cleve & auct. plur.

BROCH (l. c.) says that this species bears fine and distant poroids on the surface while *D. norvegica* is coarsely areolated. My annexed fig. 1 shows that this is not always the case, this specimen (and many others) being very coarsely areolated. Besides, I have often found cells of this species provided with small protuberances at the

¹ In this paper which appeared as I had finished the examination of the plankton samples, BÜTSCHLI's theory on the intercalary striae as growth-marks is shown to hold good, the growth of the different species is studied in detail, and the arrangement of their plates is expressed in formulae. It will really be an advantage if the plate-arrangement proves to be so constant as supposed by BROCH. — A lack in BROCH's paper is that he gives no measures of the organisms, he confines himself to criticise those given by me. His paper will be often mentioned in the following.

lower end (see the drawing), like those of *D. acuminata*. Nevertheless I think it would be premature to unite these two species *D. arctica* having a much shorter and broader form. JÖRGENSEN (Bergens Museums Aarbog 1900, No. III, p. 19) names the species *D. acuminata* var. *granulata*. Length 36—42 μ . — *D. arctica* was found in several samples from the pack-ice and the open sea outside it, mostly few specimens, and as single ones in the coast water and in Danmarks Havn.

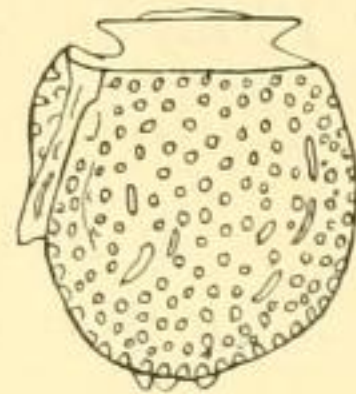


Fig. 1. *Dinophysis arctica*. 375 t. m.

Distrib. Arctic species.

3. ***Dinophysis rotundata*** Claparède & Lachmann Mém. inst. nat. Gènevois 1859, p. 409, tab. XX, fig. 16; Paulsen Nord. Plankton p. 17, fig. 18.

Fig. 2 represents a cell with a very coarsely areolated wall and broad intercalary band. The epitheca is relatively large, and oblique. This cell, whose length was 60 μ , is supposed to be an old one. Other cells with finer areolated surfaces were 40—52 μ long. From this it may be seen that the arctic specimens are somewhat bigger than those from southern waters, whose length was given by Bergh and in Nordisches Plankton by me as 48 μ .

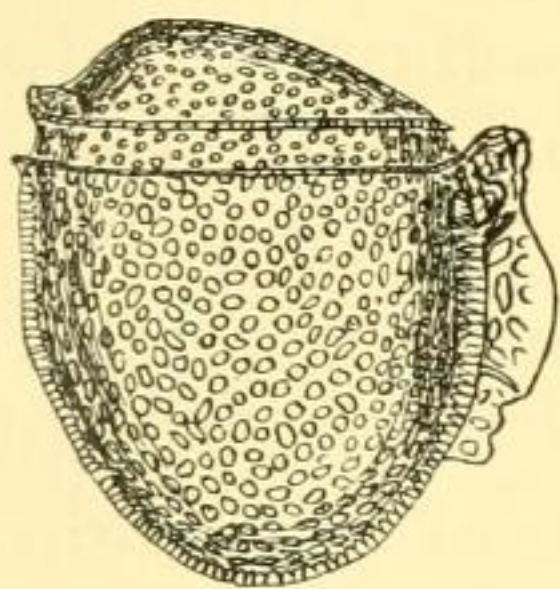


Fig. 2. *Dinophysis rotundata*. 375 t. m.

Dinophysis rotundata was found very sparingly both in the coastal water, the pack-ice and outside it.

Distrib. Boreal oceanic species, widely distributed in the northern Atlantic and its tributaries.

Gonyaulax Diesing.

4. ***Gonyaulax triacantha*** Jørgensen, Bergens Museums Aarbog 1899, No. VI, p. 35. Paulsen Nord. Plankton p. 28.

A single specimen was found in a sample from the pack-ice (1906) but a great many in a sample from Danmarks Havn in September 1907 (Water 0°).

Distrib. Arctic neritic species, known from Alaska, Iceland, West coast of Norway. In the North Sea very rare.

5. ***Gonyaulax* sp.**

In some samples from the pack-ice (1906) the little organism represented in fig. 3 was found. Length 20—24 μ .

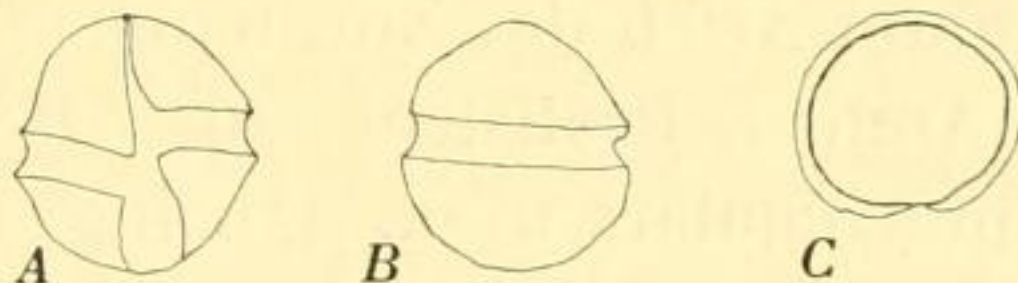


Fig. 3. *Gonyaulax* sp. 375 t. m.

I have not succeeded in finding out its plates. In some cases the surface was covered by a great-meshed reticulation of a similar kind as that figured by KLEBS in Botanische Zeitung 1884 fig. 2—5 for *Glenodinium trochoideum* (now. *Peridinium trochoideum* (Stein) Lemmermann).

Goniodoma Stein.

6. **Goniodoma Ostenfeldii** Paulsen, Plankton invest. Iceland 1903, p. 20, fig. 2; Nord. Plankton p. 34, fig. 43; Broch Spitzbergen Plankton p. 32, fig. 3.

Found in single specimens in Danmarks Havn, the coastal water, and the open sea.

Distrib. Arctic, neritic species, known from North-Iceland and Spitzbergen.

Peridinium Ehrenberg.

Of late years different methods of shortly designating the plates composing the skeleton of *Peridinium* have been proposed. The first was that of FAURÉ-FREMIET, whose paper "Étude descriptive des péri-diniens et des infusoires ciliés du plankton de la baie de la Hougue" was published in 1908 in Annales des sc. naturelles, zoologie. FAURÉ-FREMIET designates the plates by letters with annexed numbers, so e. g. the precingulars are named d_1 — d_7 , d_1 being to the right, d_2 to the left, d_3 to the right and so on. This method seems to me not to be practical.

Next to FAURÉ-FREMIET comes KOFOID, the well-known investigator of the Dinoflagellates. His paper "On *Peridinium Steini* Jørgensen, with a note on the nomenclature of the skeleton of the Peridinidae" was published in 1909 in Archiv für Protistenkunde 16. KOFOID employs only numerals, the different series of plates being distinguished by different numbers of apostrophes or other signs annexed to the numerals. So, the apicals are $1'$ — $4'$, intercalaries 1° — 3° , precingulars $1''$ — $7''$, postcingulars $1'''$ — $5'''$, antapicals $1''''$ — $2''''$. Each series begins on the left side of the body and goes round it to the right side. This system is a clear one, but not very practical because of the apostrophes as to whose numbers mistakes are likely to arise¹.

BROCH in his paper on Spitzbergen plankton (1910) gives a new method of designating the plates. He uses both numerals and letters. In the same year the method was modified in "Die *Peridinium*-Arten des Nordhafens (Val di Bora) bei Rovigno im Jahre 1909" (Arch. f. Protistenk. 20). Here, the apicals are named 1—4 and the precingulars a—g, 1 being the rhomb-plate and a the precingular neighbouring it to the left, and both series go round the body to

¹ From the table where KOFOID has arranged previous nomenclatures it appears that he has not realized the difference between „tafeln“ and „platten“ as these termini were used by SCHÜTT and after him also by the present author who in Nord. Plankton did use SCHÜTT'S nomenclature. It might have been mentioned that SCHÜTT'S „tafeln“ represent transverse series of „plates“. Only the intercalaries were not recognised as a series by SCHÜTT.

the left (descending screw). The intercalaries neighbouring c , d and e are named γ , δ and ε , which is more appropriate than in KOFOED's system where $3''$, $4''$ and $5''$ are neighbours to respectively 1° , 2° and 3° . The antapicals are named by BROCH A and B and the postcingulars I—V. It seems to me that if we here change letters to Roman numbers and vice versa we get a more practical mode of designation. Then, the apicals will be 1—4 and the antapicals I—II, the precingulars a — g and the postcingulars A—E. Thus, we have letters along both margins of the girdle and numerals at the top and at the bottom. Fig. 4 illustrates this method of denominating.

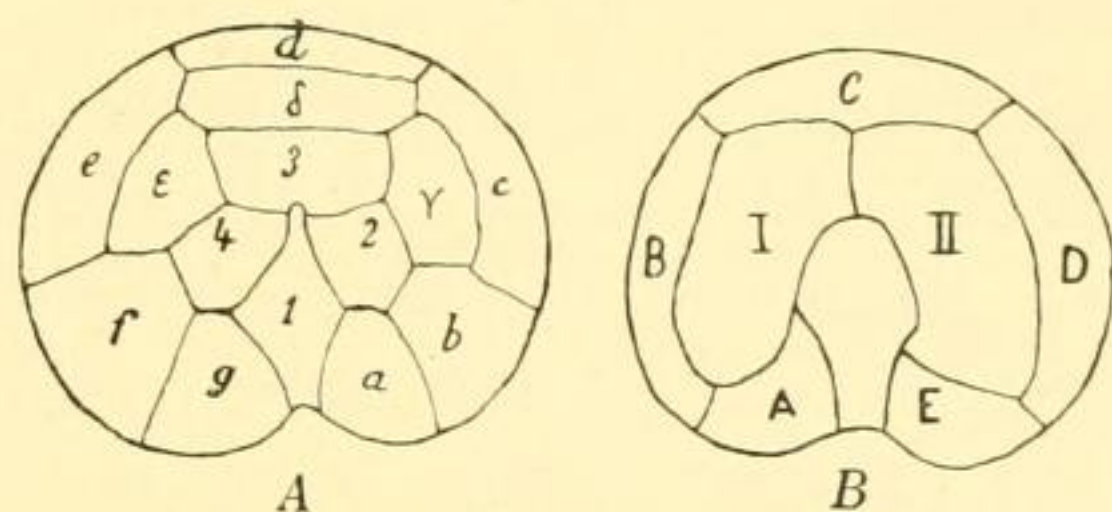


Fig. 4. Diagram of plates of *Peridinium*.

7. **Peridinium Cerasus** Paulsen, Meddel. Kommis. for Havundersøgelser, Ser. Plankton, Bd. I, No. 5. 1907, p. 12, fig. 12; Paulsen, Nord. Plankton p. 43, fig. 52. vix *P. quarnerense* (Br. Schröder) Broch, Arch. f. Protistenk. 22. 1910, p. 183.

Fig. 5 represents a specimen (36μ long) of *P. Cerasus* which species was found rather rarely in a single sample from Danmarks Havn (Sept. 5th 1907). I think BROCH is not right in uniting this species with *P. quarnerense*, he does it because of the resemblance in the arrangement of the plates of the two species, taking

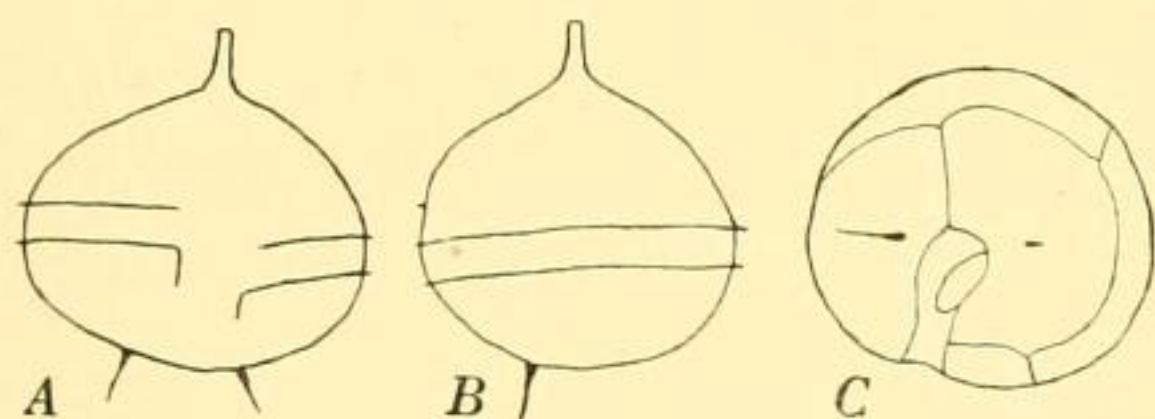


Fig. 5. *Peridinium Cerasus*. 375 t. m. a reservation on account of the incompleteness of my figures of *P. Cerasus*. In any case, my figures are clearly showing that *P. Cerasus* has a long and well marked apical horn, while *P. quarnerense* has a short one, and just this horn is the characteristic of *P. Cerasus*. The dimensions of *P. quarnerense* are unknown, so in this respect it cannot be compared with *P. Cerasus*.

Distrib. Known from the North Sea and Iceland.

8. **Peridinium roseum** Paulsen, Plankton invest. Iceland 1903, p. 23, fig. 9; Nord. Plankton p. 44, fig. 53.—? *P. ovatum* Fauré-Fremiet, Ann. sc. nat. zool. 9. sér. 1908, p. 218, fig. 5, tab. XV, fig. 6, non Pouchet.

Found in several samples from the pack-ice and Danmarks Havn, mostly in rather few specimens.

Distrib. Boreal-neritic and arctic species, known from Norway and Iceland.

9. *Peridinium ovatum* (Pouchet) Schütt, Die Perid. d. Plankton Exp. 1895 tab. XVI, fig. 49, 1896 fig. 19. Paulsen Nord. Plankton p. 44, fig. 54. Broch, Spitzbergen Plankton p. 40, fig. 9—10, non Fauré-Fremiet 1908 p. 219, tab. XV, fig. 6. — *Protoperidinium ovatum* Pouchet Journ. Anat. Physiol. 1883 p. 35, tab. 18—19, fig. 13. *Peridinium lenticulatum* Fauré-Fremiet, Ann. sc. nat. zool. 9. sér. 1908, p. 217, fig. 4, tab. XV, fig. 5.

Occurred in single specimens in Danmarks Havn and in the coastal water. Rather common in the outer part of the pack-ice but common in the open sea outside it.

Distrib. Boreal oceanic species, widely distributed in the Atlantic and its tributaries.

10. *Peridinium curvipes* Ostenfeld, in Botany of the Faeroës 1906 p. 15, fig. 128. Paulsen Nord. Plankton p. 45, fig. 55.—? Broch, Spitzbergen Plankton p. 42, fig. 11—13.

The cells represented in the annexed fig. 6 are such as have been considered by me as *P. curvipes* although its form is broader

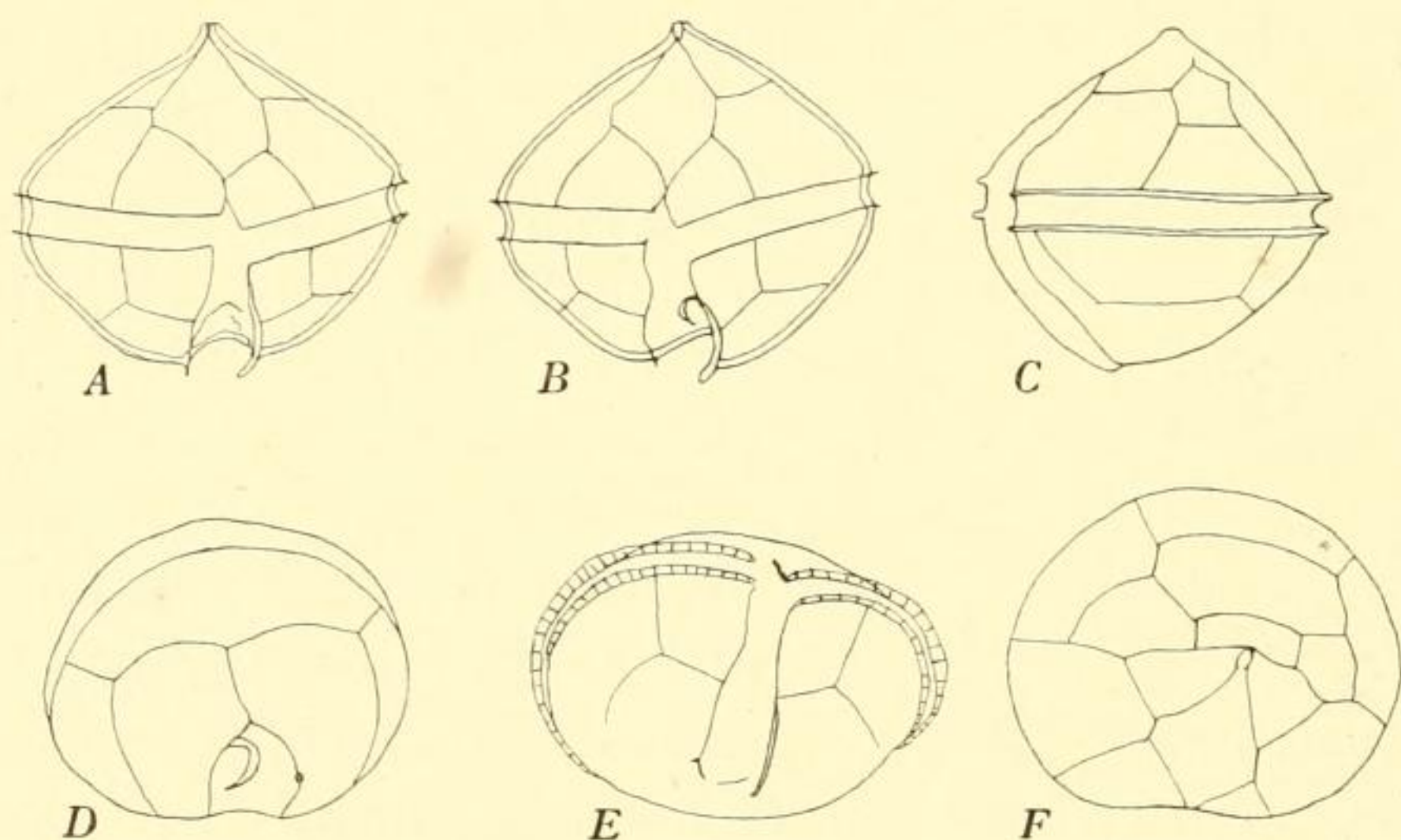


Fig. 6. *Peridinium curvipes*. 250 t. m.

and shorter than the original figure published by OSTENFELD. But those figured by BROCH l. c. are different. Unfortunately BROCH gives no figure of his species in ventral view (nor measures), but from his figures of epitheca and hypotheca it appears that the plates of his "*P. curvipes*" are arranged otherwise than in mine. Thus BROCH has the rhombplate (1) oblique, δ small, and the plates 1, b, 2 and a touch each other in a point, 1 and f do not touch each other. My fig. 6 shows that the rhomb-plate is not oblique and that 1 and b, 1 and f meet along vertical lines. The intercalary δ is long as in *P. pellucidum* and *P. islandicum*. From this difference it follows that BROCH and the present author have had different species before us. Which is the true *P. curvipes*? From

OSTENFELD's original figure (l. c.) we learn that the rhomb-plate is not oblique and that it apparently does touch nor b nor f. As to δ , OSTENFELD's figure gives no evidence. An attempt to find the original specimens was without result. But as the form of the rhomb-plate is the most conspicuous difference between Broch's and my specimens I venture to maintain that BROCH has not had *P. curvipes* before him. He says his species is in habit very like *P. ovatum*, and this statement as well as his fig. 13 representing "*P. curvipes*(?) ... Ein Individuum ... mit ausserordentlich stark entwickelten Intercalarstreifen" call to mind *P. decipiens* Jørgensen, which, however, has no spines.

P. curvipes was found in many samples from the pack-ice, the coastal water, and Danmarks Havn, as a rule in few specimens only, but in larger quantities in samples collected in the pack-ice in August 1906.

Distrib. Arctic(?) neritic species, known from W.-Greenland, Iceland, the Faeroës, and the North Sea.

11. **Peridinium breve** Paulsen, Meddel. fra Kommis. for Havundersøg. Ser. Plankton, Bd. 1, No. 5. 1907, p. 13; Nord. Plankton p. 46, fig. 56; Broch, Spitzbergen Plankton p. 47, fig. 21. *P. Steinii* Jørgensen f. *brevis*, Paulsen, Meddel. Kom. Havund., Ser. Plankton Bd. 1, No. 3, 1905, p. 4, fig. 3 a—c, f.

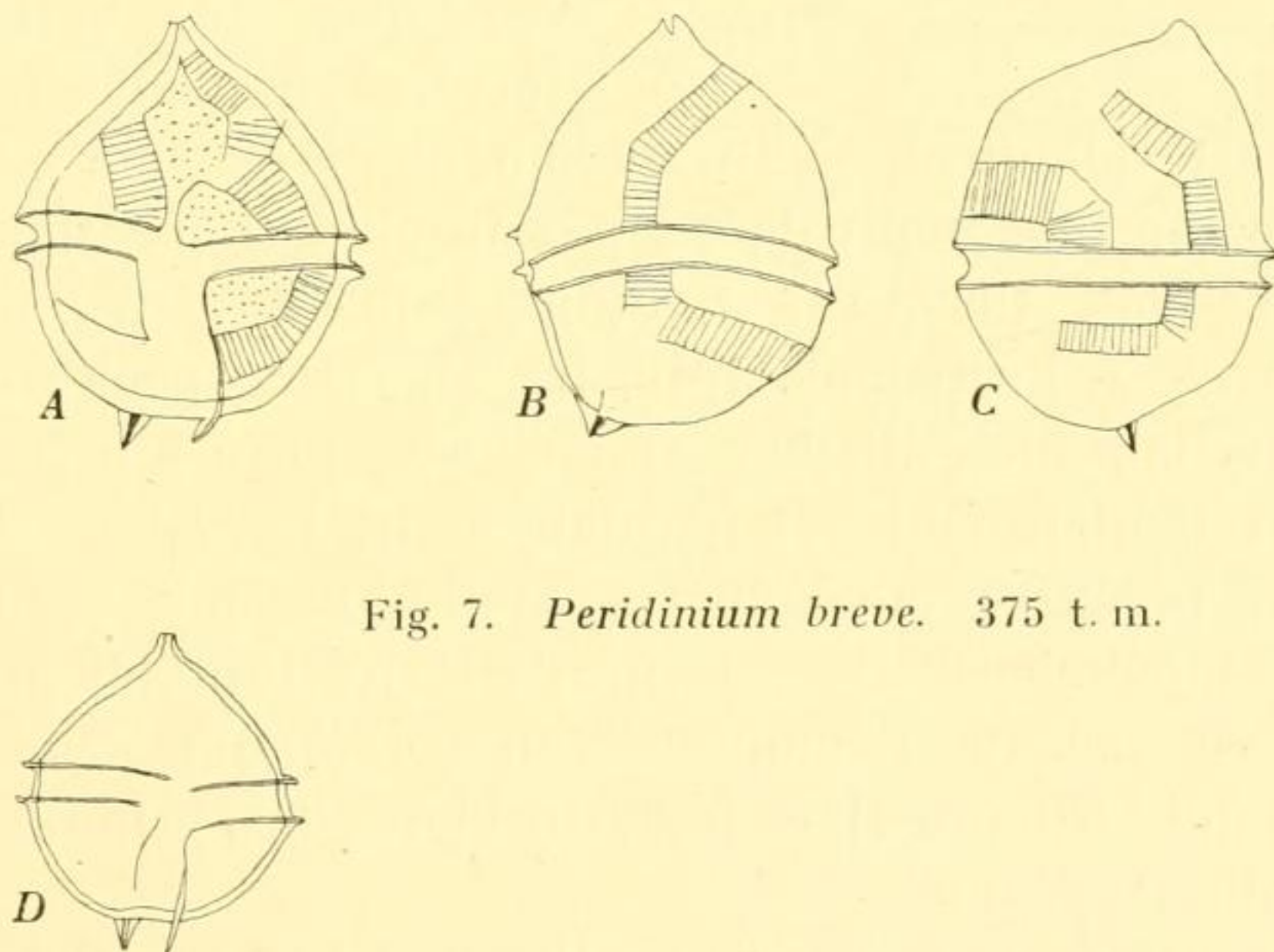


Fig. 7. *Peridinium breve*. 375 t. m.

Fig. 7 shows four cells of this species, which is indeed difficult to discern from its relatives *P. Steinii* Jørg., and *P. pyriforme* Pauls.

A—C has grown very old, thick and thick-walled, and the intercalary bands are very broad. Length 56μ , surface finely reticulated. D is a small form, 40μ long.

This species was found sparingly in few samples from the pack-ice and the coastal water.

Distrib. Arctic species, known from Spitzbergen and Iceland.

12. *Peridinium pyriforme* Paulsen, Meddel. fra Kommis. for Havundersøg. Ser. Plankton, Bd. 1, No. 5, 1907, p. 13, fig. 15; Nord. Plankton p. 46, fig. 57. *P. Steinii* Jørgensen f. *pyriformis* Paulsen, Meddel. Kom. Havund. Ser. Plankton Bd. 1, No. 3. 1905, p. 4, fig. 3 d—e.

Fig. 8 shows a species which was fairly common in some of the samples taken in August 1908 in the open water outside the pack-ice, and which I cannot refer to any other species than *P. pyriforme*. Length 42—52 μ . It differs from *P. breve* by the taller form, the irregular position of the intercalary δ , which in *P. breve* is regular (Broch l. c.) and in the very narrow rhomb-plate, but, as stated above, these two species are closely allied to each other.

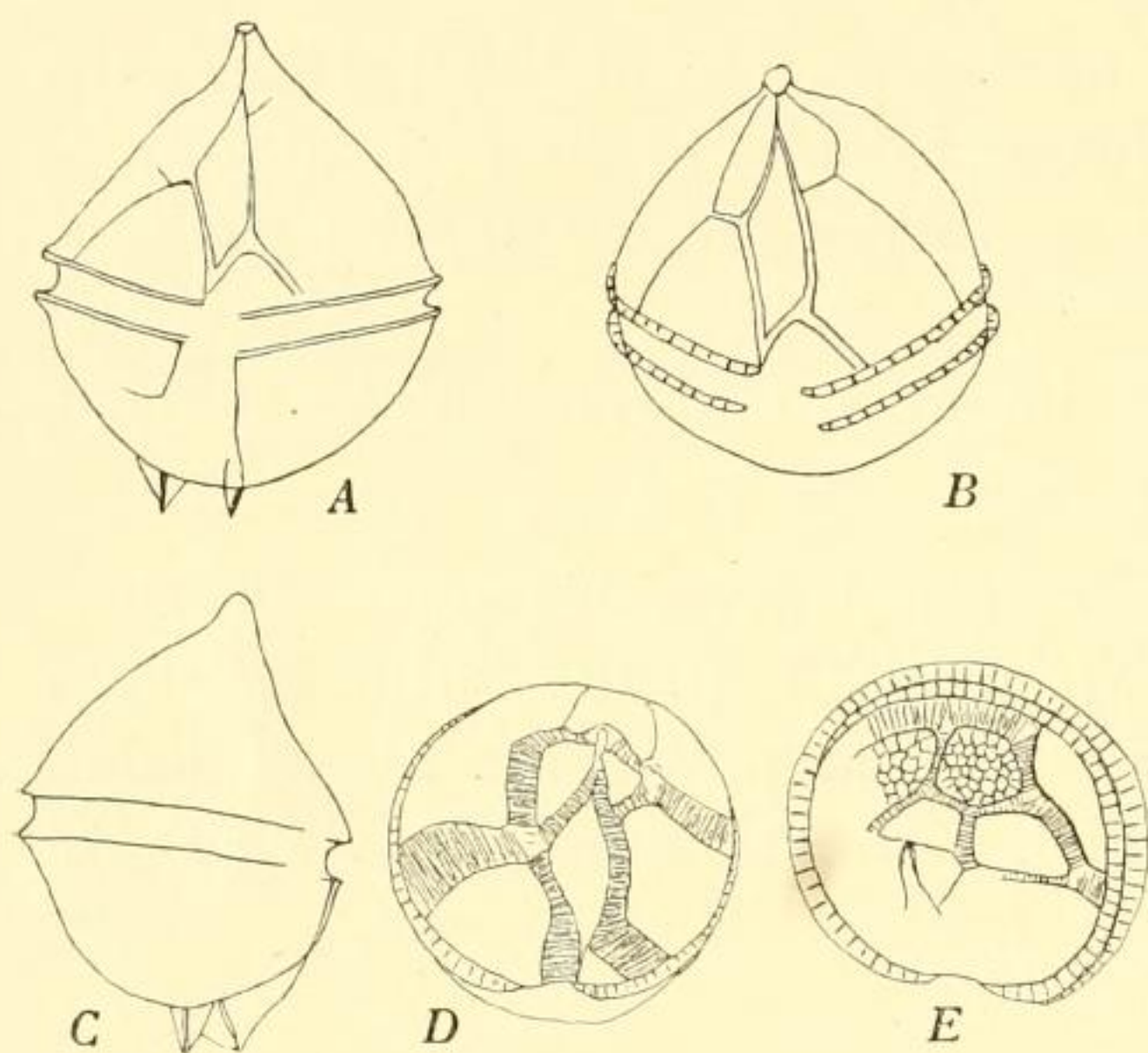


Fig. 8. *Peridinium pyriforme*. 375 t. m.

On the other hand, our species is nearly related to *P. Steinii* Jørgensen. As to the arrangement of the plates (see fig. 8 D, E) they are nearly identical, so the precingular a is small, the rhomb-plate narrow, and the intercalary δ has an oblique position (KOFOID in Arch. f. Protistenk. 1909, Taf. 2; BROCH, Spitzbergen Plankton p. 49, BROCH in Arch. f. Protistenk. 1910, fig. 4). Our species differs from *P. Steinii* in its much thicker and shorter form and in the thecal wall being reticulate and not porulate as in *P. Steinii*. BROCH says (Spitzb. Pl., p. 49): "ein näheres Studium von *Peridinium pyriforme* wird möglicherweise zeigen, dass die Individuen dieser Art nur kräftig entwickelte Exemplare von *Peridinium Steini* sind." On the other hand, KOFOID (l. c. p. 39) declares *P. pyriforme* not to be identical with *P. Steinii*.

Anyhow, it seems to me to be the best to keep the two species distinct at any rate provisionally until further evidences may come to hand.

Distrib. Boreal oceanic species, known from the northern Atlantic and its tributaries.

13. *Peridinium pallidum* Ostenfeld, in Knudsen & Ostenfeld: Iagttag. over Overfladevandets Temperatur, Saltholdighed og Plankton paa islandske og grønlandske Skibsrouter i 1898 (1899), p. 60. Paulsen, Nord. Plankton p. 48, fig. 60. Broch, Spitzbergen Plankton p. 45, fig. 17.

Fig. 9 shows an exceptionally low cell (length $56\ \mu$ without spines) with broad intercalary bands. The relation between 1 and

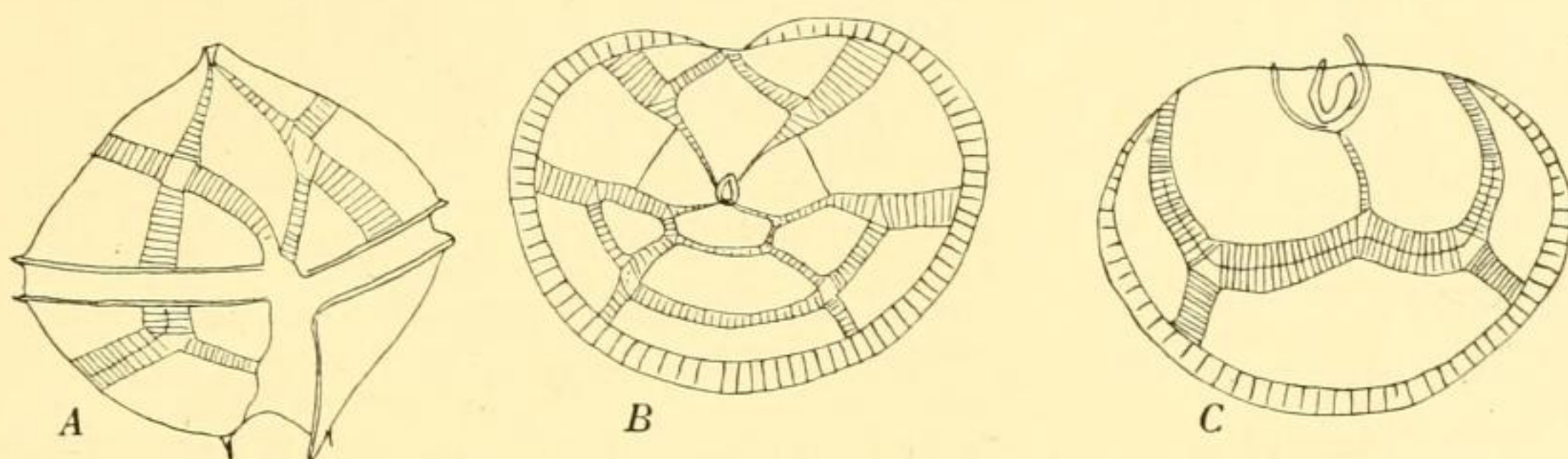


Fig. 9. *Peridinium pallidum*. 375 t. m.

f is not as shown in Broch's figure. Found in few specimens but in many samples from the pack-ice, the coastal water, and Danmarks Havn. Common in the open sea outside the ice.

Distrib. Oceanic, boreal species, widely distributed in the northern Atlantic and its tributaries.

14. *Peridinium pellucidum* (Bergh) Schütt, Die Perid. der Plankton-Exp., tab. XIV, fig. 45; Paulsen, Nord. Plankton p. 49, fig. 61; Broch, Spitzbergen Plankton, p. 44, fig. 15, 16. — *Proto-peridinium pellucidum* Bergh, Morphol. Jahrb. 1881, p. 227, fig. 46—48.

All the cells seen belong to the *forma spinosa* Broch (l. c) the antapical spines being without fins. Only a single cell with fins

was seen (from Danmarks Havn). In fig. 10 two specimens are drawn. A and B represent a very young cell (length $36\ \mu$) having thin walls, and the sutures are not conspicuous without chemical treatment. D—E are showing another cell (length $40\ \mu$) thick-walled and with broad intercalary bands. The cell represented in fig. 11 has a length of $60\ \mu$, and the intercalary

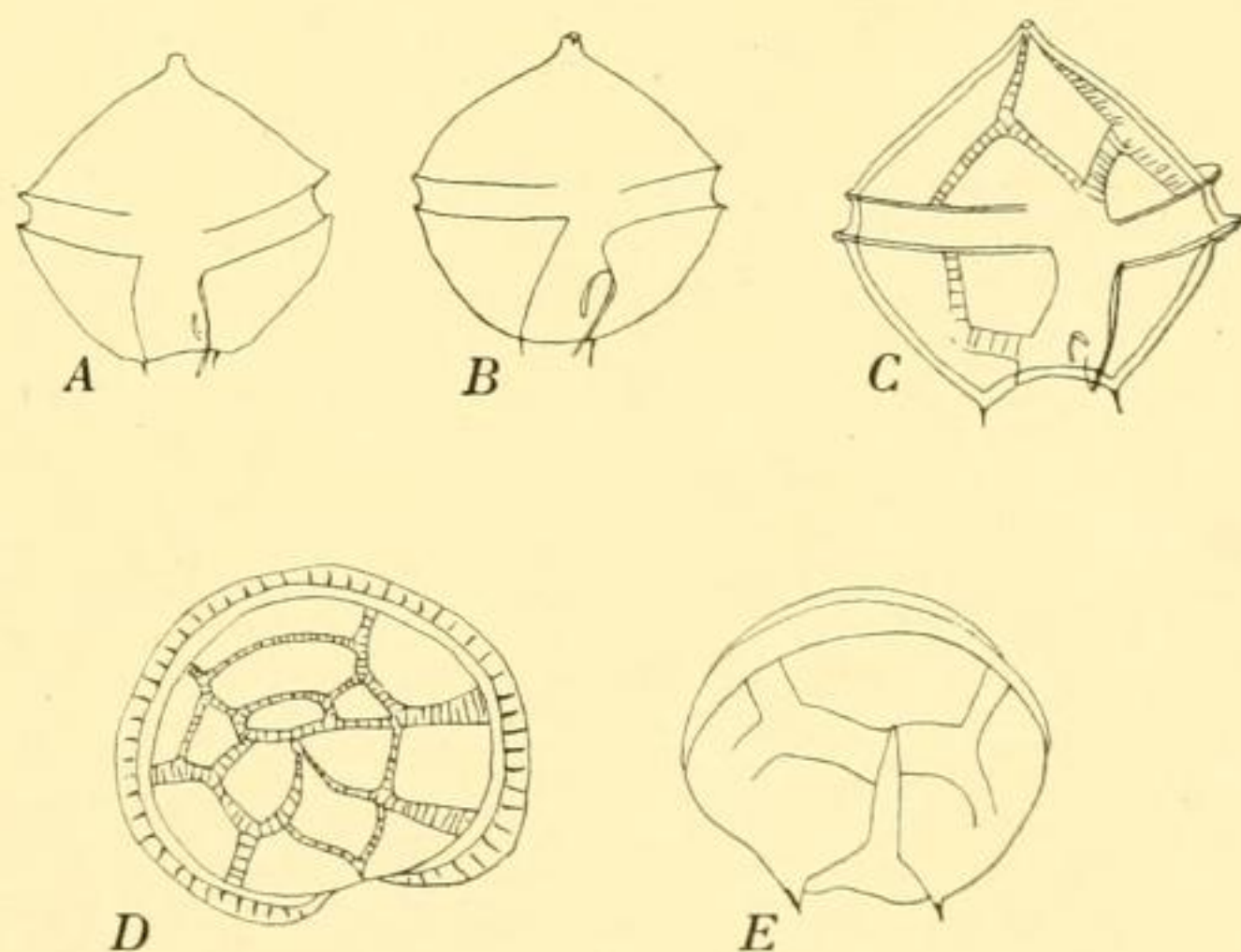


Fig. 10. *Peridinium pellucidum*. 375 t. m.

striae are very broad. Such big and thick specimens were common in some of the samples, and I refer them to *P. pellucidum* because of the girdle being not oblique as in *P. pallidum*. — Other length-

measures of this species: 38, 45, 48, 52, 56, 66 μ . *P. pellucidum* was the commonest Dinoflagellate in the samples, it occurred in Dan-

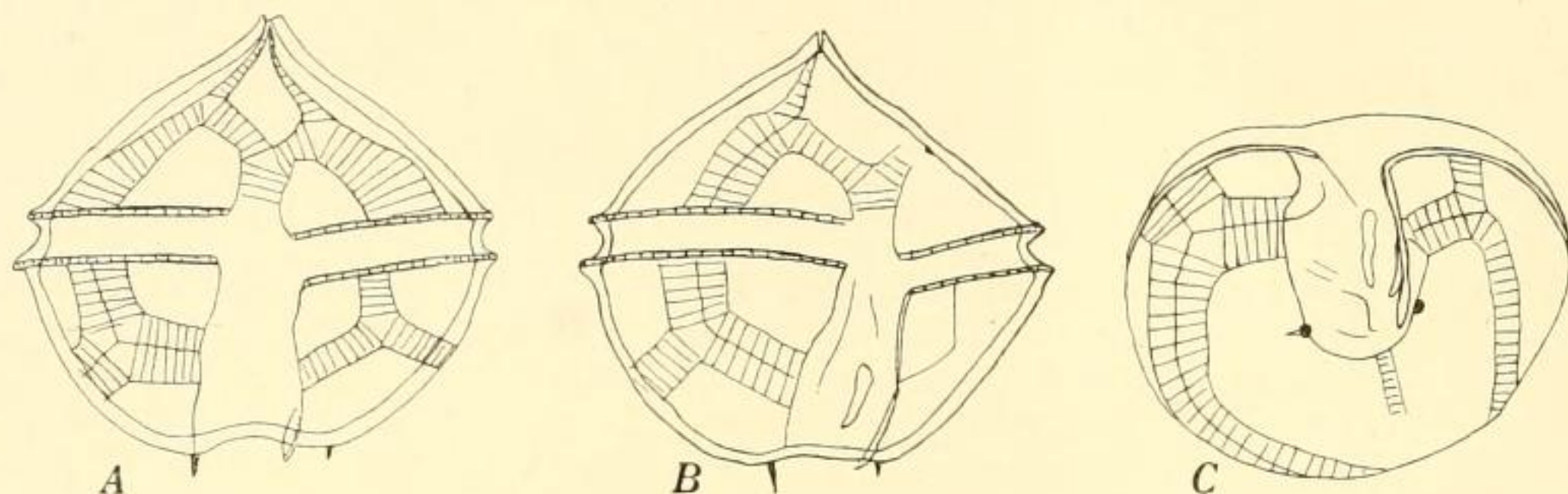


Fig. 11. *Peridinium pellucidum*. 375 t. m.

marks Havn, the coastal water, the pack-ice and in the open sea, and often frequently.

Distrib. Widely distributed neritic species, occurring from the Mediterranean to Spitzbergen and Greenland.

15. *Peridinium islandicum* Paulsen, Meddel. fra Kommis. f. Havundersøg., Ser. Plankton, Bd. I, No. 1, 1904, p. 23, fig. 7; Paulsen Nord. Plankton, p. 49–50, fig. 62; Broch, Spitzbergen Plankton, p. 46, fig. 18–20.

The cells were rather flat, as they have been figured by Broch. A single specimen measured was 44 μ long. Icelandic specimens are 53–62 μ (Nord. Plankton.) The species was fairly common in Danmarks Havn, the coastal water, and the pack-ice, but in the open sea it was found once only.

Distrib. Arctic neritic species, known from North Iceland, Spitzbergen and Greenland.

16. *Peridinium varicans* n. sp. (fig. 12).

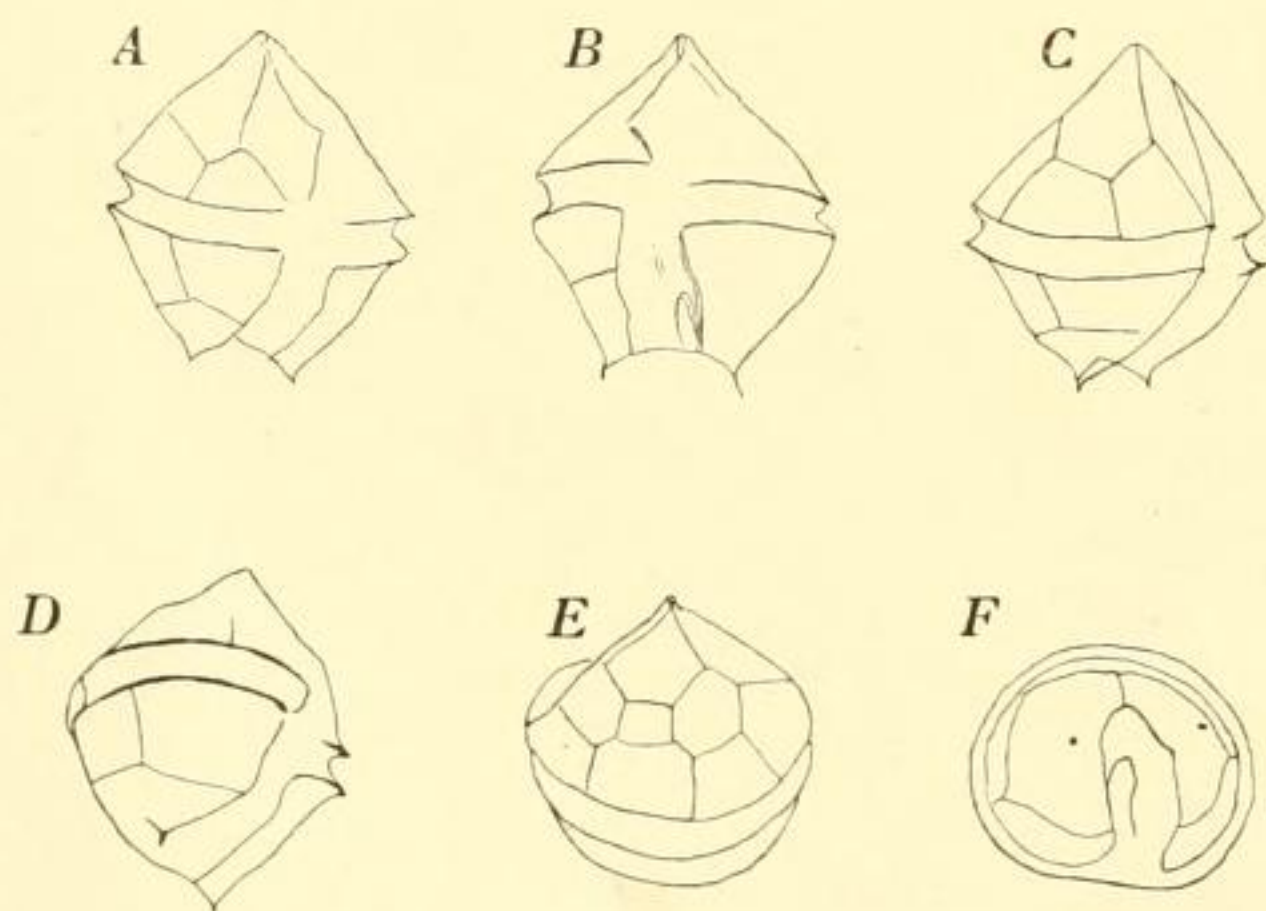


Fig. 12. *Peridinium varicans*. 375 t. m.

Cellula globoso-rhomboidea, *epitheca* acuta, *hypotheca* spinas duas divergentes (*varicantes*) a *fissura longitudinali* remotas gerente et inter spinas linea paulum et regulariter curvata terminante, *cingulo* transverso dextrorsum circum-i-ente, *fossa longitudinali* lata ad *marginem sinistram* ala angusta *praedita*. *Epitheca* tabulis 14, *intercalari* δ parvo, *hypotheca* tabulis 7 constructa. Long. cell.

36 μ . Hab. rarissime in mare gelido prope oram orientatem Groenlandiae.

This species which was found in two samples from the coastal

water and the interior part of the pack-ice (July 31th and Aug. 15th 1906) is characterized by the following features: The cell is in ventral view rhombic, the epitheca is pointed (*acutus*) but not tapering (*acuminatus*), the hypotheca ends in two diverging fin-less spines which are distant from the longitudinal furrow. The girdle forms a descending screw to the right. Of the plates of the epitheca, δ is small and almost quadratic whereas γ and ε are bigger and many-sided.

17. **Peridinium brevipes** Paulsen, Nord. Plankton, p. 108, fig. 151 (without description); Broch, Spitzbergen Plankton p. 48, fig. 22.

In 1908 I published the name and an outline-figure of this species which I had seen at Iceland. BROCH in his paper on Spitzbergen Plankton gives detailed figures of the species, and these agree well with the annexed fig. 13. Length $36\ \mu$ (different cells measured). The form of the body and the arrangement of the plates are seen in the drawings. As to the plates, δ is small and quadratic, the rhomb-plate being broad and oblique does not touch f but touches b along a vertical line. The two small spines at the lower end of the cell may be wanting. I have seen only specimens with broad intercalary bands, but BROCH has them broader yet. After his theory we have then old cells before us, but if this is the case it seems to me that they cannot be "Jugendstadium" of *P. breve*, what BROCH presumes. The adult cells are much smaller than *P. breve*, and also in form they seem to differ from *P. breve*.

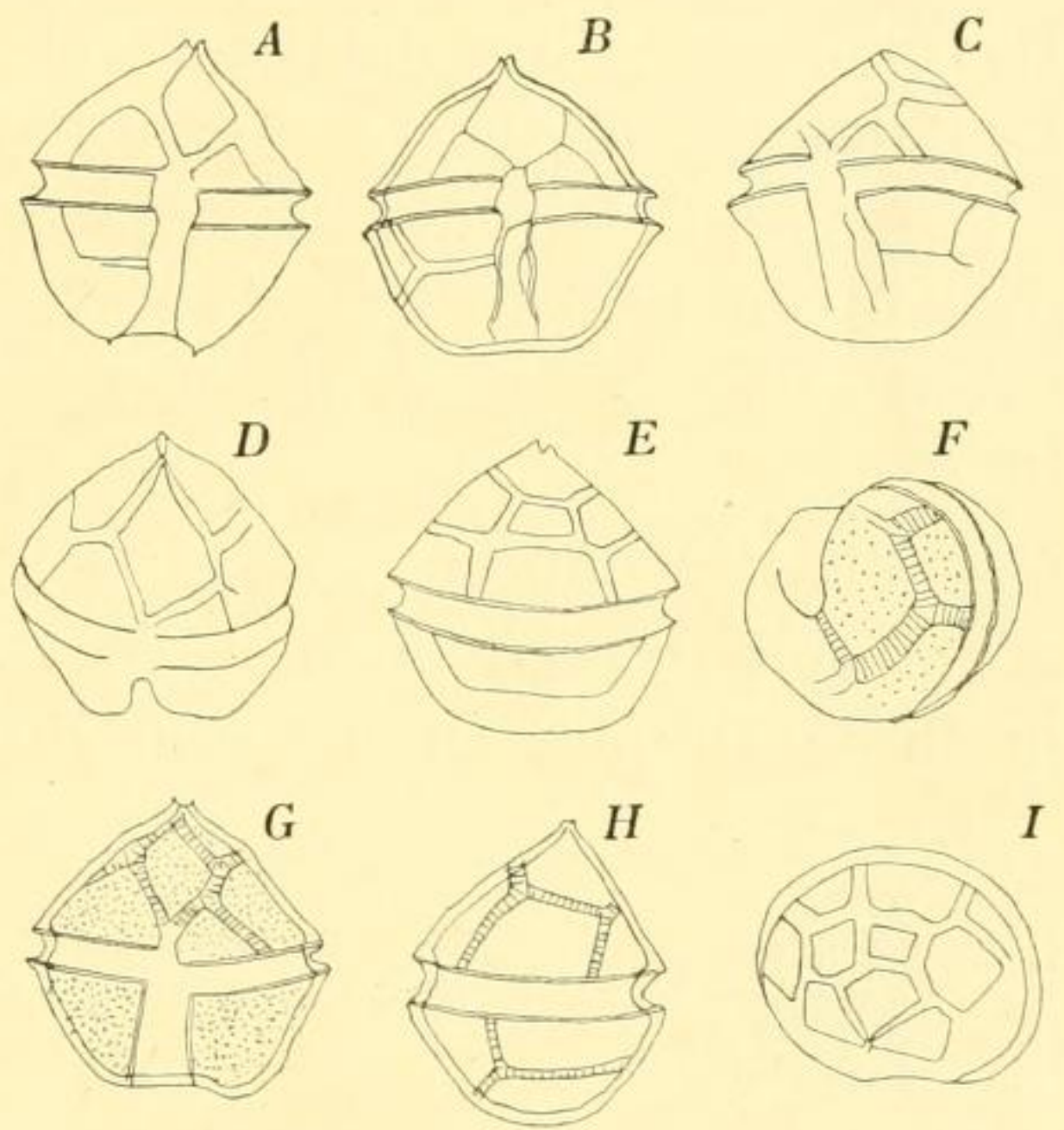


Fig. 13. *Peridinium brevipes*. 375 t. m.

P. brevipes was not common in the samples, but it is very likely that this small organism passes through the net-meshes. It was found in several samples from Danmarks Havn but in few from the coastal water, the pack-ice and the open sea.

Distrib. Arctic neritic species, known from Iceland and Spitzbergen.

18. **Peridinium depressum** Bailey, in Smithsonian contrib. to knowledge VII, 1855, p. 12, fig. 33—34; Paulsen, Nord. Plankton p. 53, fig. 67; Broch, Spitzbergen Plankton p. 51, fig. 26.

In all the specimens seen by me the antapical horns were long and hollow, so that, strange to tell, the arctic species *P. parallelum* Broch was not found in the present material.

P. depressum was found in single specimens only in the neighbourhood of the coast, repeatedly but rarely in the pack-ice and in the open sea.

Distrib. Boreal oceanic species, widely distributed.

19. ***Peridinium oceanicum*** Vanhöffen, in Grönl.-Exp. d. Gesellschaft für Erdk. zu Berlin II, 1897, tab. V, fig. 2; Paulsen, Nord. Plankton, p. 54, fig. 69.

var. typicum Broch, Nyt Magaz. f. Naturvid. Christiania, 44, 1906. fig. 3.

Found as a single cell in the open sea outside the ice.

Distrib. Oceanic boreal species.

20. ***Peridinium conicoides*** Paulsen, Meddel. fra Kommis. f. Havundersøg. Ser. Plankton, Bd. I, Nr. 3, 1905, p. 3, fig. 2; Nord. Plankton, p. 58, fig. 75; Broch, Spitzbergen Plankton, p. 53.

Not rare in several samples from the coastal water and the pack-ice in 1908.

Distrib. Arctic neritic species, known from Iceland, Spitzbergen and Greenland.

21. *Peridinium* sp.

A small species (length $20\ \mu$) represented in fig. 14 was found in three samples from Danmarks Havn in 1907. I suppose it is a

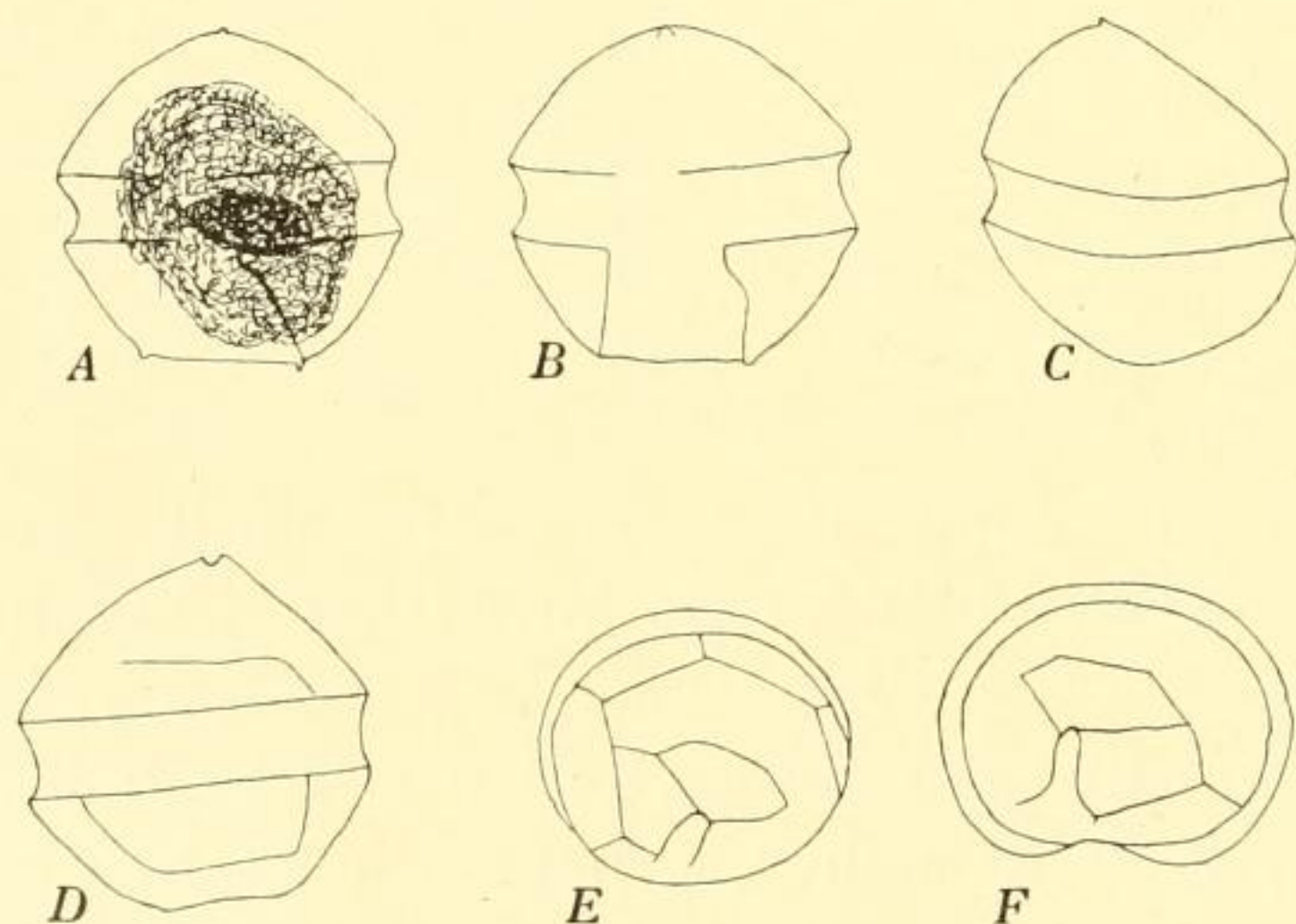


Fig. 14. *Peridinium* sp. 750 t. m.

young stage of the preceding species. In favour of this conception speaks: the whole form of the body, with convex outlines, the small hollow protuberances distant from each other, the orbicular girdle and the characteristic curvature of the longitudinal furrow's left margin. On the other hand, the number and arrangement of the plates do

not permit to unite the two species at once. There is only one intercalary plate, as illustrated in fig. E, at least I have not been able to find any sutures to separate between γ , δ and ϵ .

22. ***Peridinium subinerme*** Paulsen, Plankton invest. Iceland

1903, p. 24, fig. 10; Nord. Plankton, p. 60, fig. 78; Broch, Spitzbergen Plankton, p. 54, fig. 28.

One of the commonest species in the samples from the pack-ice in 1906. More rarely it occurred in Danmarks Havn, the coastal water (in 1909) and in the open sea.

Distrib. Oceanic(?) arctic or boreal species, known from Iceland, Greenland, Spitzbergen and (in spring) from the North Sea.

23. **Peridinium catenatum** Levander, Acta soc. pro fauna et flora fennica, IX, 1894; Paulsen, Nord. Plankton, p. 63, fig. 84.

This species, represented in fig. 15, was found rarely but in several samples from Danmarks Havn, the coastal water, and the pack-ice.

Distrib. Neritic species, known from the inner part of the Baltic, Limfjorden (Denmark), and West-Greenland.



Fig. 15. *Peridinium catenatum*. 375 t. m.

24. **Peridinium minusculum** Pavillard, Flore pélagique de l'étang de Thau, Montpellier 1905, p. 57, tab. III, fig. 7—9 (I have seen Pavillards specimens); Lemmermann, Arch. f. Hydrobiol. u. Planktonkunde, V, 1910, p. 336; *Glenodinium bipes* Paulsen, Plankton invest. Iceland 1903 (1904), p. 21, fig. 3—4; Nord. Plankton, p. 25, fig. 31.

LEMMERMANN (l. c.) in pointing out that *Glenodinium trochoideum* is a *Peridinium* says in a footnote that also *G. bipes* is a *Peridinium* and that it is to be named *P. minusculum* (*P. bipes* it cannot be named because another species, of Stein, bears that name.) It is very likely that the species is a *Peridinium*. I have seen that it has two antapicals.

P. minusculum was found, always in single specimens, in several samples from Danmarks Havn, the coast water, and the pack-ice. Without doubt most of the cells pass through the net-meshes.

Distrib. Neritic species, known from the Mediterranean, the North Sea, the Baltic, Iceland, and Greenland.

Ceratium Schrank.

25. **Ceratium arcticum** (Ehrenberg) Cleve, The seasonal distrib. of atl. Plankton-org., Göteborg 1900, p. 207. Paulsen, Nord. Plankton, p. 86, fig. 118; E. Jørgensen, Die Ceratien, Leipzig 1911, p. 85, fig. 181. *Peridinium arcticum* Ehrenberg, Bericht üb. Verhandl. d. Berliner Akad. d. Wiss. 1853, p. 528.

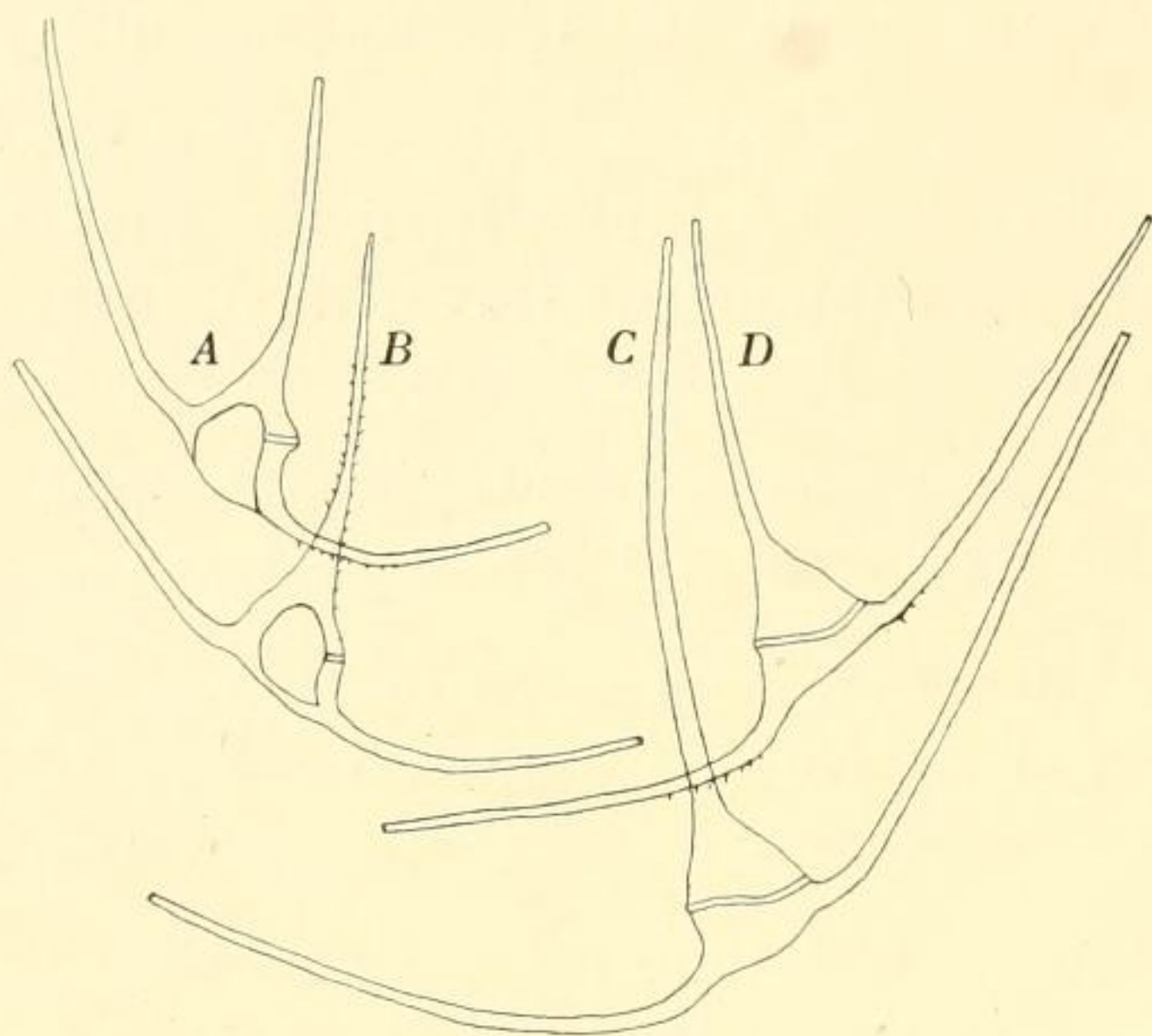


Fig. 16. *Ceratium arcticum*, different cells. 94 t. m.

This species of which fig. 16 gives some outline-figures, was very common in Aug. 1908 in the sea outside the ice. In the pack-ice and the coastal water in 1908 it was scarce though found in several samples. In Danmarks Havn and in the pack-ice and the coastal water in 1906—07 it was rare and occurred always as dead specimens.

Distrib. Arctic oceanic species.

Apodinium Chatton.

26. *Apodinium* (?) *Chaetoceratis* n. sp.

Cellulae globosae nucleiferae membrana cellulosoidea tectae, ad setas Chaetoceratis borealis appendicula adhaerentes et membranam ejus perforantes: parasitus igitur plasma hospitis exhaustiens. Divisionibus cellulae binae et quaternae nascuntur. Long. cell. ca. 13—25 μ . Hab. in mare gelido ad oram orientalem Groenlandiae.

Dr. OSTENFELD who has worked out the Diatoms and Flagellates of the present samples before I got them for investigation, called my attention to this organism which he had examined believing it was a Diatom. But as the wall gave cellulose-reaction with chloriodide of zinc and as it was without silicium he saw it would be nearer a Dinoflagellate than a Diatom, and he gave me his drawings and notes.

Once only I have found a cell of *Apodinium Chaetoceratis* upon an awn of *Chaetoceras decipiens*, all other specimens seen were fixed on the awns of *Ch. boreale*. Whether this is because the awns of *Ch. boreale* are set with fine hairs I cannot tell with certainty, I have never seen the cells spit upon the hairs or otherwise fixed to them. But it seems likely that awns set with setae afford better chance for fastening than smooth ones. How the cell is fixed to the awn is difficult to discern. Fig. 17, C and D show a little process by aid of which the cell is fixed. In other cases it seems that there are two processes. Fig. F shows a cell made pellucid by aid of Eau de Javelle, and on both sides of the awn is seen a thickening not belonging to the awn but to the *Apodinium*. Fig. I (drawed by OSTENFELD) shows two cells in a mucilage which is

fixed to the awn, such a thing I have not seen, and perhaps it does not belong to *Apodinium*.

The wall of the awn is perforated. In fig. G the perforation is distinctly seen. Through this hole the contents of the *Chaetoceras*-

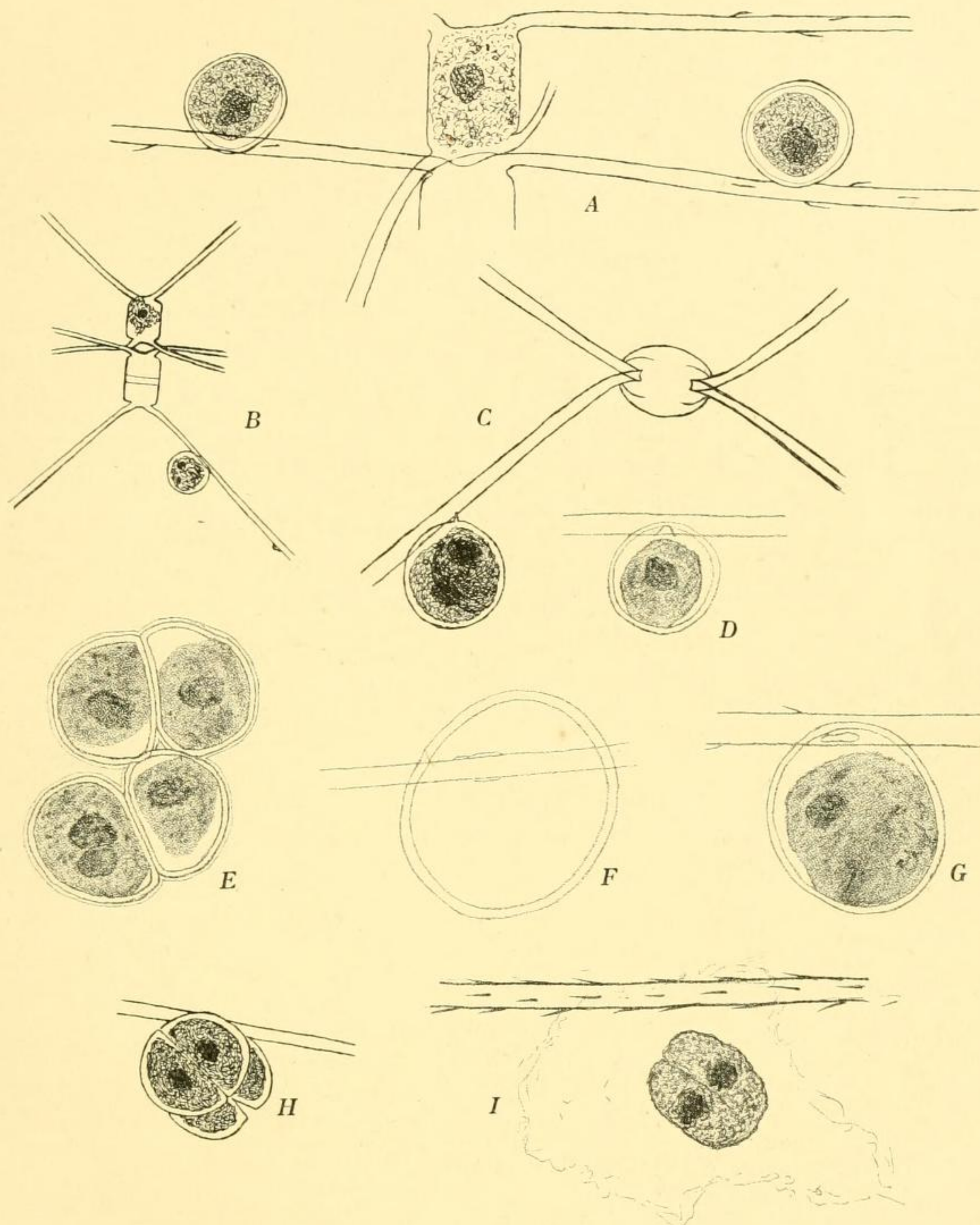


Fig. 17. *Apodinium(?) Chaetoceratis*. (See the text) A, C, D 375 t. m. B 125 t. m. E, F, G 750 t. m. H, I 500 t. m. (Fig. B, C, H, I were drawn by Dr. Ostenfeld.)

cell must be sucked out, — and all the *Chaetoceras*-cells seen bearing an *Apodinium* were empty, see fig. A, B, C.

The contents of the *Apodinium*-cell consists of a granular plasma and a rather big nucleus which often is seen to have been divided (fig. C, E). The divisions must follow speedily after each other, as

two or four cells are often seen to be together and again dividing. The cell-wall is rather thick, in some cases I have been able to see a three-fold outline (fig. E); the outmost layer is very thin and inconspicuous, by treatment with chloriodide of zinc it disappears but not with Eau de Janelle (a mucilage?) The wall itself is coloured brownish violet by chloriodide of zinc. In spite of eager research it has not been possible to find other stages of this organism than those here mentioned and figured.

The systematic position of this species, imperfectly known as it is, must of course be uncertain. I refer it with some doubt to the genus *Apodinium* Chatton (Comptes rendus Ac. sc. Paris 144. 1907, p. 283, with figures. See also: *ibid.* 143, Chatton: Les Blastodinides, ordre nouveau des Dinoflagellés parasites.) The other Blastodinidae described and figured by CHATTON are far from being like our species, but *Apodinium mycetoides*, a parasite upon *Appendicularia*, shows some features which call to mind *A. Chaetoceratis*. *A. mycetoides* is fixed upon the host by a long stalk. Growing up and dividing it has at first some resemblance to our species, being two-celled and of about the same form, but it is only partly filled by plasma, a great "lacune aqueuse" taking most of the room in the two cells. Later on the distal cell ("blastocyte") divides again forming many spores which again divide, and so a lot of small *Gymnodinium*-like spores are formed. The proximal blastocyte after a rest divides, and the new distal cell forms a new generation of spores, as described above.

Of all this I have found no trace by *Apodinium(?) Chaetoceratis*. As a whole this species may be called rather dubious.