

DANMARK-EKSPEDITIONEN

TIL GRØNLANDS NORDØSTKYST 1906—1908

UNDER LEDELSE AF

L. MYLIUS-ERICHSEN

BIND III

INDHOLD

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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

IV. GENERAL REMARKS ON THE MICROPLANKTON

BY

C. H. OSTENFELD AND OVE PAULSEN

1911

Introduction.

As remarked in the introduction to the foregoing lists of the organisms of the microplankton (see list of literature p. 336), only the plankton from the region west of 6° W. L. and north of $73^{\circ} 30'$ N. L. has been worked up by us. The series of samples from this region, the principal contents of which are shown in the accompanying Tables (I—III), can be most conveniently considered under three divisions, namely:

- I. Samples from Danmarks Havn ($76^{\circ}46'$ N. L., $18^{\circ} 43'$ W. L.).
 - IIa. Samples collected during the passage of the ship through the ice on the outward journey.
 - IIb. Samples collected during the passage of the ship through the ice on the return journey.

In the following the samples from Danmarks Havn will be dealt with separately and the remaining samples together. With regard to the grouping of the latter into two divisions, reference may be made to our previous papers. Here all the species found are also named as well as details about the places where they were found.

The first information regarding the plankton of these waters came from the Danish Expedition to Scoresby Sound (1891—92). In a large paper on the marine diatoms published in 1895, E. Østrup also dealt with a number of plankton samples from the ice-filled sea, but did not deal with the plankton associations as such. The Swedish Expedition to East Greenland in 1899 collected a quantity of plankton which was investigated by P. T. Cleve (1900). His report contains tables and short remarks on the commoner species. Of special interest to us here are the samples collected in the drift-ice in July between $70^{\circ} 30'$ N. L. and $74^{\circ} 29'$ N. L., and the samples from the fjords of North-East Greenland, 71° — 73° N. L., collected in August.

The drift-ice samples are specially characterized by such organisms as *Chaetoceras decipiens*, *C. furcellatum* and *C. sociale*, *Coscinodiscus oculus iridis* (= *subbuliens*), *Fragilaria oceanica*, *Thalassiosira gravida* — all of which are regarded by Cleve as arctic forms — and thus show a good agreement with the samples dealt with here.

The fjord samples are all very poor; the most prominent species are *Chaetoceras decipiens*, *Dinobryon pellucidum* (only in some samples), *Calanus finmarchicus*, whilst *Ceratium arcticum*, *Cyttarocypris gigantea* and *Oithona similis* occurred in quantity in a few samples.

Lastly, from the Duke of Orleans' Expedition of 1905 we have an interesting work by D. Damas and E. Køeføed, which in the introduction speaks of the rich phytoplankton found in July—August in the drift-ice and in the coastal waters of East Greenland, in contrast to the small quantities found in the open Greenland Sea, but otherwise does not deal with the microplankton. The phytoplankton was determined by H. Broch, who has arranged it in tabular form without text.

According to Broch's tables the most prominent species in the phytoplankton are *Ampiprora hyperborea*, *Bacterosira fragilis*, *Chaetoceras atlanticum*, *C. boreale*, *C. criophilum*, *C. decipiens*, *C. furcellatum*, *C. Wighamii*, *Fragilaria oceanica*, *Navicula Vanhöffenii*, *Nitzschia delicatissima*, *Thalassiosira gravida*, *T. hyalina*, *T. Nordenskiöldii*, *Phaeocystis Pouchetii*. Specially prominent are *Fragilaria oceanica* and *Thalassiosira gravida*. *Chaetoceras criophilum* was predominant in a single sample from the open sea, whilst *Ceratium arcticum*, just as in the other samples, was rare. These samples show good agreement on the whole with ours, except that *Thalassiosira gravida* and *Chaet. criophilum* play a much smaller role in our samples.¹

I. Plankton from Danmarks Havn. (Table I).

It has several times been emphasized in our previous papers, that the collecting of plankton in Danmarks Havn, where the Expedition was stationed for ca. 22 months (1906—1908), has unfortunately been very incomplete. A series of samples collected at regular intervals could have given an excellent picture of the development of the plankton throughout the year, but from the few samples collected occasionally which we have, we obtain only an imper-

¹ Unfortunately there is not always agreement between Broch's tables and the published „Journal des stations“ of the Expedition. Thus for Station 44 the table has a haul of 390—300 m. with a rich diatom plankton, which seems peculiar at this great depth. In the Journal this haul is not mentioned, but a corresponding one of 300—0 m. with almost the same organisms. Other differences also occur.

fect impression of the annual cycle of plankton. The following samples were collected: 4 in October 1905, 2 in June, 4 in August and 2 in September 1907, and one sample on July 21st 1908, when the Expedition left the station.

Table I gives the principal species and their occurrence in the samples; the rarer species have been omitted (with regard to them, see the systematic lists in our previous papers).

The samples from the beginning of October 1905, which were all taken in holes in the ice from water with a temperature of ca. -1.7° C.,¹ contain very few organisms. They are the last remnants of the summer plankton, mostly dead shells of diatoms, *Ceratium arcticum* and *Cyttarocyclus denticulata*, as also a few living *Chaetoceras boreale*, *Ch. decipiens*, *Rhizosolenia styliiformis* and Peridinians, with some *Oithona* and Nauplii. Lastly, it was interesting to find that *Coscinodiscus Joergensenii* was in process of forming auxospores at this time of year, though in very few individuals.

The two spring samples from June 1907 were also from holes in the ice (water temperature ca. -1.7° C.) and contained even fewer organisms. It was only in the last of the two samples that any fair quantity of *Melosira hyperborea* was taken, its chains in process of active division, as also some *Oithona* and Nauplii.

The August samples (the first was taken on July 30th) contain a rich diatom plankton. The principal species are *Chaetoceras sociale* and *Fragilaria oceanica*, in the later also *Chaetoceras diadema*, *Ch. Wighami* and *Coscinodiscus subbuliens*, as well as *Cyttarocyclus denticulata* and in smaller numbers *Nitzschia seriata*, *Thalassiosira gravida*, *Peridinium pellucidum* and *P. islandicum*, further *Ptychocyclus obtusa* and *Tintinnus vitreus*.

The September samples show almost the same plankton, yet are somewhat poorer for most species; only *Peridinium pellucidum*, *P. islandicum*, *Synchaeta* sp., *Oithona*, as also *Cyttarocyclus denticulata typica* and *gigantea* are more frequent, and *Gonyaulax triacantha* is added.

Among the diatoms in September resting-spore formation is found in *Chaet. sociale*, *Ch. diadema*, *Thalassiosira gravida*, and also in *Fragilaria oceanica*, the resting-spores of which, however, already occurred in August, though less frequently. The rare *Ch. gracile* had resting spores in August. In *Coscinodiscus subbuliens* auxospores were present, but in small quantity, in August and September.

The salinity of the water was highest in June ($32.3^{0/100}$) and de-

¹ The hydrographical data (surface temperature and salinity) have been kindly placed at our disposal by the Captain of the "Danmark", First-Lieutenant H. TROLLE, to whom we wish here to express our thanks.

Table II. 1906.

	31. VII	1. VIII	2. VIII	2. VIII	3. VIII	5. VIII	7. VIII	13. VIII	15. VIII	15. VIII	16. VIII
Date	9-30 p.	12-30 p.	4-30 a.	2 p.	1-30 p.	12 n.	12-30 a.	3 a.	1 a.	5-30 a	2-30 p.
Time	75-26	75-35	75-19	75-38	75-58	75-58	75-48	76-20	77-16	77-25	77-0
N. Latitude	6-10	8-15	10-35	11-05	10-15	11-31	12-52	18-20	18-30	18-25	18-09
W. Longitude	1-9	1-0	÷ 0-7	÷ 0-4	÷ 0-4	÷ 1-2	÷ 0-7	0-5	÷ 0-5	0-4	0-5
Temperature of water	32-8	31-9	31-2	31-3	31-9	31-8	31-2	—	30-6	—	—
Salinity of water	12	13	14	15	16	17	18	19	21	22	23
No. of sample											

Bacillariaceae

Amphiprora hyperborea	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT
Chaetoceras atlanticum											
— boreale							+				
— convolutum	c	+	+	c	c	IT	IT	c	c	c	c
— decipiens	IT	IT	IT	+	IT						
— diadema											
— furellatum											
— sociale											
— Wighamii											
Coccinodiscus subbulliens											
Fragilaria oceanica				IT ¹	IT ¹	IT ¹		c	+	+	r
Melosira hyperborea				IT	IT	(c-sp.)	IT	IT			IT
Navicula septentrionalis											
Nitzschia seriata											
Rhizosolenia hebetata f. semispina	c	+	+	cc	cc	IT					
— obtusa	r	c	+	c	c	IT					
— styliformis											
Thalassiosira bioculata											
— gravida											
— Nordenskiöldii			IT	IT							

Flagellata

Dinobryon pellucidum											
Distephanus speculum			+								
	IT	IT		IT							

creased greatly in the course of the summer owing to the inflow of fresh water from the melting snow of the land, so that on the surface it was brought down to 0.6—1.8‰ at the end of July, at the same time that the temperature rose to 3.6°—4.5° C., the effect of which was that the marine organisms were for a great part killed, and only the resting-spores of diatoms were living. The samples from this period really contained in the main freshwater organisms, which had been carried out by the freshwater from land, for example, *Coelastrum microporum*, *Gomphosphaeria lacustris*, *Anabaena* sp., *Spirotaenia* sp., *Staurastrum* sp., *Hyalotheca* sp., and many freshwater diatoms. In August—September the salinity again rose and the temperature sank (ca. 27—28‰ and ca. 0°), and at the same time the freshwater forms disappeared and marine species ruled again. The samples from October 1906 permit us to conclude, that the salinity continues to rise, most probably owing to the formation of ice, and the temperature to fall, just as they presumably show the demise of the plankton (see above).

The plankton of Danmarks Havn is thus an arctic coast-plankton with a flowering period of short duration in late summer. It is somewhat poor in species and consists mainly of neritic diatoms, which have a wide distribution in northern seas, also outside the arctic region. Truly arctic are probably only the following species, none of which were very abundant in the samples: *Bacterosira fragilis*, *Eucampia groenlandica*, *Chaetoceras gracile*, *Biddulphia arctica*, *Navicula septentrionalis*, *N. Vanhöffenii*, *Peridinium islandicum*, *P. brevipes*, *P. catenatum*, *Gonyaulax triacantha*, *Tintinnopsis karajacensis*, *T. pellucida* and *Tintinnus vitreus*.

II. Plankton of the drift-ice and coastal waters.

a. August 1906. (Table II).

The samples (11) belonging here were collected during the period from July 31st to August 16th in the ice-filled waters; they fall naturally into two groups:

The outermost group (5 samples) are from water with a temperature of —0.7° to —1.9° C. and a salinity of 31.2—32.8‰ and they were taken between ca. 6°—11° W. L. (ca. 120—180 miles from the coast). The plankton is very uniform in all the samples; it consists mainly of diatoms and tintinnids; the most frequent species are *Chaetoceras convolutum*, *Rhizosolenia hebelata* f. *semispina*, *Rh. obtusa*, *Cyrtarocydis denticulata typica* and *robusta*, *Peridinium subinermis*, *P. curvipes* and *P. pellucidum*. Characteristic, though occurring in smaller quantities, were *Coccolithophora pelagica* (dead), *Pontosphaera borealis*, *Dinophysis arctica*, *Peridinium roseum*, *Dinobryon pellucidum*

and *Distephanus speculum*. From the transition to the inner group we have a single sample (No. 17 in the Table), which mainly consists of *Melosira hyperborea* (with resting spores) and *Calanus finmarchicus*; the very low temperature (-1.2°) implies special conditions in the water, e. g. that the sample might have come from the immediate vicinity of an ice-floe.

The inner group (5 samples) come from water with a temperature of ca. 0° and a salinity of 30.6—31.2 ‰ and the samples were taken from ca. 13° W. L. (ca. 90 miles from land) in towards the coast (Germania Land and Koldewey Island). The principal species are *Chaet. boreale*, *Ch. decipiens*, which in small quantities were also found in the samples from the outer group, and *Oithona similis*; *Rhizosolenia styliformis* replaces the other two *Rhizosolenia* species. *Coscinodiscus subbuliens* and *Apodinium Chaetoceratis* only occur in the samples from near the coast. In a couple of the samples *Calanus finmarchicus* was present in large numbers. With regard to the Peridinians, *Ceratium arcticum* was found in small quantity and usually only as empty shells in all the samples (also of the outer group), whilst the other species had practically disappeared.

b. July—August 1908. (Table III).

We have examined 28 samples taken on the return voyage during the period from July 21st to August 3rd in almost the same region as the samples from 1906.

The samples can be divided naturally into three groups:

The inner group (15 samples) goes from the coast to ca. 14° W. L. The salinity determinations are few; they vary between 28.1 and 31.7 ‰ and the temperature on the surface lies between 0° and -4° C. The samples are somewhat rich in species, the most prominent being the following diatoms: *Chaetoceras decipiens*, *Ch. boreale* and *Coscinodiscus subbuliens*, and common to all is the small quantity of Peridinians: *Per. conicoïdes*, *P. curvipes* and *Ceratium arcticum* being the near most characteristic. Three samples taken west of Germania Land (Nos. 1276, 1279, 1289) in water with $3-4^{\circ}$ temperature (and presumably low salinity) are wanting in, among others, *Chaet. Wighami* and *Fragilaria oceanica*, which are found otherwise in larger or smaller number in most samples. *Chaet. sociale* appears first further away from land (from No. 1290), but is then constantly present and usually in quantity. *Calanus finmarchicus* and *Thalassiosira gravida* (to a smaller extent) chiefly keep on the other hand to the samples from nearer land. The two northernmost (ca. 78° N. L.) samples (Nos. 1301, 1303) are remarkable for a large quantity of *Melosira*

Table III.

Date	21. VII	21. VII	21. VII	22. VII	22. VII	22. VII	22. VII	23. VII	23. VII	23. VII	24. VII	24. VII
Time	7 p.	8 p.	9 p.	11 a.	6 p.	10 p.	12 p.	5 a.	8 a.	11-30p.	10 a.	2 p.
W. Latitude	Mouth of the harbour	C. Bismarck—Marousia	Off Marousia	N. of Marousia	northwards along the coast			77.0	77.15	ca.78.0	ca.78.0	—
N. Longitude	ca. 0°0			ca. 1°0	ca. 4°0	ca. 3°0	ca. 3°0	17.15	16.0	c.15°30	c.15°30	—
Temperature of water	ca. 0°0			ca. 1°0	ca. 4°0	ca. 3°0	ca. 3°0	3.15	2.10	1.4	0.7	0.3
Salinity of water	31.7	31.7	31.7	ca. 30.0	—	—	—	28.06	29.36	—	28.7	—
No. of sample	1242	1243	1244	1270	1276	1279	1289	1290	1291	1299	1301	1303
Bacillariaceae												
<i>Amphiprora hyperborea</i>	r	rr	r	r	...	...	...	rr	...	...	rr	r
<i>Chaetoceras atlanticum</i> . . . . .	...	rr	...	...	...	...	...	...	rr	...	rr	rr
— <i>boreale</i>	cc	e	e	cc	cc	cc	cc	e	cc	e	+	r
— <i>convolutum</i> . . . . .	...	...	...	...	...	...	...	...	...	...	rr	rr
— <i>decipiens</i>	e	e	e	e	e	e	e	e	cc	e	e	e
— <i>diadema</i> . . . . .	...	...	...	...	...	...	...	r	...	...	...	...
— <i>furcellatum</i> . . . . .	...	...	...	...	...	...	...	...	...	...	...	...
— <i>sociale</i> . . . . .	...	...	...	...	...	...	...	e	r	r	+	cc
— <i>Wighami</i>	r	r	+	r	...	...	...	cc	+	...	rr	r
<i>Coccolithidium subbaliense</i>	+	e	e	e	e	cc	e	e	e	cc	rr	r
<i>Fragilaria oceanica</i>	cc	cc	cc	cc	...	...	...	rr	r	r	r	+
	(c. sp. +)	(c. sp. +)	(c. sp. +)	(c. sp. r)	...	...	...	...	(sp.)	(sp.)	(sp.)	(c. sp. r.)
<i>Melosira hyperborea</i>	rr	rr	rr	rr	...	rr	rr	...	+	+	e	e
	(sp.)	(sp.)	(sp.)	(sp.)	...	(sp.)	(sp.)	...	...	...	(c. sp. +)	(c. sp. +)
<i>Navicula septentrionalis</i> . . . . .	...	r	+	r	...	...	...	...	...	...	rr	...
<i>Nitzschia seriata</i>	rr	...	...	...	...	...	...	...	...	...	...	...
<i>Rhizosolenia hebetata</i> f. <i>semispina</i> . . . . .	...	...	...	...	...	...	...	...	...	...	...	...
— <i>obtusa</i> . . . . .	...	...	...	...	...	...	...	...	...	...	...	...
— <i>styliformis</i>	rr	...	rr	...	...	...	...	...	r	...	rr	rr
<i>Thalassiosira bioenlata</i>	rr	rr	...	...	rr	...	...	...	...	...	rr	...
— <i>gravida</i>	+	+	+	+	rr	...	...	r	rr	rr	rr	r
— <i>Nordenskiöldii</i>	rr	(c. sp. rr.)	...	...	...	...	...	rr	rr	rr	rr	r
Flagellata												
<i>Dinobryon pellucidum</i> . . . . .	...	...	...	...	...	...	...	...	...	...	...	...
<i>Distephanus speculum</i>	rr	r	r	rr	...	...	...	...	...	rr	...	...
<i>Phaeocystis Pouchetii</i> . . . . .	...	...	...	...	...	...	...	+	...	...	...	...
<i>Coccolithophora pelagica</i> . . . . .	...	...	...	...	...	...	...	...	...	...	...	...
<i>Pontosphaera borealis</i> . . . . .	...	...	...	...	...	...	...	...	...	...	...	...

† Mostly dead specimens.

1908.

25.VII	25.VII	28.VII	28.VII	29.VII	30.VII	30.VII	31.VII	31.VII	31.VII	31.VII	1.VIII	1.VIII	1.VIII	2.VIII	3.VIII
7 a.	8 p.	2·15 a.	2 p.	1·45 p.	8·30 a.	12·15p.	11·30a.	1·45 p.	3 p.	5·30 p.	2·15 a.	8 a.	4 p.	12·30a.	1 p.
—	—	—	75·45	—	—	75·15	75·08	—	ca. 75·0	—	—	74·20	73·58	73·30	73·4
—	—	—	12·15	—	—	8·45	8·0	—	ca. 7·30	—	—	7·0	7·0	6·0	—
1·0	2·0	1·7	1·53	0·9	÷ 0·6	0·5	1·5	2·1	0·6	—	4·5	6·2	7·2	7·0	7·1
—	—	—	31·06	—	—	31·00	30·9	—	29·56	—	—	32·9	33·2	34·0	—
1304	1312	1319	1332	1335	1340	1344	1350	1353	1355	1358	1381	1383	1386	1388	1398
rr	rr	rr	...	...	...	rr	...	...	...	...	...	...	...	...	...
rr	rr	rr	...	...	rr	...	rr	...	...	...	...	...	...	...	...
c	+	c	...	rr	...	...	...	...	...	...	...	...	...	...	...
...	...	...	r	...	...	...	r	rr	rr	rr	rr	rr	rr	rr	...
cc	c	c	r	rr	rr	rr	...	...	...	...	...	rr ¹	rr ¹	rr ¹	...
...	...	rr	...	...	r	+	r	...	...	...	...	...	...	...	...
...	...	...	cc	cc	c	c	+	...	...	...	...	+	r	...	...
c	c	cc	...	...	...	...	...	...	...	...	...	...	...	...	...
...	rr	+	...	...	...	...	rr	...	...	...	...	...	...	...	...
c	c	r	...	...	rr	...	...	rr	...	...	...	...	...	...	...
r	rr	...	rr	...	...	...	...	...	...	...	...	...	...	...	...
(c. sp. rr.)	(sp.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...
r	rr	r	...	r	rr	...	rr	...	...	...	...	...	...	...	...
(c sp. rr.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...
...	...	...	+	r	rr	rr	...	...	...	...	...	...	...	...	...
...	...	...	rr	rr	rr	...	rr	...	...	...	...	...	...	...	...
...	...	rr	...	rr	rr	rr	...	...	...	...	...	...	...	...	...
rr	rr	+	r	rr	+	+	r	...	...	...	...	...	...	...	...
rr	...	rr	r	+	rr	rr	...	...	...	...	...	...	...	...	...
...	...	...	rr	+	r	+	+	+	r	r	...	c	c	rr ¹	...
...
...	...	...	rr	...	rr	...	...	...	...	...	...	+	...	...	...
...	...	...	...	rr	...	...	...	...	...	...	...	+	+	...	...
...	...	...	...	...	...	rr	...	...	...	...	...	r	rr	...	...

Table III.

Date	21.VII	21.VII	21.VII	22.VII	22.VII	22.VII	22.VII	23.VII	23.VII	23.VII	24.VII	24.VII
Time	7 p.	8 p.	9 p.	11 a.	6 p.	10 p.	12 p.	5 a.	8 a.	11:30p.	10 a.	2 p.
W. Latitude	Mouth of the harbour	C. Bis- marck- Marous- sia	Off Marous- sia	N. of Marous- sia	northwards along the coast			77·0	77·15	ca.78·0	ca.78·0	—
N. Longitude								17·15	16·0	c.15·30	c.15·30	—
Temperature of water	ca. 0·0			ca. 1·0	ca. 4·0	ca. 3·0	ca. 3·0	3·15	2·10	1·4	0·7	0·3
Salinity of water....	31·7	31·7	31·7	ca. 30·0	—	—	—	28·06	29·36	—	28·7	—
No. of sample	1242	1243	1244	1270	1276	1279	1289	1290	1291	1299	1301	1303
Tintinnodea												
<i>Cyttarocyclus denticulata</i> , typica .....	...	...	...	...	rr	rr	...	...	...	1	...	...
— — <i>gigantea</i> .....	...	...	rr ¹	...	...	...	...	r	...	...	...	...
— — <i>robusta</i> .....	...	...	...	...	...	...	...	...	...	...	...	...
<i>Psychoyclus obtusa</i> .....	...	rr	...	...	...	...	...	rr	rr	r	...	...
<i>Tintinnus norvegicus</i> , <i>gra-</i> <i>cilis</i> .....	...	...	...	...	...	...	...	...	...	...	...	...
Peridiniales												
<i>Apodinium</i> (?) <i>Chaetoceratis</i>	rr	...	rr	...	rr	...	...	...	...	...	...	...
<i>Ceratium arcticum</i> .....	...	rr	rr	rr	rr	rr	...	rr	rr	...	...	rr
<i>Dinophysis arctica</i> .....	...	...	...	...	...	...	...	...	...	...	...	...
— <i>rotundata</i> .....	...	...	...	...	...	...	...	...	...	...	rr	...
<i>Goniodoma Ostenfeldii</i>...	...	...	rr	...	...	...	...	rr	...	...	...	...
<i>Gonyaulax triacantha</i>...	...	...	...	...	...	...	...	...	...	...	...	...
— <i>sp.</i> .....	...	...	...	...	...	...	...	...	...	...	...	...
<i>Peridinium breve</i> .....	...	...	...	...	...	...	...	...	rr	rr	...	...
— <i>brevipes</i>	r	...	...	...	...	...	...	rr	...	...	...	...
— <i>catenatum</i>	rr	rr	r	...	rr	...	...	...	...	...	...	rr
— <i>conicoides</i> .....	...	...	...	...	...	...	...	rr	+	r	...	...
— <i>curvipes</i>	r	+	r	rr	rr	rr	...	r	r	rr	...	...
— <i>depressum</i> .....	...	rr	rr	...	...	rr	rr	...	...	...	...	...
— <i>islandicum</i>	r	...	...	r	...	...	...	rr	...	...	...	...
— <i>minutum</i> .....	...	...	...	...	...	...	...	rr	...	...	...	...
— <i>ovatum</i> .....	...	...	rr	...	...	rr	...	...	...	r	...	...
— <i>pallidum</i>	r	...	...	...	...	...	...	...	...	...	...	...
— <i>pellucidum</i>	+	r	r	r	...	...	...	rr	r	rr	...	...
— <i>pyriforme</i> .....	...	...	...	...	...	...	...	...	...	...	...	...
— <i>roseum</i> .....	...	r	rr	rr	...	...	...	...	...	rr	...	...
— <i>subinerme</i> .....	...	rr	...	...	...	...	...	...	...	...	...	...
Metazoa												
<i>Calanus finmarchicus</i> .....	...	+	c	r	+	c	cc	...	rr	c	...	...
<i>Oithona similis</i> et Nauplii	...	...	+	...	...	...	...	...	r	+	+	r

¹ Mostly dead specimens.

1908 (continued).

25.VII	25.VII	28.VII	28.VII	29.VII	30.VII	30.VII	31.VII	31.VII	31.VII	31.VII	1.VIII	1.VIII	1.VIII	2.VIII	3.VIII
7 a.	8 p.	2·15 a.	2 p.	1·45 p.	8·30 a.	12·15p.	11·30a.	1·45 p.	3 p.	5.30 p.	2·15 a.	8 a.	4 p.	12·30a.	1 p.
—	—	—	75·45	—	—	75·15	75·08	—	ca. 75·0	—	74·20	73·58	73·30	73·4	73·4
—	—	—	12·15	—	—	8·45	8·0	—	ca. 7·30	—	7·0	7·0	6·0	—	—
1·0	2·0	1·7	1·53	0·9	÷ 0·6	0·5	1·5	2·1	0·6	—	4·5	6·2	7·2	7·0	7·1
—	—	—	31·06	—	—	31·00	3·09	—	29·56	—	32·9	33·2	34·0	—	—
1304	1312	—	1332	1335	1340	1344	1350	1353	1355	1358	1381	1383	1386	1388	1398
...	rr	rr	r	+	+	rr	r	+	+	c	c	+	r	rr	..
...	...	...	...	...	...	...	...	...	...	...	...	...	rr	rr	...
...	...	...	...	...	...	...	rr	+	r	rr	+	r	+	r	...
rr	+	r	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	rr	...	...	...	rr	...	r	r	+	+	...
...
rr	rr	...	rr	...	...	...	...	...	...	rr	rr	rr	+	c	c
...	...	...	rr	...	...	rr	...	...	...	rr	rr	...	rr	rr	+
...	...	...	r	r	...	...	rr	...	...	...	...	...	...	...	rr
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	rr
rr	...	rr	...	...	...	...	...	...	...	...	...	...	...	...	...
r	...	...	...	rr	rr	...	...	...	...	...	...	...	...	...	r
...	rr	rr	...	...	...	...	...	...	rr	...	...	...	...	...	...
rr	...	r	...	r	r	rr	...	rr	...	...	...	...	...	...	...
r	r	...	...	rr	...	rr	...	...	rr	rr	...	...	...	...	...
...	...	...	rr	...	rr	...	r	r	rr	rr	...	rr	...	...	r
r	rr	...	rr	...	rr	...	rr	...	...	...	...	...	...	...	...
...	rr	...	rr	...	...	...	...	...	...	...	...	...	...	...	...
...	r	+	rr	+	r	r	+	+	+	r	r	+	+	c	+
rr	...	rr	r	r	r	r	r	rr	...	rr	rr	rr	r	+	r
rr	+	r	+	+	r	r	+	r	r	r	rr	r	+	+	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	rr	+
...	...	r	...	...	...	...	rr	...	r	...	...	...	...	...	...
...	...	...	...	rr	...	...	rr	rr	...	...	...	...	rr	r	...
...	+
rr	c	r	r	+	+	rr	c	c	c	+	c	+	c	c	...

hyperborea, small quantity of *Coscinodiscus subbuliens*, *Chaet. boreale* and *Ch. Wighami*.

The intermediate group (5 samples) extends from ca. 12° to 8° W.L.; here we have a salinity of ca. 31‰ and a surface temperature of -0.6° to -1.5° C. It is characterized by the following species, which are hardly at all found inside: *Chaetoceras furcellatum*, *Rhizosolenia obtusa*, *Rh. hebetata* f. *semispina*, *Dinobryon pellucidum*, *Cyrtarocydis denticulata typica*. A few species, which very seldom occur in the inner group, appear here more regularly, namely, *Chaet. diadema*, *Peridinium pallidum*, *P. pellucidum* and *P. ovatum*. *Thalassiosira gravida*, which was much reduced, again becomes more frequent in this region. Most of the species prominent in the inner group disappear here or are only present in small quantity.

A couple of samples form the transition to the outer group, to which we ascribe the region from ca. 7° to 6° W.L. and from 75° to 73° N.L. The salinity is here higher (33—34‰) and also the temperature on the surface (6°—7°) than in the other regions; we are here outside the pack-ice. The quantity of the plankton is but small; the diatoms have almost entirely disappeared; characteristic however is the regular occurrence of *Chaetoceras convolutum* in small quantities; further, a number of diatoms of more temperate origin appear irregularly and in few individuals and likewise some Protozoa (see our preceding papers). The most abundant organisms are: *Peridinium ovatum*, *Dinobryon pellucidum*, *Cyrtarocydis denticulata typica* and *robusta*, *Oithona* and Nauplii, and in most samples *Ceratium arcticum*, *Tintinnus norvegicus gracilis* and *Peridinium pyriforme*. In a few samples occurred *Phaeocystis Pouchetii*, *Pontosphaera borealis* and *Coccolithophora pelagica*.

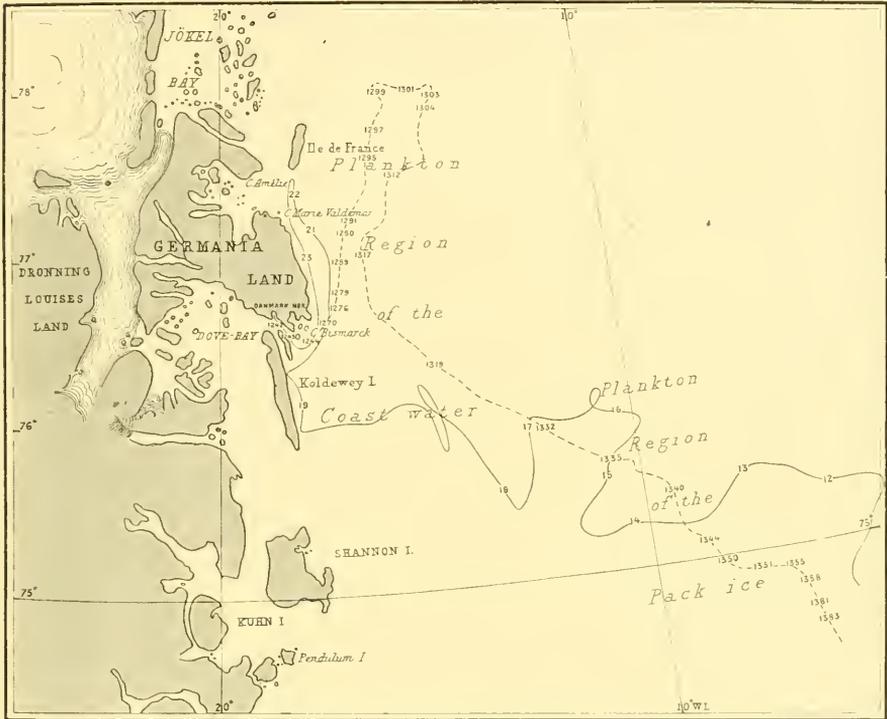
The plankton in the outermost samples corresponds nearest to the "Ceratium arcticum plankton", which Paulsen (1909) has described from North Iceland (the southern boundary of which is placed at ca. 64 N.L. in his fig. 2), but differs from this in the absence of *Ceratium longipes* (the *C. arcticum* most resembling *longipes* is figured in the foregoing paper fig. 16A).

A general review of the plankton of the pack-ice and coastal waters, according to the samples examined, would appear somewhat as follows. In the accompanying sketch map the plankton regions and the places of the samples (the figures refer to the Tables) have been marked out. There are three regions.

1. Innermost the plankton region of the coastal waters (inner group in 1906 and 1908), characterized by diatoms, namely *Chaetoceras* species, *Coscinodiscus subbuliens*, *Fragilaria oceanica* and by *Calanus finmarchicus*.

2. The plankton region of the pack-ice (outer group in 1906, intermediate group in 1908), characterized by *Cyrtarocydis denticulata*, *Rhizosolenia hebetata semispina* and *R. obtusa*, *Chaet. furcellatum*, *Peridinium subinermis*, *P. pellucidum* and *P. curvipes*, and *Dinobryon*.

3. The plankton region of the open water (outermost group in 1908) with small quantities of characteristic species: *Cera-*



Sketch-map of the area investigated. The full line signifies the path of the Expedition into the coast, the broken line the way out. The figures refer to nos. of samples in the plankton tables.

tium arcticum, *Peridinium ovatum*, (*Pontosphaera borealis* and *Coccolithophora?*).

There is the probability that the plankton region of the pack-ice corresponds to the East Icelandic Polar Current, whilst the plankton region of the coastal water corresponds to the coastal waters mixed with water from the melting snow of the land. Lastly, the plankton region of the open sea may probably be referred to the circulating central area of the Greenland Sea. This agrees with what Damas and Koefoed say (l.c. p. 328): "les diatomées qui seules jouent un rôle important dans le phytoplankton, prennent un deve-

loppement beaucoup plus considérable dans le courant polaire que dans la région centrale de la Mer du Groenland”.

We must remember here, however, that our knowledge of the plankton of these waters is restricted to the summer season.

We may remark, finally, that oceanic plankton forms, e. g. *Rhizosolenia styliformis*, *Certium arcticum*, are carried right in to the coast, where they may be considered to perish sooner or later.

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