BERGENS MUSEUM

HYDROGRAPHICAL AND BIOLOGICAL INVESTIGATIONS

IN

NORWEGIAN FIORDS

By

O. NORDGAARD

THE PROTIST PLANKTON AND THE DIATOMS IN BOTTOM SAMPLES

BY

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WITH 21 PLATES AND 10 FIGURES IN THE TEXT

BERGEN
JOHN GRIEG
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III. BOTTOM-LIFE.

NOTES.

When dredgings have been made, soundings, both at the start and finish of the haul, have generally been taken. So that when, for instance, Oxsund 450—630 m. is noted, it is to be understood that the depth was 630 m. where the dredge was thrown out, and 450 m. where the dredging was ended.

A. Results of Dredgings.

a. Dredging stations. 1899—1900.

Nr.	Date	Name	Dept in metres	Temperature of the bottom layer C°	Salinity of the bottom layer ‰	Nature of the bottom	Remarks
	1899						
1	13/2	Henningsværstrømmen	20—40	1.75	33.12	Stones and *Lithothamnion*	Between Øst- and Vestvaagø.
2	14/2	Liland, Østnesfjord	30—40			Clay	Østvaagø, Lofoten.
3		Langstrand	50—70			Pebbles	Østvaagø, Lofoten.
4	15/2	Skroven—Guldbrandsøerne				Clay	Østlofoten.
5	16/2	Brettesnes—Skroven	350—410	6.3	35.08	Clay	Østlofoten.
6	—	Mouth of Raftsund	250—300			Clay	Between Hindø and Østvaagø.
7	—	At Digermulen	100—150			Stones and sand	In Raftsund.
8	17/2	Oxsund	450—630	6.3	35.08	Clay	Between Hammerø and Lundø.
9	18/2	Sagfjord	200	6.4	34.89	Clay	At the inner end of Furnesvæggen.
10	22/2	Mortsund I	230	6.6	35.03	Clay	SE of Mortsund.
11	—	Mortsund II				Clay	SE of Mortsund.
12	—	Mortsund III	100—120			Sand and stones	SE of Mortsund.
13	1/3	Moskenstrømmen I	204	6.0	34.97	Sand and clay	Between Værø and Moskenesø.
14	—	Moskenstrømmen II	150	5.0	34.40	Shells and stones	Between Værø and Moskenesø.
15	3/3	Kirkfjord I	108—130	2.7	33.48	Clay	At little inside the Vorfjord.
16		Kirkfjord II	50	2.5	33.40	Clay	In the middle of the Kirkfjord.
17	—	Kirkfjord III	70—80			Clay and stones	At Tennes.
18	—	Kirkfjord IV	30—50			Shells and clay	In the Vorfjord.
19	4/3	Reine I	150	6.7	34.70	Sand	11 miles SE of Reine.
20	6/3	Ure I	230	6.8	34.97	Clay	9 1/2 miles SSE of Ure.
21	—	Henningsvær I	110	6.2	34.52	Rocky	6 miles SW b W 1/2 W of Henningsvær.
22	10/3	Risværtlaket	150—180	1.6	33.40	Clay	Outside the Ogstjord, off the Pundsletvaag.
23	14/3	Ogsfjord I	100	2.1	33.10	Clay	At the head of the fiord.
24	16/3	Tranødybet	450—530	6.3	35.06	*Lophohelia*	Between Tranø and Lødingen.
25	—	Tranødybet	607—640	6.3	35.06	Clay	Between Tranø and Lødingen.
26	17/3	Kanstadfjord, inside the ridge	30—90	1.6	33.48	Sand, clay and stones	At Handø.
27	—	Kanstadfjord, outside the ridge	95	4.4	34.06	Rocky	At Handø.
28	22/3	Røsthavet	350—500	4.05	35.13	?	68° 3′ N., 10° 0.5′ E.
29	24/3	Røst I	120	4.25	34.60	Fragments of shells	Outside Røst.
30	—	Røst II	100	4.85	34.79	Pebbles and fragm. of shells	Outside Røst.
31	25/3	Røst II	150	6.7	35.11	Fragments of shells	Inside Røst.
32	28/3	Tysfjord I	500	6.3	35.11	*Lophohelia*	Inside Skarberget.
33	7/4	Stene	120—200	6.6	34.99	Rocky	Vestlofoten.
34	—	Reine	100	4.5	34.42	Rocky	Vestlofoten.
35		Moskenstrømmen	90	4.1	34.29	Stones	Between Moskenesø and Værø.
36	11/4	Gaukværø	250	5.2	34.86	Clay	68° 34′ N., 14° 17′ E.
37	14/4	Malangenfjord	380	4.1	34.67	Clay	Off Stønnesbotn.
38	—	Malangen II	100—200			Clay, Rocky	Between Stønnesbotn and Lysbotn.
39		Malangen III	200	3.7	34.54	Clay, Rocky	Between Stønnesbotn and Lysbotn.
40	15/4	Stønnesbotn	40—80			Rocky	At Senjen Island.
41	19/4	Kvænangen II	90	0.75	34.21	Clay, Stones	At Noklen island.
42	20/4	Jøkelfjord I	110	1.0	34.29	Clay	At the head of the fjord.
43	—	Jøkelfjord II	80			Clay	At the head of the fjord.
44	21/4	Jøkelfjord III	110	1.4	34.35	Rocky	Off Tverfjord.
45	—	Kvænangen	300—343	2.3	34.49	Clay	Between Spildern and the northern mainland.
46	24/4	Ingøhavet	270—315	3.45	35.24	Rocky	71° 10′ N., 23° 10′ E.
47	25/4	Troldfjordsund	30—40			Sand	Between Ingø and Rolfsø.
48		Breisund	100	1.7	34.51	Sand, Rocky	Between Havø and Hjelmesø.
49	26/4	Repvaag harbour	10			Sand	In Porsangerfjord.
50	27/4	Porsangerfjord	200	0.2	34.18	Clay, Rocky?	Between Great and Little Tamsø.
51	—	Porsangerfjord	70			Rocky	Between Great and Little Tamsø.
52	—	Porsangerfjord	30—50			Pebbles, *Lithothamnia*	Between Great and Little Tamsø.
53	3/5	Lyngenfjord II	250	2.85	34.97	Clay	Off the Kaafjord.
54	—	Lyngen III	320	3.65	34.81	Clay	Between ytre Gamvik and Elo.
	1900						
55	23/3	Østnesfjord I	20—30			Stones and *Lithothamnia*	At the head of the fjord.
56	—	Østnesfjord II					Between Vaterfjord and Folstad.
57	—	Østnesfjord III					Off Helle.
58	26/3	Balstad	150—180				Vestlofoten.
59	30/3	Landegø	400	6.2	35.13	Clay	67° 22′ N., 14° 4′ E.
60		Arnø	300—400	6.55	35.18	Rocky	67° 11′ N., 14° 2′ E.
61	—	Sund harbour	0			Sand	In Gildeskaal.
62	31/3	Morsdalfjord (S. Beierfjord)	50—150			Clay	Between Sandhornø and Sund.

Nr.	Date	Name	Depth metres	Temperature of the bottom layer C°	Salinity of the bottom layer ‰	Nature of the bottom	Remarks
	1900						
63	31/3	N. Beiersfjord	50			Fragments of shells	Between Sandhorno and Beieren.
64	2/4	Skjerstadfjord I	30—50			Sand, Clay	The head of Skjerstadfjord.
65	—	Skjerstadfjord II	100—185	3.35	33.99	Clay	1½ miles from the end.
66	—	Skjerstadfjord III	230	3.2	33.99	Rocky	
67		Skjerstadfjord IV	330	3.15	34.04	Clay	
68	3/4	Skjerstadfjord VI	100—150			Clay	At Fauske.
69	—	Skjerstadfjord VII	470—490	3.15	33.99	Clay	Off Fauske.
70	—	Skjerstadfjord VIII	190			Clay	
71	—	Skjerstadfjord IX	30—50			Rocky	
72	—	Skjerstadfjord X	10—30			*Lithothamnion*	Mouth of the Misværfjord.
73	—	Skjerstadfjord XI	50			Shells	Misværfjord.
74	4/4	Skjerstadfjord XVI	10—20			Sand	Inside Saltstrommen.
75	5/4	Saltenfjord I	15—20			Sand, Clay	Seivaagen.
76	—	Saltenfjord II	320—370	6.65	35.13	Clay	Inside the mouth.
77	6/4	Foldenfjord I	530	6.55	35.00	Clay	Between Hjerto and the southern mainland.
78	7/4	Grøto	6—24			Sand	

In the list of animals collected, I have also included some which I caught during a short trip to Finmark in the months of August and September 1894. I have added the year (1894), after the name of place, for all such.

b. Outcome of Dredgings.

Porifera.[1])

W. Lundbeck, Mag. scient., Copenhagen, determ.

Asbestopluma pennatula, O. Schmidt.

The Lyngen Fiord, 300 m.

Cladorhiza abyssicola, M. Sars.

The Salten Fiord, Skroven (Vest Fiord), 400 m.

Bubaris vermiculata, Bowerbank.

Reine (the Vest Fiord), 150 m.

Stylocordyle borealis, Lovén.

The Skjerstad Fiord, 230 m.

Tentorium semisuberites, O. Schmidt.

The Skjerstad Fiord, 230 m.

Halicnemia verticillata, Bowerbank.

Moskenstrommen, 200 m.

Trichostemma hemisphaericum, M. Sars.

The Lyngen Fiord, 250 m.

Tethya lyncurium, Johnst.

The Porsanger Fiord, 200 m.

Craniella cranium, Müll.

The Sag Fiord, 200 m.

[1]) Not many sponges were found, but those which were obtained were classified at once by Mag. Lundbeck, together with material belonging to the Danish Ingolfexpedition. Only a few species are noted here, the names of which Mr. Lundbeck has kindly furnished me with.

Hydrozoa.

Hydroida.

Miss Bonnevie, Kristiania, determ. Remarks by the author.

Corymorpha sarsi, Steenstrup.

Mehavn (1894).

Tubularia indivisa, Lin.

Svolvær (1894); Balstad (1896); Breisund, 100 m.; the Porsanger Fiord, 200 m.

Tubularia larynx, Ell. & Sol.

Nordkyn (1894).

Tubularia variabilis, Bonn.

The Porsanger Fiord, 200 m. This species has previously been found at Rauberget in the Trondhjem Fiord, and by the Norwegian North Atlantic Expedition at stations 325 and 362.

Tubularia humilis, Allman.

Svolvær (1894); Nordkyn (1894).

Perigonimus repens, Wright.

Balstad (1996). Has been observed from Bergen to Lofoten.

Dicoryne conferta, Alder.

Svolvær (1894).

Hydractinia echinata, Flemming.

Svolvær (1894); Balstad (1896).

Eudendrium rameum, Pall.

The Ostnes Fiord.

Eudendrium insigne, Hincks.

Moskenstrommen. Only collected on the Norwegian coast in Moskenstrømmen.

Eudendrium tenellum, Allman.

Moskenstrommen.

Halecium halecinum, Lin.

Napstrommen (1896); the North Cape (1894).

Halecium labrosum, Alder.

Moskenstrommen; the North Cape (1894).

Halecium tortile, Bonn.

Balstad (1897). Up to the present, only known from Balstad (Lofoten).

Halecium scutum, Clark.

The North Cape (1894); Nordkyn (1894).

Halecium sessile, Norman.

The North Cape (1894).

Halecium schneideri, Bonn.

Nordkyn (1894).

Lafoëa serpens, Hassal.

The Ingo Sea, 300 m.; Nordkyn (1894).

Lafoëa abietina, M. Sars.

Moskenstrommen; Balstad (1897); The Ingo Sea, 300 m.; The North Cape (1894).

Lafoëa gracillima, Alder.

Balstad (1897); The Ingo Sea, 300 m.; Malangen 100—200 m.

Lafoëa dumosa, Flemming.

Hammerfest (1894).

Lafoëa fruticosa, M. Sars.

Moskenstrommen; Balstad (1897); Malangen, 100—200 m.; Hammerfest (1894); Sværholt (1894); The Porsanger Fiord, 200 m.

Lafoëa symmetrica, Bonn.

The Ingo Sea, 300 m. This species has been found, in addition to the place here mentioned, at station 313 (The Norw. North. Atl. Exp.).

Campanularia verticulata, Lin.

Malangen, 100—200 m.; Hammerfest (1894); The North Cape (1894); The Porsanger Fiord; Nordkyn.

Campanularia geniculata, Müll.

Svolvær (1894); The North Cape (1894); Nordkyn (1894).

Campanularia dichotoma, Lin.

The North Cape (1894).

Campanularia hyalina, Hincks

Balstad (1897); The Porsanger Fiord, 200 m. Up to this time, the most northerly known limit was The Trondhjem Fiord.

Campanularia johnstoni, Alder

Balstad (1897); Hammerfest (1894); Mehavn (1894).

Campanularia hincksi, Alder.

Balstad (1897).

Campanularia calyculata, Hincks.

The North Cape (1894); Nordkyn (1894).

Campanularia volubilis, Lin.

Moskenstrommen; Balstad (1897).

Campanularia syringa, Lin.

Balstad (1897).

Sertularella polyzonias, Lin.

Hammerfest (1894); Breisund, 100 m.; The North Cape (1894); Nordkyn (1894).

Sertularella tricuspidata, Alder.

Moskenstrommen; Hammerfest (1894); Ingohavet, 300 m.; Breisund; The North Cape (1894).

Dynamena pumila, Lin.

Malangen.

Dynamena tamarisca, Lin.

Moskenstrommen; Svolvær (1894); Hammerfest (1894).

Thuiaria abietina, Lin.

Moskenstrommen; Hammerfest (1894); Nordkyn (1894).

Thuiaria argentea, Ell. & Sol.

The North Cape (1894).

Thuiaria filicula, Ell. & Sol.

Balstad (1897); Breisund, 100 m.; The North Cape (1894); Nordkyn (1894); Mehavn (1894).

Thuiaria articulata, Pall.

Malangen, 100—200 m.

Thuiaria thuja, Lin.

Svolvær (1894); Breisund, 100 m.; The North Cape (1894).

Hydrallmania falcata, Lin.

Svolvær (1894); The Kanstad Fiord, 20—90 m.

Aglaophenia integra, G. O. Sars.

Ingohavet, 300 m.

Aglaophenia pourtalesi, Verrill.

Ingohavet, 300 m. The previously known distribution extended from Espevær to the Trondhjem Fiord.

Antennularia antennina, Lin.

Hammerfest (1894); Breisund.

Papers about hydroids: Kristine Bonnevie, Hydroida, The Norw. North Atl. Exp.

On p. 98 *et seq.* of this work will be found a complete list of papers.

Scyphozoa.

Lucernaria quadricornis. MÜLL.

Hammerfest (1894); Mehavn (1894); The Skjerstad Fiord.

M. SARS has given a detailed description of this animal.[1] He notes the following places where it has been found: Glesvaer, Solsvik, Floro, Kinn, all of these being on the Bergen coast. My locality in the Skjerstad Fiord (S. XVI) lies just inside Saltstrommen. Here several specimens of *Lucernaria* were found on algae at a depth of from 10—20 m.

Anthozoa.

Alcyonaria.

JAMES A. GRIEG determ. Remarks by the author.

Alcyonium digitatum. LIN.

The Skjerstad Fiord (S. X), 10—30 m. The locality in the Skjerstad Fiord is the northern limit for this species as far as is now known. Its distribution, according to Dr. WALTER MAY, is confined to Norway and England.[2]

Paraspongodes fruticosa. M. SARS.

The Skjerstad Fiord (S. III), 230 m.; the sea NW of Rost, 700 m.; The Porsanger Fiord, 200 m.

The species is common in the Arctic Sea.

Paraspongodes rosea, DAN. & KOR.

Balstad, 80 m.

Paramuricea placomus. LIN.

Arno, 300—400 m.

The species has not, up the present, been found north of this place. In „Beretning om en zoologisk Reise (1849)" M. SARS mentions the following animals belonging to this group: *Primnoa lepadifera,* LIN., from the Ox Fiord and Hammerfest, and *Paragorgia arborea,* LIN, from the Ox Fiord. The last mentioned species has been taken at two stations (183—260 m.), in the Murman Sea by the Austro-Hungarian Expedition.[3]

Isidella hippuris. GUNNERUS.

The Sag Fiord, 200 m.; Tranodybet, 607—640 m.; Oxsund, 600 m.; Brettesnes-Skroven, 350—400 m.

STORM has caught this species in the Trondhjem Fiord, according to GRIEG[4], and GUNNERUS mentions it from Smolen. Under the name of *Mopsea borealis* it is fully described by G. O. SARS[5] from specimens caugth at the fishing station Skroven in Lofoten.

Pennatula aculeata. DAN. & KOR.

At Risvaer (Lofoten), 150—180 m.

Kophobelemnon stelliferum. O. F. MÜLL.

The Salten Fiord, 320—380 m., Landego, 400 m.

[1] Cfr. *Fauna littoralis Norvegiae,* Part I, pag. 20.

[2] Cf. WALTER MAY, Beiträge zur Systematik und Chorologie der Alcyonaceen, p. 104. Abdruck aus der jenaischen Zeitschrift f. Naturw. Vol. XXXIII, N. F. XXVI.

[3] Cf. STUXBERG. Faunaen pa och kring Novaja Semlja, p. 163.

[4] Bidrag til kjendskaben om de nordiske alcyonarier, p. 5. Berg. Mus. Aarb. 1893.

[5] On Some Remarkable Forms of Animal Life, I, p. 50, pl. V, figs. 1—23.

According to GRIEG[1], this species was known from the Kristiania Fiord to the Trondhjem Fiord. Its northern limit is now the Vest Fiord.

Cladiscus gracilis. DAN. & KOR.

The Skjerstad Fiord, 230 m.

GRIEG mentions that the type-specimen was from Slotholmen in Nordland (l. c. p. 18). The species has also been caught in the Trondhjem Fiord by V. STORM.

Zoantharia.

JAMES A. GRIEG determ. Remarks by the author.

Ulocyathus arcticus. M. SARS.

The Salten Fiord, 320 m.; Landego, 400 m.; The Folden Fiord, 530 m.; Oxsund, 600 m.; The Sag Fiord, 200 m.; Mortsund, 200 m.; Ure, 250 m.; Reine, 150 m.; The Lyngen Fiord, 300 m.

During his expedition in the summer of 1849, MICHAEL SARS found this peculiar species in the Ox Fiord, and in the account a short description was given of it. Later on, it was thoroughly described.[2] A contribution respecting its anatomy has been made by Miss EMILY ARNESEN.[3] The Austro-Hungarian expedition collected this species at two stations in the Murman Sea. (183 m., 230 m.).

Lophohelia prolifera. PALL.

Tranodybet, 450—530 m.; The Tys Fiord (T. I), 500 m.

This species was seen in large quantities especially at the place last mentioned. The *Lophohelia*-reef at the mouth of the Tys Fiord is, as far as I know, the most northerly which has hitherto been observed. Later on in this treatice, I will refer somewhat more in detail to this interesting formation.

Actiniaria.

DR. CARLGREN, Stockholm, determ. Remarks by the author.

Protanthea simplex. CARLGR.

The Tys Fiord (T. I) 500 m. On *Lophohelia prolifera,* PALL.

CARLGREN says, in a written communication to me, that *Protanthea* is only found in Bohuslen and on the Norwegian coast. The distribution of this species hitherto known is Bohuslen—Lofoten.

Edwardsia andresi. DAN.

The Lyngen Fiord (L. III), 300 m.; The Skjerstad Fiord, 320 m.

It was caught by the Norw. North Atl. Exp. at St. 253 (The Skjerstad Fiord, 481 m.).[4]

Paraedwardsia arenarea, CARLGR. nov. gen. nov. sp.

The Skjerstad Fiord, 320 m.

The new genus and species will later on be thoroughly described by Dr. CARLGREN. In a written communication to me he says:—„*Paraedwardsia* is characterized by 8 complete mesenteries like *Edwardsia,* but the scapus in *Paraedwardsia* is furnished with

[1] Oversigt over Norges pennatulider, p. 16. Berg. Mus. Aarb. 1891.

[2] *Fauna littoralis Norvegiae* Part II, p. 73, pl. 10, figs. 18—27.

[3] Beiträge zur Anatomie und Histologie von *Ulocyathus arcticus* etc. Archiv f. Math. og Naturv. Vol. XX. Nr. 9.

[4] Cfr. DANIELSEN, Actinida, p. 111.

papilla like *Halcampa*, and foreign bodies (grains of sand) are fastened to these papillæ.

Bolocera tuediae, Johnst.

The Malangen Fiord, 380 m.; Stonnesbotn, 40—80 m.

Tealia (Madoniactis) lofotensis, Dan.

Stonnesbotn, 40—80 m.; The Ogs Fiord I, 100 m.

The Norw. North Atl. Exp. caught this species in Saltstrommen.

Actinostola callosa, Verr.

Stonnesbotn, 40—80 m.; The Jokel Fiord, 80—100 m.

This species was also observed in several other fiords, but no specimen was preserved.

Metridium dianthus, Ellis.

Kvænangen II, 90 m.

M. Sars in his account of his expedition in 1849 says that this form was commonly found between the pebbles on the beach in the Ox Fiord and at Hammerfest.

Chondrachtinia digitata, O. F. Müll.

The Ogs Fiord, 100 m.; Stonnesbotn, 40—80 m.; Malangen, 100—200 m.; The Jokel Fiord I, 100 m.; The Porsanger Fiord, 200 m.

This form is very common in the fiords of Northern Norway.

Chondrachtinia nodosa, Fabr.

The Porsanger Fiord, 200 m. (3 specimens).

This is surely the first time that this genuine arctic species is noted from any Norwegian fiord. The Norw. North. Atl. Exp. collected it at St. 290 (between Norway and Beeren Eiland. Danielsen[1]) mentions it under the name of *Actinauge (Verrill) nodosa* Fabr.

Carlgren says in a written communication that he has numerous specimens of Fabricius' species from Greenland, Spitzbergen and Beeren Eiland. At the same time, he gives the important information that *Actinida nodosa*, Fabr. is not identical to the chief variety of *Actinauge nodosa*, Verrill. The latter has therefore since been named *Actinauge verrilli*. On the other hand, Carlgren declares that *Actinauge nodosa var. tuberculosa*, Verr. = *Chondrachtinia nodosa*, Fabr., which species is also found on the east coast of North America.

Epizoanthus erdmanni, Dan.

Malangen, 380 m.; Lyngen II, 280 m.; Lyngen III, 300 m.; Kvænangen, 300—313 m.

The Norw. North Atl. Exp. took this species at four different places.

Isozoanthus (Epizoanthus) arborescens, Dan.

Mortsund I, 200 m.; Tranodybet, 607—640 m.

Danielsen[2]) notes this species from St. 149 (The Vest Fiord). Carlgren has classified *Isozoanthus* as a new genus, which differs from *Parazoanthus* in wanting a ring sinus.

[1]) Actinida, p. 42.

[2]) Actinida, p. 129.

Crinoidea.[1])

James A. Grieg determ.

Rhizocrinus lofotensis, M. Sars.

Tranodybet, 640 m.; Oxsund, 600 m.; The Sag Fiord, 200 m.; Brettesnes, 350—400 m.; Reine, 150 m.; Moskenstrommen, 200 m.

Antedon tenella, Retzius.

The Beier Fiord, 30—150 m.; The Skjerstad Fiord, 330—490 m.; The Tys Fiord, 500 m., Malangen, 100—200 m.

Ophiuroidea.

James A. Grieg determ.

Ophiura albida, Forbes.

The Salten Fiord, 15—20 m.; Groto, 4 m.; The Ostnes Fiord, 30 m.; The Trold Fiord, 40 m.

Ophiura sarsi, Lütken.

Numerous specimens both from the outer and inner fiord districts, 30—600 m., and on soft as well as hard bottom.

Ophiura robusta, Ayres.

The Skjerstad Fiord, on hydroids; The Ogs Fiord, 100 m.; The Kirk Fiord, 30—50 m.; The North Cape (1894).

Ophiura carnea, M. Sars.

The Sag Fiord, 100 m.

Ophiocten sericeum, Forbes.

Was seen at a number of stations, both out at sea and in the fiords, 100—160 m.

Amphilepis norvegica, Ljungman.

Landego, 300—400 m.; The Salten Fiord, 220—380 m.; The Folden Fiord, 530 m.; Oxsund, 600 m.; Brettesnes—Skroven, 350—400 m.; Tranodybet, 640 m.

Ophiopholis aculeata, Lin.

Exceedingly common at most of the stations, 10—700 m.

Ophiacantha bidentata, Retz.

Commonly distributed. Especially numerous in the Ogs Fiord, the Porsanger Fiord etc.

Ophiacantha abyssicola, G. O. Sars.

Sea NW of Rost, 300—500 m.

Ophiacantha spectabilis, G. O. Sars.

Arno, 300—400 m.; The Tys Fiord, 500 m.; Tranodybet, 450—530 m.

Ophiotrix fragilis, O. F. Müller.

Rost, 100 m.

Ophioscolex glacialis, Müll. & Trosch.

The Skjerstad Fiord, 470—490 m.; The Salten Fiord, 220—380 m.; Landego, 200—400 m.; The Folden Fiord, 530 m.; The

[1]) Cfr. Grieg, Oversigt over det nordlige Norges echinodermer. Berg. Mus. Aarb. 1902, No. 1.

Sag Fiord, 200 m.; The Tys Fiord, 500 m.; Skroven, 200—400 m.; Kvænangen, 300—343 m.

Ophioscolex purpureus, Düb. & Kor.

The Tys Fiord, 500 m.

Gorgonocephalus lamarcki, Müll. & Trosch.

The Sea west of Ingo, 300 m.

Asteroidea.

James A. Grieg determ.

Pontaster tenuispinus, Düb. & Kor.

From a number of stations between Salten Fiord and Malangen, 100—640 m.

Platonaster parelii, Düb. & Kor.

Balstad, 150 m.; The Folden Fiord, 530 m.; Svolvær (1894); Sværholt (1894).

Ctenodiscus crispatus, Retz.

Of very common occurrence on the mud in the basins of the fiords betveen the Skjerstad and Porsanger fiords, 30—530 m.

Leptoptychaster arcticus, M. Sars.

From numerous stations, 30—400 m.

Astropecten irregularis, Pennant.

Seivaagen (Salten Fiord), 15—17 m.

Psilaster andromeda, Müll. & Trosch.

The Beier Fiord, 50 m.; The Skjerstad Fiord, 30—50 m.; Landego, 200—400 m.; The Folden Fiord, 530 m.; Mortsund (Vest Fiord), 200 m.; the mouth af Raftsund, 250—300 m.

Pentagonaster granularis, Retz.

The Salten Fiord, 320—380 m.; The Ostnes Fiord, 130 m.; Reine, 100 m., Mortsund, 200 m.; Balstad, 150 m.; Moskenstrømmen, 200 m.; Røst, 150 m.; Malangen, 100—200 m.; The North Cape (1894); Sværholt (1894).

Hippasterias phrygiana, Parelius.

The Skjerstad Fiord, 230 m.; Sværholt (1894).

Poraniamorpha rocea, Dan. & Kor.

The Folden Fiord, 530 m.

Solaster papposus, Lin.

The Skjerstad Fiord, 10—30 m.

Solaster endeca, Retz.

Balstad, 30—70 m.; The Ostnes Fiord, 30 m.

Solaster syrtensis, Verr.

The Beier Fiord, 50 m.

Pteraster pulvillus, M. Sars.

Henningsvær, 150 m.; Sværholt (1894).

Pteraster militaris, O. F. Müller.

The Tys Fiord, 500 m.; Tranødybet, 450—530 m.; Reine (Vest Fiord); Sea W of Ingo, 300 m.; The Jøkel Fiord, 100 m.; Sværholt (1894).

Cribrella sanguinolenta, O. F. Müller.

Common, especially on the Lofoten banks, 30—300 m.

Pedicellaster typicus, M. Sars.

Balstad (Vest Fiord), 80 m.

Stichaster roseus, O. F. Müller.

The Ostnes Fiord, 130 m.

Asterias glacialis, Lin.

Moskenstrommen, 90 m.; The Kanstad Fiord, 30—90 m.; Breisund, 100 m.

Asterias mülleri, M. Sars.

Occurs from a number of stations between The Skjerstad Fiord and Sværholt, 10—250 m.

Asterias lincki, Müll. & Trosch.

The Kanstad Fiord, 90 m.; The Jøkel Fiord, 60—100 m.

Asterias rubens, Lin.

From several localities in Lofoten.

Brisinga coronata, G. O. Sars.

The Folden Fiord, 530 m.

Echinoidea.

James A. Grieg determ.

Echinus norvegicus, Düb. & Kor.

Moskenstrommen, 200 m., Røst, 150 m.

Echinus elegans, Düb. & Kor.

The Tys Fiord, 500 m.

Echinus esculentus, Lin.

Malangen, 100—200 m.

Strongylocentrotus drøbachiensis, O. F. Müll.

From 13 places between Skjerstad Fiord and Sværholt.

Echinocyamus pusillus, O. F. Müll.

Skroven (Vest Fiord), 200—400 m.; Moskenstrommen 90 m.; Røst, 100 m.

Schizaster fragilis, Düb. & Kor.

Landego, 300—400 m.; The Kanstad Fiord, 30—90 m.; The Kirk Fiord, 70—100 m.; Malangen, 100—200 m.

Spatangus purpureus, O. F. Müll.

The Skjerstad Fiord, 330 m.; The Ostnes Fiord; Moskenstrommen, The North Cape (1884), Sværholt (1894).

Echinocardium cordatum, Pennant.

Sværholt (1894).

Echinocardium flavescens, O. F. Müll.

The Salten Fiord, 15—20 m., Stene (Vest Fiord), 120—200 m.; Troldfiordsund, 40 m.; Sværholt (1894).

Holothurioidea.

Dr. Hjalmar Östergren, Upsala, determ.[1]

Stichopus tremulus, Gunnerus.

The Salten Fiord, 320—380 m.; Landego, 300—400 m.; Balstad, 150 m.; Balstad (13/4 1897), in the stomach of cod (*Gadus callarias*).

Bathyplotes natans, M. Sars.

The Folden Fiord, 530 m.; Oxsund, 600 m.

Mesothuria intestenalis, Ascanius.

The Folden Fiord, 530 m.; Oxsund, 600 m.

Cucumaria frondosa, Gunnerus.

Balstad (1897); Reine, in the stomachs of cod (*Gadus callarias*); Rost, in the stomachs of cod; Troldfiordsund, 30—40 m.

Cucumaria hispida, Barrett.

The Salten Fiord, 320—380 m.; Landego 300—400 m.; The Sag Fiord, 200 m.; Oxsund, 600 m.; Skroven, 200—400 m.; Brettesnes, 350—400 m.; Tranodybet, 607—640 m.

Phyllophorus pellucidus, Fleming.

Digermulen, 100—150 m.; Kvænangen, 90 m.; Rost, in the stomachs of haddock (*Gadus æglefinus*).

Psolus phantapus, Strussenfeldt.

The S. Beier Fiord, 30—150 m.; The Ostnes Fiord, 50—70 m.; Mehavn (1894).

Lapidoplax buski, M'Intosh.

The Kirk Fiord, 50 m.

Myriotrochus rinki, Steenstrup.

The Lyngen Fiord, 250 m.; Kvænangen, 300—343 m.; The Jokel Fiord, 100 m.

Myriotrochus vitreus, M. Sars.

Brettesnes, 350—400 m.

Nemertinea.[2]

Dr. R. C. Punnett, Cambridge, determ.

Lineus scandinaviensis, Punnett, n. sp.

The Jokel Fiord, 100 m.

Lineus cinereus, Punnett, n. sp.

The Tys Fiord, 500 m., on *Lophohelia*.

Eunemertes nordgaardi, Punnett, n. sp.

The Salten Fiord, 200 m.; Balstad, 150 m.

Amphiporus pusillus, Punnett, n. sp.

Lofoten (exact locality uncertain).

[1]) Cf. Östergren, The Holothurioidea of Northern Norway. Berg. Mus. Aarb. 1902.

[2]) A description of the new species here mentioned will be found in Dr. Punnett's treatise, On the Nemerteans of Norway. Bergens Mus. Aarb. 1903, Nr. 2.

Amphiporus magnus, Punnett, n. sp.

The Tys Fiord, 500 m.; on *Lophohelia prolifera*.

Amphiporus thompsoni, Punnett.

Balstad, 50 m.; The Porsanger Fiord, 200 m.

Drepanophorus borealis, Punnett.

The Lyngen Fiord II, 250 m.

Annelida.

Polychæta.

O. Bidenkap, Kristiania, and G. M. R. Levinsen, Copenhagen, determ. Remarks by the author.

Harmothoë oculinarum, Storm.

Gankværo, 250 m.

The species had previously been known as distributed from Bommeloen to The Trondhjem Fiord.

Harmothoë mollis, M. Sars.

Reine (Vest Fiord), 150 m.

According to Bidenkap[1]) this species is rare on the Norwegian coast.

Harmothoë rarispina, M. Sars.

The Skjerstad Fiord (S. XVI); Malangen, 100—200 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.; The Porsanger Fiord, 200 m.

Harmothoe propinqua, Malmgren.

Henningsværstrommen, 20—40 m.

The northern limit for this species hitherto was The Trondhjem Fiord.

Harmothoë sarsi, Kinberg.

The Sag Fiord, 200 m.; Lyngen III, 300 m.; The Jokel Fiord, 100 m.

Harmothoë nodosa, M. Sars.

Malangen, 100—200 m.; The Skjerstad Fiord, 10—20 m.; Breisund, 100 m.

Harmothoë imbricata, Lin.

Napstrommen (Lofoten); Troldfiordsund, 40 m.; Særholt (1894); The Kjølle Fiord (1894).

Harmothoë impar, Johnst.

The S. Beier Fiord, 50—150 m.; The Skjerstad Fiord, 230 m.; The Tys Fiord, 500 m.; Ingohavet (hav = sea), 300 m.

Harmothoë clavigera, M. Sars.

The list of places where found is lost. The species has previously been caught near Christiansund by M. Sars and in The Trondhjem Fiord by Storm. I caught specimens in 1899, my district was then The Beier Fiord—The Porsanger Fiord. So that this species is also found north of the arctic circle.

[1]) O. Bidenkap, System. oversigt over Norges Annulata Polychæta. Krist. Vid. Selsk. Forh. 1894. No. 10.

Harmothoë asperrima, M. Sars.

Malangen, 100—200 m.

Hitherto the northern known limit for this species had been Bodø.

Lepidonotus squamatus, Lin.

Svolvær (1894); Napstrommen (1897), 30—40 m.

Lepidonotus cirrosus, Pall.

The Beier Fiord, 50 m.; The Sag Fiord, 200 m.

Lepidonotus amondseni, Malmgren.

Stonnesbotn, 40—80 m.

The Trondhjem Fiord was previously the northern limit for this species.

Aphrodite aculeata, Lin.

Moskenstrommen, 200 m.; Tranødybet, 607—640 m.

Laetmonice filicornis, Kinberg.

The Folden Fiord, 530 m.; Landego, 200—400 m.; Oxsund, 600 m.; The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Gaukværo, 250 m.; Malangen, 100—200 m.

Leanira tetragona, Kinb.

The Skjerstad Fiord (several places); The Salten Fiord, 200 m.; Landego, 200—400 m.; The Folden Fiord, 530 m.; Risvær, 150—180 m.; Malangen, 380 m.

Eumida sanguinea, Orsted.

The Skjerstad, 20 m.

Phyllodoce maculata, Lin.

The Beier Fiord, 30—150 m.; The Skjerstad Fiord, 330 m.; The Salten Fiord, 15—20 m.; The Kirk Fiord, 70—80 m.; Sværholt (1894).

Eteone depressa, Malmgren.

The Kirk Fiord, 70—80 m.

This species is not mentioned in Bidenkap's list of the Polychæta of Norway. Later on, however, Bidenkap found a specimen at Horsnes in The Lyngen Fiord.[1] It is known from Greenland, Spitzbergen and Novaja Semlja.

Nepthys malmgreni, Théel.

The Kanstad Fiord, 30—90 m.; Risværflaket, 150—180 m.; Gaukværo, 250 m.; Lyngen II, 250 m.; Kvænangen, 300—353 m.; The Jokel Fiord, 80 m.

Nephtys incisa, Malmgren.

Svolvær (1894); Malangen, 380 m.; The Jokel Fiord, 100 m.; Bidenkap mentions Lofoten as the northern limit, but this must now be changed to Kvænangen and the Jokel Fiord.

Nephtys ciliata, Müller.

The S. Beier Fiord, 50 m.; Landego, 200—400 m.; Svolvær (1894); The Ogs Fiord, 100 m.; The Kirk Fiord, 50—40 m.; Digermulen, 100—150 m.; The Kanstad Fiord, 30—90 m.; Stonnesbotn, 40—80 m.; Malangen, 100—200 m.; Kvænangen, 300—343 m.; The Jokel Fiord, 80 m.

[1] Lyngenfjordens evertebratfauna. Tromsø Mus. Aarsh. 20, 1897, p. 95.

Nephtys coeca, Fabr.

The Beier Fiord, 30—150 m.; The Ogs Fiord I, 100 m.; mouth of Raftsundet, 250—300 m.; Svolvær (1894); Henningsvær I, 150 m.; The Kirk Fiord, 30—50 m.

Glycera capitata, Orsted.

The Skjerstad Fiord X, 10—30 m.; Skroven, 200—400 m.; Rost II, 100 m.; Sværholt (1894).

Staurocephalus erucaeformis, Malmgren.

Balstad, 150 m.

Lumbriconereis fragilis, Müller.

The Kirk Fiord, 70 m.

Onuphis conchylega, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Ostnes Fiord; The Kanstad Fiord, 30—90 m.; Lyngen III, 250 m.; The Jokel Fiord, 100 m.; The Porsanger Fiord, 70 m.

Onuphis quadricuspis, M. Sars.

Ure I (Vest Fiord), 200—250 m.

Hyalinoecia tubicola, Müller.

Svolvær (1894).

Christiansund was the previously known northern limit.

Nereis pelagica, Lin.

The Skjerstad Fiord XIII, 110 m.; Troldfiordsund, 40 m.; Breisund, 100 m.; Sværholt (1894); The Kjolle Fiord (1894); Nordkyn (1894).

Leodice norvegica, Lin.

The Beier Fiord, 50 m.; The Skjerstad Fiord, 30—50 m.; The Tys Fiord I, 500 m.; The Kanstad Fiord, 30—90 m.; Digermulen, 100—200 m.; Henningsvær, 150 m.; Mortsund, 200 m.; Balstad, 150 m.; Rost II, 150 m.; Malangen, 100—200 m.; Kvænangen, 90 m.; Breisund, 100 m.; The Porsanger Fiord, 50 m.

Leodice gunneri, Storm.

The Tys Fiord I, 500 m.

? *Cirratulus abranchiatus*, Ar. Hansen.

The Jokel Fiord II, 80 m.

Aricia kuppferi, Ehlers.

Landego, 200—400 m.

This species had previously on the coast of Norway only been found in The Bergen Fiord.

Trophonia plumosa, Müller.

Glea (Rost) on the beach; The Ogs Fiord; The Folden Fiord, 530 m.; The Jokel Fiord; Kvænangen.

Brada villosa, Rathke.

The Skjerstad Fiord, 230 m.; The Salten Fiord I, 15—20 m.; The Folden Fiord, 530 m.

Brada granulosa, Armauer Hansen.

Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

The southern limit for this species must thus, for the present, be considered to be Malangen. It is new for the fauna of Norway; the places at which The Norw. North Atl. Exp. found it all lie at a considerable distance from the Norwegian coast.

Brada granulata, MALMGREN.

Glea (Rost) on the beach; Malangen 100—200 m.; Kvænangen.

Euphrosyne borealis, ORSTED.

Malangen, 100—200 m.

Spinther oniscoides, JOHNST.

The Porsanger Fiord, 220 m.

According to a written communication from Mr. LEVINSEN, *S. oniscoides*, JOHNST. = *S. major* LEVINSEN = *S. arcticus* ARMAUER HANSEN.

Eumenia crassa, ORSTED.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 470—490 m.

Arenicola marina, LIN.

Sund (Beier Fiord) in sand on the beach.

Clymene praetermissa, MALMGREN.

The Kirk Fiord, 100 m.; in large quantities. According to MALMGREN, this species is common on clay bottom in Finmarken.

Nicomache lumbricalis, MALMGREN.

The Skjerstad Fiord III, 130 m.; The Ogs Fiord I, 100 m.; Stonnesbotn, 40—80 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.

Maldane biceps, M. SARS.

The Skjerstad Fiord III, 230 m.; Landego, 200—400 m.

Pectinaria hyperborea, MALMGREN.

The Skjerstad Fiord I, 30—50 m.; The Kirk Fiord III, 70—80 m.; The Ostnes Fiord, The Ogs Fiord, 100 m.; The Jokel Fiord, 100 m.

Pectinaria koreni, MALMGREN.

Malangen, 380 m.

BIDENKAP mentions this species only from the west and south coast of Norway. The northern limit must now be moved much higher, *viz.* right up to Malangen.

Terebellides strömi, M. SARS.

The Skjerstad Fiord, 230 m.; mouth of Raftsund, 250 m.; Malangen, 100—200 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.; The Jokel Fiord II, 80 m.; The Porsanger Fiord, 70 m.

Artacama proboscidea, MALMGREN.

Lyngen III, 300 m.

This species has not often been collected on the Norwegian coast. Prof. ESMARK found it at Nakholmen in the Kristiania Fiord, and G. O. SARS at Lofoten.

Thelepus circinnatus, FABR.

The Skjerstad Fiord IX, 40—50 m.; The Kirk Fiord IV, 30—50 m.; Napstrommen, 30—40 m.; Henningsværstrommen, 20—40 m.; Kvænangen, 90 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

Amphitrite cirrata, MÜLLER.

Kvænangen, 90 m.; The Porsanger Fiord, 200 m.

Amphitrite groenlandica, MALMGREN.

The Jokel Fiord II, 80 m.

BIDENKAP mentions that this species has rarely been found at Vadso by M. SARS and G. O. SARS. Thus it is new from Vest Finmarken.

Terebella debilis, MALMGREN.

The Ostnes Fiord (1894).

Euchone papillosa, M. SARS.

Kvænangen, 300—343 m.

Chone infundibuliformis, KRÖYER.

The Salten Fiord I, 15—20 m.; The Folden Fiord, 530 m.

Dasychone dalyelli, KÖLLIKER.

Kvænangen, 90 m.

BIDENKAP gives Bodo as the northern limit, this must now be altered to Kvænangen.

Sabella pavonia, SAVIGNY.

The Sag Fiord, 200 m.; Gaukovær, 250 m.; Malangen, 100—200 m.; The Jokel Fiord II, 80 m.

Sabella fabricii, KRÖYER.

Kvænangen, 90 m.

Potamilla neglecta, M. SARS.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord XVI, on *Hydroida*; The Jokel Fiord II, 100 m.; Breisund, 100 m.

The hitherto known southern limit on the Norwegian coast for this species was Tromso. It must now be changed to be Beier Fiord.

Potamilla reniformis, MÜLLER.

Nordkyn (1894) in numbers.

Leptochone steenstrupi, KRÖYER.

Svolvær (1894).

Filigrana implexa, BERKLEY.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 230 m.; Mortsund (Vest Fiord) 100 m.; Nordkyn (1894).

Pomatocerus triqueter, MÖRCH.

The Jokel Fiord, 80 m.

Common on stones and shells.

Hydroides norvegica, GUNNERUS.

Digermulen, 100—150 m.; Lyngen III, 300 m.

Common on stones and shells.

Placostegus tridentatus, FABRICIUS.

Gaukværo, 250 m.; The Jokel Fiord, 100 m.; Hammerfest (1894).

Ditrupa arietina, MÜLLER.

Röst I, 120 m.; Balstad, 150 m.; Stene (Vest Fiord), 200 m.; Ure I (Vest Fiord), 200—250 m.; Svolvær (1894); Gaukværo, 250 m.; Sværholt (1894).

Sternaspis fossor. SIMPSON.

The Beier Fiord. 50—150 m.

This is a new species of Norwegian fauna. LEVINSEN,[1] who has classified my specimen from the Beier Fiord, gives it the following distribution: Iceland, Greenland and North America.

Gephyrea.

Echiurus pallasi. GUÉR.

Sund at the Morsdal Fiord, on the beach, several specimens (LEVINSEN determ.).

Bryozoa or Polyzoa.

Determ. by author.

Cheilostomata.

Gemellaria loricata. LIN.

The Trold Fiord Sund, 30—40 m.; Nordkyn, 30 m.

Menipea ternata. ELLIS and SOLANDER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 100—185 m.; Balstad (The Vest Fiord), 30—50 m.; Mortsund III (The Vest Fiord), 100 m.; Henningsværstrommen, 20—40 m.; The Ostnes Fiord, 130 m.; The Ogs Fiord I, 100 m.; Stonesbotn, 40—80 m.; The Trold Fiord Sund, 30—40 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

It was var. *gracilis* which occurred at most of the above mentioned places.

Menipea jeffreysi. NORMAN.

Mortsund III, 100 m.; Moskenstrommen, 200 m.

Menipea normani. NORDGAARD.

The sea NW of Rost, 700 m.

This species is easily recognized by the pedunculate avicularia on the front wall.

Scrupocellaria scabra. I. VAN BENEDEN.

Balstad, 30—50 m., Groto, 6—24 m.; The Kanstad Fiord, 30—90 m.; The Trold Fiord Sund, 30—40 m.; The North Cape (1894); Nordkyn (1894).

Caberea ellisi. FLEMING.

The Beier Fiord, 50—150 m.; Balstad (The Vest Fiord), 30—50 m; The Ostnes Fiord; Malangen, 100—200 m.; Stonesbotn, 40—80 m.; Kvænangen II, 90 m.; Ingøhavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.; Nordkyn (1894).

Bicellaria alderi. BUSK.

Moskenstrommen, 200 m.; Reine I (The Vest Fiord), 150 m.; The Sea NW of Rost, 700 m.

Bugula elongata. NORDGAARD.

The Beier Fiord, 50—150 m.; Rost II, 150 m.; The Kirk Fiord III, 70—80 m.; Svolvær (1894); Malangen, 100—200 m.; Breisund, 100 m.; Mehavn (1894).

[1]) Cf. LEVINSEN, Systematisk-geografisk oversigt over de nordiske *Annulata, Gephyrea, Chætognathi* et *Balanoglossi*. Vid. Med. Nat. Foren. Kjobenhavn, 1882 and 1883.

Bugula purpurotincta. NORMAN.

Malangen, 100—200 m.

Bugula murrayana. JOHNSTON.
Pl. III, fig. 8.

The Beier Fiord, 50—150 m.; Moskenstrommen, 90 m.; The Kirk Fiord II, 50 m.; The Ogs Fiord I, 100 m.; Malangen, 100—200 m.; Stonesbotn, 40—80 m.; Breisund, 100 m.; The Trold Fiord Sund, 30—40 m.; The Porsanger Fiord, 200 m.; Nordkyn (1894).

Kinetoskias smitti. DAN. and KOREN.

The Ostnes Fiord; The Oxsund, 100 m.; The Sag Fiord, 200 m.; Tranodybet, 607—640 m.; Malangen, 100—200 m.

Lofoten was the hitherto known northern limit for this species. It must now be changed to Malangen.

Cellaria fistulosa. LIN.

Moskenstrommen, 90 m.; Malangen, 100—200 m. The northern limit is now moved from Lofoten to Malangen.

Flustra carbasea. ELLIS and SOLANDER.
Pl. III, fig. 1.

Balstad (The Vest Fiord), 100 m.; Svolvær (1894); Breisund, 100 m.; The Porsanger Fiord, 200 m.; Mehavn (1894).

Flustra securifrons. PALLAS.
Pl. III, fig. 2.

Rost II, 150 m.; Moskenstrommen, 90 m.; Mortsund (The Vest Fiord), 100 m.; Malangen, 100—200 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.; Vardo (on *Pecten islandicus*).

Flustra membranaceo-truncata. SMITT.
Pl. III, figs. 3, 4.

The Skjerstad Fiord XVI; The Skjerstad Fiord III, 230 m.; The Ogs Fiord I, 100 m.; Malangen, 100—200 m.; The Trold Fiord Sund, 30—40 m.; The North Cape (1894).

Flustra barleei. BUSK.
Pl. III, figs. 5, 6.

Rost II, 150 m.; Arno (The Vest Fiord), 300—400 m.

Flustra abyssicola. M. SARS.
Pl. III, Fig. 7.

The sea NW of Rost, 700 m.; Reine (The Vest Fiord), 100 m.; Balstad (The Vest Fiord), 150 m.; Mortsund (The Vest Fiord), 100 m.; Brettesnes—Skroven, 350—400 m.; The Ox Sund, 600 m.; The Sag Fiord, 200 m.

Membranipora[1]) *pilosa.* LIN.

Napstrommen (Lofoten), 10 m.; Svolvær (on algae), Groto (on algae); The Trold Fiord Sund (on algae).

Membranipora membranacea. LIN.

The Trold Fiord Sund, 30—40 m., on algae; Nordkyn, on *Laminaria.*

[1]) NORMAN, in his work Notes on the Natural History of East Finmark (Ann. Mag. Nat. Hist., Ser. 7, Vol. XI), has divided the genus *Membranipora* into several others. I have not yet had time, however, to form a definite opinion about this division, so I prefer here to retain the old nomenclature.

Membranipora lineata, LIN.

Hammerfest (1894).

Membranipora arctica, D'ORBIGNY.

Kvænangen, on algae; The North Cape (1894); Nordkyn (1894).

Membranipora craticula, ALDER.

On an ascidian near Hammerfest (1894); The Lakse Fiord (collected by SPARRE SCHNEIDER).

Membranipora cymbaeformis, HINCKS.

The North Cape (1894) on algae.

Membranipora trifolium, S. WOOD.

The Ostnes Fiord, 50—70 m.; Digermulen, 100—150 m.; Stonesbotn, 40—80 m.; The Jøkel Fiord III, 100 m.; Hammerfest (1894).

Membranipora minax, BUSK.
Pl. III, fig. 11).

Rost II, 150 m., on *Waldheimia*; Moskenstrommen II, 150 m., on *Waldheimia*; Digermulen, 100—150 m., on stone; Malangen, 100—200 m., on *Waldheimia*.

Lepralia (Membraniporella) nitida, JOHNSTON.[1])

Rost II, 150 m.; Nordkyn (1894).

Gephyrotes (Cribrilina) nitido-punctata, SMITT.

Moskenstrommen II, 150 m.; Nordkyn (1894). LOVÉN had specimens from Hammerfest.

Cribrilina cryptooecium, NORMAN.[2])

The Kjølle Fiord (1894); Nordkyn (1894).

Cribrilina annulata, FABR.

The North Cape (1894).

Microporella ciliata, PALLAS.

Svolvær (1894), Sværholt (1894).

Microporella impressa, AUDOUIN.

Ingohavet, 300 m., on stones; Breisund, 100 m., on stones.

Doryporella[3]) *spatulifera*, SMITT.

Breisund, 100 m., on *Rhynchonella psittacea*. An excellent illustration of the zooecia in this peculiar species, will be found in WATERS (Bryozoa from Franz-Josef Land. Journ. Linn. Soc., XXVIII, pl. 12, fig. 6).

Hormeria[4]) *scutulata*, BUSK.

Nordkyn (1894), on stones.

Tessaradoma gracile, M. SARS.

Mortsund III, 100 m.; Digermulen, 100—150 m.; The Sag Fiord, 200 m., on dead branches of *Isidella hippuris*; Tranodybet, 607—640 m., on dead branches of *Isidella hippuris*. Malangen, 100—200 m.; Ingohavet, 300 m.

Porina tubulosa, NORMAN.

Hammerfest (1894); The Lakse Fiord (collected by SPARRE-SCHNEIDER).

Hippothoa hyalina, LIN.

Groto, 6—24 m., on algae; The Trold Fiord Sund, 30—40 m., on algae; Breisund, 100 m., on an ascidian. This species has sometimes been mentioned as a *Schizoporella*, sometimes as a *Cellepora*.

Hippothoa divaricata, LAMOUROUX.

Tromsø (collected by SCHNEIDER); The Lakse Fiord (collected by SCHNEIDER).

Schizoporella alderi, BUSK.

Moskenstrommen, 90 m., on stones; The Ostnes Fiord, 50—70 m.; Hammerfest (1894); Ingohavet, 300 m.; Sværholt (1894).

Schizoporella sinuosa, BUSK.
Pl. III, figs. 9, 10.

Moskenstrommen, 90 m., on stones and *Waldheimia*; The Ostnes Fiord, 50—70 m., on stones and coal; Digermulen, 100—150 m., on stones; Malangen, 100—200 m., on *Modiola modiolus*. Operculum (cfr. fig. 10) presents a divergent appearance from the genus *Schizoporella*, and the species *sinuosa* ought indeed to be removed.

Schizoporella linearis, HASSALL.
Pl. V, fig. 26.

Moskenstrommen, 90 m., on shells.

Schizoporella unicornis, JOHNSTON.
Pl. V, figs. 23—25, 27.

„Glea" (Rost), on the beach.

The specimens from Rost differ somewhat from those I have collected in the Hjelte Fiord, near Bergen, but the variations are not so great as to make a new species necessary. Besides fig. 23 agrees well with HINCKS' figures in Brit. Mar. Pol.

On comparing opercula[1]) of *Schizoporella unicornis* from the Hjelte Fiord and from Rost, it was found that those from the latter place were somewhat larger. (Cfr. figs. 24, 27). The zooecia in the specimens from Rost also had a rather wider sinus on the proximal edge of the oral aperture. The species has a wide distribution and probably varies very considerably. Lofoten is up to the present the northern known limit, both for *unicornis* and *linearis*.

Schizoporella candida, SMITT.
Pl. IV figs 6, 7.

Mollia vulgaris, forma candida, SMITT. Öfvers. Kgl. Vet. Akad. Forh. 1867 (Bihang) pp. 16, 107, pl. 25, fig. 83.

[1]) Cfr. NORMAN, Finmark Polyzoa, p. 100.

[2]) Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist., Ser. 7, Vol. XII, p. 102.

[3]) NORMAN, Finmark Polyzoa, p. 106.

[4]) NORMAN, Finmark Polyzoa, p. 107.

[1]) It is practical to measure the maximum breadth (b, pl. V, figs. 26, 27) and the maximum height (h), when comparing opercula. These measurements may also be found useful in determining species. For, not taking their absolute value into account, in some species b will be larger than h (b > h), in others they will be equal in size (b = h) and in others less (b < h). It is also sometimes useful to take similar measurements of the maximum breadth and height of the mandibles.

Malangen, 100—200 m., on stone; Hammerfest (1894) on stone.

I have not had any opportunity of seeing STIMPSON's work (Invertebr. of Gr. Manan), so that I am unable to form any opinion as to the correctness of SMITT's conclusion that his f. *candida* is the form described by STIMPSON as *Lepralia candida*. But as VERRIEL[1]) classifies STIMPSON's species as a *Smittia*, and also remarks that „this species has been entirely misunderstood by SMITT and others owing to the imperfection of the original description", it is certainly safest to give SMITT's form the designation which I have used here.

Schizoporella stormi, n. sp.

Pl. V, figs. 1, 2.

On a stone form the North Cape (1894), a Schizoporella was found, which I suppose to be a new species. The zooecia, which were rather broad in proportion to their length, had a single row of pores along the margin, together with a few small pores on the frontal side (cf. fig. 1). No ooecia were present in the colonies, but large avicularia were found under and a little to the side of the oral aperture. The mandible was very pointed. The surface of the zooecia was finely granulated and had weak radial stripes. The zooecia were separated by distinct lines, and it may be mentioned as a peculiarity that there is a crossline (l, fig. 1) by the oral aperture. I think the species will easily be kept distinct from others on account of the distinct opercular ribs (o. r., fig. 2). I have this species both from the North Cape and Hammerfest.

I have taken the liberty of naming this species after the manager of the zoological collection, V. STORM, in Trondhjem.

Schizoporella hexagona, n. sp.

Pl. V, figs. 12, 13.

Formed a little crust on stone from Kvænangen II, 90 m.

It is possibly this species which SMITT has illustrated on pl. 25, fig. 79[2]) under the name of *Mollia vulgaris*, forma *ansata*.

It is easily recognized by its six-sided zooecia whose frontwall is punctured, but not perforated. The zooecia are separated by distinct lines. On my specimen there were neither oocica nor avicularia.

A characteristic feature of this species is the large proximal lobe of the eperculum (fig. 13). In the operculum $b < h$.

Schizoporella levinseni, n. sp.

Pl. V, figs. 3, 4.

Kvænangen II, 90 m., on stone.

The zoarium formed a crust on a stone. In a dried state, the majority of the zooecia were of a deep red colour. The zooecia have a few pores on the frontal wall, and between the pores there are hollows (reminding one of a thimble). The ooecia, which are nearly ball shaped, are furnished with deeper hollows, but are not pierced. There were no avicularia on the colonies which I have had an opportunity of examining. The proximal border of the oral aperture is straight with a marked sinus in the middle.

The operculum has a lobe which answers exactly to the sinus mentioned (fig. 4). In the operculum $b > h$.

I have taken the liberty of calling this species after the Inspector of the Museum in Copenhagen, G. M. R. LEVINSEN.

Schizoporella reticulato-punctata, HINCKS.

Pl. IV, figs. 16, 17.

1867. *Escharella porifera*, forma *edentata*, SMITT, Krit. Förteckn. etc. Öfv. Kgl. Vet. Akad. Förh. 1867. (Bihang), p. 9, pl. 24, fig. 39.
1877. *Lepralia reticulato-punctata*, HINCKS. Polyzoa from Iceland and Labrador. Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 103, pl. 10, figs. 3, 4.
1884. *Lepralia reticulato-punctata*, LORENZ. Bryozoen von Jan Mayen, p. 88.
1887. *Escharella reticulato-punctata*, LEVINSEN. Dijmphna Togtets zool-bot. Udbytte, p. 318, pl. 27, fig. 4.
1895. *Smittia reticulato-punctata*, NORDGAARD. Syst. fort., Berg. Mus. Aarb. 1894—95, No. II, p. 27.
1897. *Smittia reticulato-punctata*, BIDENKAP. Bryozoen von Ost-Spitzbergen. Zool. Jahrb., vol. 10, p. 623.
1900. *Schizoporella harmsworthi*, WATERS. Bryozoa from Franz Josef Land. Journ. Linn. Soc. Zool., vol. 28, p. 65, pl. 9, figs. 10—12.
1903. *„Lepralia" reticulato-punctata*, NORMAN. Notes on the Nat. Hist. of East Finmark. Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 122.

Hammerfest (1894); the North Cape (1894); the Porsangerfjord, 200 m., Nordkyn (1894).

In my list of Norwegian *Cheilostomata* I entered this species as a *Smittia*, but on closer examination it became clear that the species cannot be left there. Neither can it be considered to be a *Lepralia*, as HINCKS does.

I at first thought of setting it up as the type for a new genus, together with SMITT's *Escharella porifera*, forma *typica* and the one which I described as *Smittia lineata*, but on further consideration, I have not ventured to start a new genus. In all three species mentioned, there is a distinct sinus on the proximal margin of the oral aperture, and notwithstanding that the opercula in these three species vary from that which is usual in the genus Schizoporella, they have, however, at any rate a trace of a proximal lobe. WATERS has described a form, *Schizoporella harmsworthi*, from Franz Josef Land, which he has identified with SMITT's *Escharella legentili*, forma *prototypa*. This can hardly be correct. True, the mouth in young zooecia of forma *prototypa* may bear a certain resemblance to the oral aperture in WATERS' species, but there is a great difference in the developed zooecia, *harmsworthi* having a sinus on the proximal margin (cfr. WATERS l. c. pl. 9, fig. 10), while forma *prototypa* has a mucro (cfr. BIDENKAP, Bryozoen v. Ost Spitzbergen, pl. 25, fig. 3, and also the present work pl. IV, fig. 24).

Besides, in *harmsworthi* the ooecia are perforated (cfr. WATERS, pl. 9, fig. 10), while in f. *prototypa* they are provided with hollows, reminding one of a thimble. On the other hand, there seems to be complete resemblance between *harmsworthi* and SMITT's *Escharella porifera*, forma *edentata*, but as this form was raised to the rank of a species by HINCKS in 1877, *harmsworthi* must give way to *reticulato-punctata* which form I consider, as does also WATERS, to be a *Schizoporella*. In one specimen from the Porsanger Fiord, I could plainly see the oral glands at the opening of the tentacular sheath, as illustrated by WATERS.

[1]) Proc. U. S. N. M., Vol. II, 1879, p. 192.

[2]) Krit. Förteckn. Övers. Kgl. Vet. Akad. Förh. 1867 (Bihang).

Schizoporella porifera, Smitt.
Pl. V, fig. 32.

Escharella porifera, forma *typica*, Smitt. Krit. förteckn., Öfvers. Kgl. Vet. Akad. Förh. 1867 (Bihang), p. 9, pl. 24, figs. 30—32.

As to other synonyms, cfr. Norman, Notes on the Nat. Hist. of East Finmark, p. 121.

Napstrommen (Lofoten), 30—40 m.; Malangen, 100—200 m.; The Jøkel Fiord II, 80 m.; Hammerfest (1894); The Kjølle Fiord (1894); Mehavn (1894).

Both the shape of the mouth and the operculum with its proximal lobe, prove that there is a relationship to *Schizoporella*, (Pl. V, fig. 32). It must, at any rate, be more correct to classify this species as a *Schizoporella* than as a *Smittina* or *Eschara (Lepralia)*. The southern limit of the species which has been found up to the present is Lofoten; its distribution is arctic.

Schizoporella lineata, Nordgaard.
Pl. V, figs. 33, 34.

1895. *Smittia lineata*, Nordgaard, System. fortegn. Bergens Mus. Aarb. 1894—95, nr. 2, p. 27, pl. 2, fig. 2.

1903. „*Smittia*" *lineata*, Norman, Notes on the Nat. Hist. of East Finmark, Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 122, pl. 9, figs. 14, 15.

Nordkyn (1894).

Norman has taken this species in East Finmark, on *Escharopsis rosacea*, dredged off Vadsø. He remarks also (l. c.): — „Other specimens in my collection are one received from Smitt taken at Spitzbergen, and named *Escharella auriculata*; others from the Gulf of St. Lawrence (Whiteaves), and off Holsteinborg, Greenland, in 57 fathoms."

From this it will be seen that *lineata* has an arctic distribution, and it is probable that what has been stated to be *Schizoporella auriculata*, Hassal from these latitudes should be transferred to *lineata*. The two species appear to be very closely allied, so that it is easily explained that the arctic form (*lineata*) is confused with the more southern one (*auriculata*).

Leieschara coarctata, M. Sars.

Moskenstrommen, 90 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.

Leieschara plana, Dawson.

The Jøkel Fiord II, 80 m.; Kvænangen, Sværholt (1894).

Norman[1]) has made it clear that *Myriozoum crustaceum*, Smitt = *Lepralia plana*, Dawson. Waters is[2]) probably right in placing this species under the genus *Schizoporella*.

Eschara polita, Norman.

Lepralia polita, Norman, Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 87, pl. 11, fig. 1.

Hammerfest (1894), on stone.

In his work on „the Polyzoa of East Finmark", from which several quotations are taken in this paper, Norman has given the reasons for substituting *Eschara* for Hincks' genus *Lepralia*. The synonyms for *Lepralia polita* may be found in my paper: — „Die Bryozoen des westlichen Norwegens". Die Meeresfauna von Bergen, p. 87.

[1]) Finmark Pol., p. 110.
[2]) Bryozoa from F. Josef Land, p. 64.

Eschara moskensis, n. sp.
Pl. IV, figs. 3—5.

Moskenstrommen II, on stone, 150 m.

This species is particularly noticeable on account of its large, wide zooecia (fig. 3), which are scantily pierced with small holes in the sides. The oral aperture is partly surrounded by 1—6 short spines. On the surface of the ooecium (fig. 4) there are fine punctures, but they are not pierced through. The operculum (fig. 5) is quite solid, and the muscle insertions are very distinct.

It is probable that Smitt[1]) has this form in his paper of 1871, under the name *Discopora megastoma*, for fig. 26 shows no slight resemblance to the above mentioned species. I have, however, given a new name, as I consider that Smitt's *Discopora megastoma* includes two species, neither of them being identical to *Lepralia megastoma*, Busk. (Cfr. Smitt's illustrations and description just quoted with Crag Polyzoa, p. 55, pl. 8, fig. 5).

Eschara nordlandica, n. sp.
Pl. IV, figs. 32—35.

Kvænangen II, 90 m., on stone.

The zooecia large, but not so broad as in the preceding species. The front wall is perforated by conspicuous pores and there are no spines on the edge of the oral aperture. Under the aperture there is a protrusion (umbo). There are raised lines between the zooecia fig. 32) nearly all over. The ooecia are punctured, but not perforated. The operculum is quite solid and has distinct ribs (fig. 35). In fig. 33, it may be seen how these ribs lie against the condyles of the oral aperture.

It is not improbable that this species is included under Smitt's definition *Discopora megastoma*. In Smitt's paper of 1871, the figs. 24, 25 show no little resemblance to the above mentioned species. In his description (l. c., p. 1129), Smitt also mentions a protusion at the front of the zooecium. But there are hardly sufficient grounds for supposing that this species is identical to *Lepralia megastoma*, Busk. His species has, for instance, „a single row of channelled pores".[2]) On the other hand, there is a stronger resemblance between *Eschara nordlandica* and *Eschara (Lepralia) pertusa*, *Esper*, according to Hincks' characterisation of this species in Brit. Mar. Pol. (1888), p. 305, pl. 43, figs. 4, 5. But the shape of the oral aperture seems to be different, as well as the puncturing of the ooecia. I think it is quite justifiable to enter it as a new species, for I share the opinion that less harm is done by introducing a new name for a known species than by classing two different species under an old name.

The name *Lepralia megastoma* is used, in addition to the places above mentioned, also by Lorenz[3]) and Bidenkap[4]), the latter also mentions the species as being a Mucronella. Bidenkap remarks that „die stark verkalkten Zooecien haben die ganze Vorderseite mit grossen Poren durchlöchert", from which it appears extremely likely that the species, which Bidenkap had before him (from Spitzbergen) was *E. nordlandica*.

[1]) Övers. Kgl. Vet. Akad. Förh., 1871, p. 1129, pl. 21, figs. 24—26.
[2]) Crag Pol., p. 55. Cfr. pl. 8, fig. 5.
[3]) Bryozoen von Jan Mayen. Beobachtungsergebnisse der östreich. Polarstation Jan Mayen. III B., p. 89.
[4]) Fauna arctica (von Römer u. Schaudinn), B. I, p. 524.

Eschara sincera, Smitt.
Pl. III, figs. 12—14.

Balstad (Lofoten): The Ostnes Fiord, 50—70 m., on coal; Digermulen, 150 m., on stone; The Lyngen Fiord, 250 m.; The Jøkel Fiord II, 80 m.; The North Cape (1894); Mehavn (1894).

I have previously classified this species as belonging to the genus *Mucronella*, and although, I now enter it as an *Eschara*, it is not at all because it can be said to be any typical form of this genus.

Discopora (Umbonula) verrucosa, Esper.

In the beach at „Glea", Rost.

I have previously found this interesting form near Bergen. The northern limit for the species is henceforth Lofoten.

Discopora (Mucronella) peachii, Alder.[1]

The Kirk Fiord, 100 m.; The Trold Fiord Sund, 40 m.; Særholt (1894). From Sparre Schneider I have received colonies which he took in the Lakse Fiord.

Porella minuta, Norman.

Grøtø, 6—24 m., on algae.

Norman was the first to find this species in Norway, he took it in the Bog Fiord and the Lang Fiord (East Finmark).

Porella concinna, Busk.

Breisund, 100 m., on *Rhynchonella psittacea*; Mehavn (1894), on shells.

Porella aperta, Boeck.[2]

The Beier Fiord, 30—150 m., on *Pecten vitreus*.

Porella acutirostris, Smitt.[3]

Svolvær (1894), on coal from the bottom.

The species is a new one to our fauna.

Porella princeps, Norman.
Pl. IV, figs. 21—23.

1892. *Monoporella spinulifera*, var. *praeclara*, Hincks, „The Polyzoa of St. Lawrence". Ann. and Mag. Nat. Hist., ser. 6, vol. 9, p. 152, pl. 8, fig. 3.

1903. *Porella princeps*, Norman, „Notes on the Natural History of East Finmark". Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 114, pl. 9, figs. 8—11.

In the work already mentioned of Norman, he has availed himself of the opportunity of describing „a Greenland *Porella*", to which he has given the name above. This species has now also been shown to be European; for on looking through some dried material from Mehavn (Finmark, 1894), I found a little red colony on *Neptunea despecta*. There is perfect agreement with Norman's description, but so as to prevent any doubt with regard to identity, I have illustrated the characteristic operculum (Pl. IV, fig. 21).

Below the oral aperture of the zooecium, a swelling is indicated, both in Hincks' and Norman's figures. Below the swollen frontal wall is the chamber of the avicularium. From this chamber a passage goes to the lateral walls. (Pl. IV, fig. 23). The mandible of the avicularium is very small. (Pl. IV, fig. 22).

This species has previously been mentioned from St. Lawrence (Hincks). Norman speaks of it (l. c., p. 115) as being „taken by the Valorous", 1875, off Holsteinborg, W. Greenland, „in 57 fathoms". Mehavn in Finmark now comes as a third locality. I have also found a little colony on a stone from Hammerfest (1894).

Porella glaciata, Waters.
Pl. V, fig. 5—7.

1868. *Eschara cervicornis*, forma *lepraliae*, Smitt, Öfv. Kgl. Vet. Akad. Förh. 1867 (Bihang), p. 23, pl. 26, figs. 136, 137.

1900. *Porella glaciata*, Waters, Bryozoa from Franz Josef Land. Journ. Linn. Soc. Zool. Vol. 28, p. 78, text figure 2, 3.

Mehavn (1894), on *Neptunea despecta*.

As a synonym for his *Porella glaciata*, Waters adds, in the work above referred to, the designation, followed by a note of interrogation, *Eschara cervicornis*, f. *lepraliae*, Smitt.

Waters remarks (l. c. p. 78): — „The peristome is raised at the side, the avicularian chamber is wide and distinct with the mandible within the peristome, but on the top of a more or less tubular projection." If this belongs to the description of *glaciata*, it is not correct. But, on the other hand, this description is applicable to *Porella propinqua*. I have no doubt that Smitt's forma *lepraliae* and Waters' *glaciata* are identical. It also seems to be certain that it was *glaciata* which I took at Mehavn in Finmark. Smitt's specimens were from Greenland, so that the distribution of the species as at present known is: — Greenland, Finmark, Franz Josef Land.

Porella struma, Norman.

Balstad (Lofoten), 80 m.; Digermulen, 150 m.; Malangen, 100—200 m.; The Jokel Fiord, 100 m.; Ingøhavet, 300 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

Porella laevis, Fleming.
Pl. III, fig. 15.

Moskenstrommen, 90 m.; Balstad, 150 m.; Mortsund III, 100 m.; Malangen, 100—200 m.; The North Cape (1894).

Porella saccata, Busk.[1]
Pl. III, fig. 16.

Breisund, 100 m.; The North Cape (1894); The Porsanger Fiord, 200 m.

Porella propinqua, Smitt.
Pl. IV, figs. 18—20 b.

Eschara propinqua, Smitt (part.), Öfvers. af Kgl. Vet. Akad. Förh., 1867 (Bihang), pp. 22, 146, pl. 26, figs. 126—129.

Lepralia propinqua, Hincks, Polyzoa from Iceland and Labrador. Ann. Mag. Nat. Hist., ser. 4, vol. 19, p. 103, pl. 10, figs. 5—7.

Smittia propinqua, Nordgaard, Syst. fortegn. marine polyzoa, p. 27. Berg. Mus. Aarbog, 1894—1895.

Smittia propinqua, Bidenkap, Bryozoen von Ost-Spitzbergen, Zool. Jahrbücher, B. 10, 1897, p. 624.

Smittia propinqua, Bidenkap, Die Bryozoen, II. Theil. Fauna arctica (von Römer und Schaudinn), B. I, p. 518.

Hammerfest (1894), on hydroids and *Bugula murrayana*; The North Cape (1894), on hydroids and *Menipea*; Mehavn (1894).

[1]) Cfr. S. F. Harmer, On the Morphology of the Cheilostomata. Quart. Journ. Mic. Sci. Vol. 46, N. S., p. 296.

[2]) Cfr. Norman, Finmark Polyzoa, p. 112 and Waters, F. J. B., p. 83, pl. 10, figs. 6, 7.

[3]) Cfr. Waters, F. J. B., p. 83, pl. 10, figs. 1—5.

[1]) Cfr. Waters, F. J. B.; p. 81.

Under the name *Eschara propinqua*, SMITT has entered two forms which undoubtedly are separate species. In the explanation of the illustrations it is mentioned that figs. 131—134 represent zooecia of specimens found in Finmark on *Flustra*. These belong to the species which HINCKS later described as *Porella proboscidea*. In the latter species, the zooecium is unperforated, while it has a characteristic perforation (Pl. IV, fig. 20 b) in *propinqua*.

In *propinqua* the peristome is very elevated on the sides of the oral aperture, and the operculum has a characteristic shape (20 b). Another peculiarity of *propinqua* is the occurrence of small perforations on the backside of the zoarium (fig. 19).

The lateral wall of the zooecium has two multipored rosette-plates.

Porella proboscidea, HINCKS.
Pl. IV, figs. 8—11.

Eschara propinqua, SMITT (part), Öfvers. Kgl. Vet. Akad. Förh. 1867 (Bihang), p. 22, pl. 26, figs. 130—134.

Porella proboscidea, HINCKS, The Polyzoa of the St. Lawrence. Ann. Mag. Nat. Hist., ser. 6, vol. 1, p. 223, pl. 14, fig. 4.

Porella proboscidea, NORDGAARD, Syst. forteg. marine polyzoa. Berg. Mus. Aarb. 1894—95, p. 25, pl. 1, fig. 4.

Porella skenei, var. *proboscidea*, WATERS, F. J. B., p. 79, pl. 11, figs. 17, 18.

Hammerfest (1894); The North Cape (1894); Nordkyn (1894); Mehavn (1894).

The avicularian rostrum is much larger in this species than in the foregoing one. (Cfr. figs. 8 and 18).

The Zooecium is poreless, and so is the basal wall of the zooecium.

The opercula are also different with regard to shape. *Proboscidea* is so different from *skenei* that the former can scarcely be considered to be a variety of the latter.

Palmicellaria skenei var. *tridens*, BUSK.
Pl. IV, fig. 12.

Moskenstrømmen, 90 m.; Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

With regard to this variety, I beg to refer to my paper: — Die Bryozoen des westlichen Norwegens. Meeresfauna von Bergen. p. 89.

The operculum is, however, not very carefully illustrated there (pl. I, fig. 14), for which reason I give another illustration here (fig. 12).

Palmicellaria skenei var. *bicornis*, BUSK.
Pl. IV, fig. 13.

Lepralia bicornis, BUSK, A Mon. of the foss. Pol. of the Crag, p. 47, pl. 8, figs. 6, 7.

The Jokel Fiord III, 100 m.

I have also taken this variety in the Trondhjem Fiord.

Escharopsis (Escharoides) sarsi, SMITT.

Tromsø Sound, 70 m.

From SPARRE SCHNEIDER, I got a colony which was 17.5 cm. in length and 8 cm. in width.

The cavity of the colony served as a hidingplace for *Ophiopholis aculeata*, *Cribrella* etc. The colony itself was covered with *Thuiaria thuia* and other hydroids.

Escharopsis rosacea, BUSK.
Pl. III, fig. 17.

Moskenstrømmen, 90 m.; Digermulen, 100—150 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.

Pseudoflustra solida, STIMPSON.[1])

Kvænangen II, 90 m.; The Porsanger Fiord, 70 m.

Monoporella spinulifera, HINCKS.[2])
Pl. IV, figs. 14, 15.

Porina ciliata, forma dura, SMITT, Öfvers. af Kgl. Vet. Akad. Förh. 1867 (Bihang) pp. 6, 61, pl. 24, fig. 17.

Discopora cruenta, SMITT, Öfvers. af Kgl. Vet. Akad. Förh. 1871, p. 1127, pl. 21, figs. 20—23.

In my list of the Norwegian Bryozoa (Bergens Mus. Aarb. 1894—95), I have entered this species as *Mucronella cruenta*, NORMAN, as I, with SMITT took NORMAN's *Lepralia cruenta* to be the same as *Discopora cruenta*, SMITT. I had, however, noticed at that time that there was a resemblance between *Discopora cruenta*, SMITT and *Mucronella spinulifera*, HINCKS. The identity of these two forms has later been confirmed by HINCKS and NORMAN. It must, however, be observed that SMITT both mentions and illustrates a single row of marginal pores on the zooecia, while HINCKS[3]) does not even hint at their presence. In other respects the resemblance is striking, and the only possible explanation is that HINCKS has overlooked the marginal pores. On Pl. IV, fig. 15 the arrangement of the marginal pore-chambers will be seen.[4])

The species is known from St. Lawrence, Greenland, Spitzbergen and King Charles' Land.[5]) I found it to be quite common on stones at Hammerfest in 1894.

Escharella immersa, FLEMING = *Mucronella (Lepralia) peachi*, JOHNSTON.[6])
Pl. IV, fig. 27.

Moskenstrommen II, 150 m.; Malangen, 100—200 m. (var. *octodentata*).

Escharella ventricosa, HASSALL.
Pl. IV, fig. 28.

Moskenstrommen II, 150 m.; Svolvaer (1894), on coal; The Östnes Fiord, 50—70 m., on stone and shells, Hammerfest (1894) on stones.

Escharella laqueata, NORMAN.
Pl. IV, fig. 29.

Moskenstrommen II, 150 m.; The Östnes Fiord 50—70 m., on stone; Malangen, 100—200 m., on stone, Hammerfest (1894).

Escharella abyssicola, NORMAN.
Pl. IV, fig. 30.

The Tys Fiord I, 500 m., on *Lophohelia prolifera*; Kvænangen II, 90 m., on shells.

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[1]) Refer to NORMAN (l. c. p. 124) for synonyms.

[2]) Cf. NORMAN (l. c. p. 115).

[3]) The Polyzoa of St. Lawrence. Ann. and Mag. Nat. Hist., ser. 6, vol. 3, p. 431, pl. 21, fig. 3

[4]) Cfr. LEVINSEN, Studies on Bryozoa. Vid. Med. Nat. Hist. Foren. in Copenhagen, 1902, (Sep.), p. 10.

[5]) Cfr. BIDENKAP, „Die Bryozoen". Fauna Arctica, B. I, Lief. 3, p. 521.

[6]) Cfr. NORMAN (l. c. p. 118).

Escharella labiata. Boeck.

Pl. IV. figs. 25, 26, 31.

The Beier Fiord, 50—150 m.; The Kirk Fiord III, 70—80 m.; Svolvær (1894), on coal; Malangen, 100—200 m., on *Retepora cellulosa*; The Jokel Fiord II, 80 m.; Breisund, 100 m., on *Retepora cellulosa*; The Porsanger Fiord, 200 m.; Sværholt (1894); Mehavn (1894).

In this species the basis of the ooecium is perforated (fig. 26). *Labiata* is different from *abyssicola* in that it has several rows of marginal pores (fig. 25).

The Norwegian species of this genus can fairly easily be distinguished by the help of the oral denticle, as this varies both in form and size in the species which I have had an opportunity of examining (figs. 27—31).

Phylactella peristomata, n. sp.

Pl. V. figs. 28—31.

The Jokel Fiord II, 80 m., on *Waldheimia*.

The genus *Phylactella* was started by Hincks, and it is characterized as follows in the Brit. Mar. Pol. (p. 356): — „Zooecia with the primary orifice more or less semicircular, the lower margin usually dentate; peristome much elevated, not produced or channelled in front. No avicularia. Zoarium (in British species) incrusting."

As belonging to the British fauna, Hincks mentions three species, *labrosa*, *collaris* and *eximia*. Of these, *labrosa* is stated to have a porous front wall and a „triplet" of oral denticles. *Collaris* has neither pores nor denticles, *eximia* is provided with marginal pores.

On *Waldheimia* from the Jokel Fiord, a form was found which, on account of its unusually elevated peristome, suggested *Phylactella*. On most of zooecia there was a single row of marginal pores, and it corresponded so far to *eximia* (fig. 28), but differed from it in having quite smooth ooecia (fig. 29). Further, the peristome was elevated to the same height and thus was not provided with lateral, triangular lobes as is the case in *eximia*. The specimen from the Jokel Fiord also had small avicularia with semicircular mandible (fig. 30). On young zooeciea the avicularia are quite plainly seen (fig. 29), but they are not so easily seen on older individuals which have the large collar below the oral aperture.

According to the diagnosis of the genus made by Hincks, there should be no avicularia, but as the resemblance between the species from the Jokel Fiord and the hitherto described *Phylactella* species is striking in other respects, it is, I think, most practical to extend the limits of the genus to include also those species which have avicularia.

The oral denticle (fig. 31) is similar in shape to that of *Escharella labiata* (Pl. IV, fig. 31), but it is much narrower. Below the oral aperture, there is a swelling for the avicularian chamber, which is connected with the surface by help of a few pores (fig. 28).

Escharoides[1]) *jacksoni*. Waters.

Pl. III, fig. 19.

Macronella coccinia. Bidenkap. Bryzoen von Ost-Spitzbergen. Zool. Jahrb. B. 10. p. 624, pl. 25, figs. 5, 6.

Smittia jacksoni. Waters. Bryozoa from Franz Josef Land. Linn. Soc. Journ. Zoology, vol. 28, p. 87, pl. 12, fig. 18.

[1]) Cf. Norman, Notes on the Nat. Hist. of East Finmark. Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 117.

The Jokel Fiord III, 100 m., on *Terebratulina*; Kvænangen II, 90 m., on stone and *Waldheimia*; Ingohavet, 300 m.

I consider that there are good grounds for distinguishing this form from *E. coccinea*, as Waters has done in the work above mentioned. The descriptions which Bidenkap and Waters have given of the *jacksoni* species, answer perfectly for the specimens I have found. In *jacksoni* the zooecia are much larger, the mandible too is rather different in shape (figs. 18, 19). It is new to the fauna of Norway.

Smittina[1]) *reticulata*. Macgillivray.

Reine, 100 m.; Mortsund III, 100 m.; Henningsvær I, 150 m. Lofoten is the hitherto known northern limit for this species.

Smittina trispinosa. Johnston.

(Pl. V. fig. 35).

Balstad (Lofoten).

Smittina arctica. Norman.

1869. *Escharella porifera*, forma *minuscula*. Smitt. Öfvers. Vet. Akad. Förh. 1867, Bihang, pp. 9, 73, pl. 24, figs. 33—35 (not forma *majuscula*).

1894. *Smittia arctica*. Norman (part.). A Month on the Trondhjem Fiord. Ann. Mag. Nat. Hist. ser. 6, vol. 13, p. 128.

1895. *Smittia arctica*, Nordgaard, System. fort. over Norges marine Polyzoa. Bergens Mus. Aarb., 1894—95, nr. 2, p. 27, pl. 1, fig. 2.

1900. *Smittia landsborovii*, var., Waters. Bryozoa from Franz Josef Land. Journ. Linn. Soc. Zool., vol. 28, pl. 12, fig. 7.

1903. *Smittia arctica*, Nordgaard. Die Bryozoen des westlichen Norwegens. Die Meeresfauna von Bergen. (ed. by Dr. Appellöf) p. 90, pl. 1, figs. 16, 17.

1903. *Smittina arctica*, Norman. Notes on the Nat. Hist. of East Finmark. Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 121.

Moskenstrommen, 90 m., on shells; The Ostnes Fiord, 50—70 m., on stone; Malangen, 100—200 m.; Kvænangen II, 90 m.; Hammerfest (1894); Breisund, 100 m.; Sværholt (1894); The Kjolle Fiord (1894); Nordkyn (1894).

In the work above quoted, Norman has entered Smitt's forms of *Escharella porifera* (f. *minuscula* and *majuscula*) under the name of *Smittia arctica*. During my excursion to Finmark in 1894, I found numerous specimens of f. *minuscula*, of which I also found some in the Lyse Fiord (59° 3' N.) in the winter of 1902. In the course of investigations made in 1899 in northern Norway, I found it at several places, and I also succeeded in one locality in obtaining forma *majuscula*, on a stone in the Porsanger Fiord, 200 m. A closer examination of the latter species has led to the conclusion that it must be considered to be a distinct one. It is doubtless most correct to retain Norman's designation, *arctica*, but this term will now have a different meaning to that originally given to it by Norman, as it will now only apply to forma *minuscula*, Smitt.

Smittina majuscula, n. sp.

Pl. IV, figs. 36—38.

1869. *Escharella porifera*, forma *majuscula*, Smitt. Öfvers. etc. 1867, Bihang, pp. 9, 74, pl. 24, figs. 36—38.

1888. *Smittia landsborovii*, forma *porifera*, Hincks. Ann. Mag Nat. Hist., ser. 6, vol. 1, p. 225, pl. 14, fig. 2.

[1]) Cfr. Norman, (l. c. p. 120).

The Porsanger Fiord. 200 m., on a stone.

Smitt (l. c., p. 75) calls attention to the fact that the ectocyst in zooecia and ooecia are thinner than in the foregoing form.

In *arctica* there are in the ooecia often transverse and longitudinal lines or sutures, these too are mentioned by Smitt (l. c., p. 71, pl. 24, fig. 33). Smitt also says that these lines sometimes occur in the ooecia of *majuscula*, but I have not noticed them.

It is easy to distinguish between the two species. With regard to size, it may be mentioned that the zooezia in *arctica* are 0.8 mm. in length from the lower end to the tip of the oral denticle, and the corresponding measurement in *majuscula* gives 0.5—0.6 mm. Ooecia in *arctica* are rather oval, in *majuscula* they are approximately ballshaped, in both species they are punctured like a thimble, but this is coarser in *majuscula* than in the other species.

The perforation in the frontal wall of the zooecia of *majuscula* is closer than in *arctica*, where it is, indeed, somewhat different. Hincks (l. c., pl. 14, fig. 2) has illustrated the oral denticle as being pointed, and I found some of them of this shape in the colony which I had under examination.

Operculum in *arctica*, I have not yet succeeded in isolating, in *majuscula*, on the other hand, it has a characteristic form, which also differs from the usual one in the genus *Smittina* (fig. 37).

A very evident difference between to two species is that the zooecia in *majuscula* are plainly separated, while in *arctica* they more evenly merge into each other.

This species is most likely exclusively arctic. In addition to the Porsanger Fiord, in Finmark, the following findingplaces are mentioned, Spitzbergen, (Smitt), St. Lowrence (Hincks).

Smittina smitti, Kirchenpauer.

Pl. IV, fig. 24.

The Ogs Fiord I. 100 m.

In „Bryozoen des westlichen Norwegens", I used a new name for this form, *Smittia lecenseni*, as Kirchenpauer's name for Smitt's *Escharella legentilii*, forma *prototypa* had quite slipped out of my memory, notwithstanding that I made a note of it several years ago. Norman[1]) here too made the necessary correction. I beg reference to Norman's list of synonyms, at the same time remarking that *Schizoporella Harmsworthi*, Waters, ought to be excluded from it, in accordance with what I have previously pointed aut, that this must be = *Schizoporella reticulato-punctata*, Hincks.

Each zooecium has 6—8 lateral rosette-plates. As far as I could see, the two upper ones were bi-pored and the two next ones tri-pored.

This species has not previously been found in Norway.

Smittina jeffreysi, Norman.[2])

The Porsanger Fiord. 70 m.

The species was not previously found in Norway.

Rhamphostomella scabra, (Fabr.), Smitt.

(Pl. V, figs. 8—11).

1867. *Cellepora scabra*, Smitt (part.). Krit. förteckn., p. 30, pl. 28, figs. 183—185.

1886. *Rhamphostomella scabra*, Lorenz, Bryozoen von Jan Mayen, p. 93.

[1]) Finmark Polyzoa, p. 123.

[2]) Refer to synonyms in „Finmark Polyzoa", p. 120.

Digermulen, on stone, 150 m.; The Jokel Fiord I, 100 m.; The Porsanger Fiord, 70 m.

Lorenz divided Smitt's *Cellepora scabra* into two species, and as for as I can judge this division is perfectly justifiable. The difference between them may be characterized as follows.

R. costata has an oral denticle (pl. V, fig. 22) but in *scabra* it is wanting. In *costata* the avicularian mandible is about half as long as it is wide, while in *scabra* the height is only very little more than the width.

The ooecia in *costata* have usually more pores than those of *scabra* have (cfr. figs. 9, 21). The rostrum in the latter species is shorter and blunter than in the former one. It is generally the case too that the radial lines in *costata* are continued on the rostrum, but this is not often so in the case of *scabra*. Both species are punctured on the basal wall of the zooecium (fig. 10) but more closely in *scabra* than in *costata*.

Bidenkap[1]) has found *Rh. scabra* in the Lyngen Fiord. So that the species is now known from the coast of Finmark to Lofoten.

Rhamphostomella costata, Lorenz.

(Pl. V, figs. 21, 22).

1867. *Cellepora scabra*, Smitt (part). Krit. förteckn., pag. 30, pl. 28, figs. 186—188.

1886. *Rhamphostomella costata*, Lorenz, Bryozoen von Jan Mayen, p. 12 (94), pl. 7, fig. 11.

1892. *Rhamphostomella costata*, Hincks, Polyzoa of St. Lawrence. Ann. and Mag. Nat. Hist., ser. 6, vol. 3, p. 426, pl. 21, figs. 6—8.

1900. *Rhamphostomella costata*, Waters, Bryozoa from Franz Josef Land, p. 91, pl. 11, figs. 26, 27.

Tromsø, Mehavn (1894).

Norman has taken this form in the Varanger Fiord, and Bidenkap in Lyngen. The hitherto known southern limit for this species is Tromsø.

Rhamphostomella plicata, Smitt.

(Pl. V, figs. 14, 15.)

1867. *Cellepora scabra*, forma *plicata*, Smitt, Krit. fört., p. 30, pl. 28, figs. 189, 191, 195.

1877. *Cellepora plicata*, Hincks, Polyzoa from Iceland and Labrador. Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 106, pl. 11, figs. 3, 4.

1886. *Rhamphostomella plicata*, Lorenz, Bryozoen von Jan Mayen, p. 12 (94).

1900. *Rhamphostomella plicata*, Waters, Bryozoa from F. J. L., p. 92, pl. 11, figs. 28, 29.

Nordkyn (1894), on an annelid tube.

As is the case with *costata*, this species too has an oral denticle, which is, however, longer and narrower than in the species mentioned.

The ooecium is as a rule provided with a few pores. I was not able to discover any punctures on the back side of the colony. It is therefore probable that Smitt's fig. 190 does not represent this species.

[1]) Lyngenfjordens evertebrat fauna. Tromsø Mus. Aarh. 20, 1897, p. 92.

Rhamphostomella radiatula, HINCKS.
Pl. V. fig. 16, 17.

1867. *Cellepora scabra f. plicata*, SMITT (part.), Krit. fört. pl. 28, fig. 193.

1877. *Lepralia radiatula*, HINCKS, Polyzoa from Iceland and Labrador. Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 104, pl. 10, figs. 9—14.

1886. *Rhamphostomella radiatula*, LORENZ, Bryozoen von Jan Mayen, p. 13 (95), pl. 7, fig. 9.

Hammerfest (1894); The Trold Fiord Sund, 40 m.; The North Cape (1894); The Kjølle Fiord (1894).

I found this species quite common on algae and hydroids which I took on the coast of Finmark in the autumn of 1894.

The zooecia are rather small, and the species is easily distinguished from the foregoing one, in that it wants the suboral rostrum and by the presence of the peculiar elevated peristome, about which HINCKS (l. c., p. 104) very appropriately remarks that it has „a very fantastic appearance".

The species is now known from Labrador, Iceland, Spitzbergen, Jan Mayen and Finmark.

Rhamphostella contigua, SMITT.
Pl. V. figs. 18—20.

1867. *Cellepora ramulosa*, forma *contigua*, SMITT, Krit. fört. p. 31, 189, pl. 28, figs. 198—201.

The Ostnes Fiord, 50—70 m., on stone; Hammerfest (1894), on stone; Breisund, 100 m., on a gastropod shell; Mehavn (1894), on *Balanus*.

The species of the genus *Cellepora* have characteristic opercula with a more or less distinct proximal lobe as in the *Schizoporella* species.

The shape of the operculum in the above mentioned species proves that it is quite impossible to look upon it as a variety of *C. ramulosa*, it can, indeed, not be considered to belong to the *Cellepora* genus. Neither is it a typical *Rhampostomella*, but I retain it for the present under that genus, as I do not now know any more suitable place for it.

The surface of the zooecia are quite even, occassionally there is a suggestion of radial stripes. The young zooecia have as a rule 4 spines on the distal side of the oral aperture. The operculum is more solid than in the other *Rhampostomella* species. The mandible of the avicularia is not of the same shape either as is characteristic of the other species which belong to the same genus.

Cellepora tuberosa, D'ORBIGNY.

1867. *Cellepora ramulosa*, f. *tuberosa*, SMITT., Krit. fört. pp. 31, 191.

1903. *Cellepora tuberosa*, NORDGAARD, Die Bryozoen des westlichen Norwegens, p. 69, pl. 2, figs. 28—34.

Moskenstrømmen; The Ostnes Fiord, 50—70 m.; The North Cape (1894).

Respecting this species, I beg to refer to what I have previously said in the paper written by me, which is quoted above.

Cellepora nodulosa, LORENZ.
Pl. III, figs. 21—24.

1867. *Cellepora ramulosa*, f. *acicularis*, SMITT (part.), Krit. förteckn., p. 32, 194, pl. 28, figs. 207—210.

1886. *Cellepora nodulosa*, LORENZ, Bryozoen von Jan Mayen p., 14 (96), pl. 7, fig. 14.

Kvænangen II, 90 m.; The Jøkel Fiord II, 80 m.; The Jøkel Fiord III, 100 m.; The North Cape (1894); The Porsanger Fiord; Sværholt (1894); The Kjølle Fiord (1894); Mehavn (1894).

The specimens from the places above mentioned answer, on the whole, well to LORENZ's illustrations and description of *C. nodulosa*.

The mandible of the avicularia (fig. 24) had a row of fine teeth in the distal margin, and in the operculum b was > h (fig. 23). On examining some old material of *Cellepora* specimens, I found that the forms which I entered as *C. pumicosa* from Finmark in my list of Norwegian Cheilostomata were really young colonies of *nodulosa*.

I am afraid that NORMAN and WATERS have been guilty of the same mistake, when they mention *pumicosa* respectively from Finmark and Franz Josef Land. I do not think that *pumicosa* occurs in Finmark. In addition to the places already mentioned, I have determined specimens of *C. nodulosa* from the North Ocean Expedition st. 223, 273, 363.

BIDENKAP has taken it in the inner part of the Lyngen Fiord.

Cellepora ventricosa, LORENZ.
Pl. III, figs. 26—29.

When I was working out the Bryozoa from the North Ocean Expedition, I treated *ventricosa* and *incrassata* as being the same, as I supposed that the difference between the forms lay within the limits of variation for the one species. After I had got more material, however, I found that they must be treated as two separate species, and this opinion is shared by WATERS in his treatment of the Bryozoa from Franz Josef Land.

I have a typical *C. ventricosa* (fig. 26) from Breisund in Finmark.

The zoarium probably never attains to such a decided branching as is the case in *C. incrassata*. The two species can be distinguished at once by the naked eye, as *incrassata* is comparatively smooth on the surface, the zooecia not reaching so far forward from the colony as in *ventricosa*.

There were no vicarious avicularia on the specimens of *C. ventricosa* which LORENZ and WATERS had at their disposal, but they were present (fig. 29) in my colony from Breisund. They are different from those in *C. incrassata*, the greatest width of the mandible of *ventricosa* is about double that at the hinging joint, while the corresponding mandible in *incrassata* is more evenly wide. (Cfr. WATERS, Bryozoa, from F. J. Land, pl. 12, fig. 13).

The mandible in the oral avicularium is semicircular also in *ventricosa* (fig. 28), but it is considerably larger than in *incrassata*.

C. ventricosa is new to Norwegian fauna.

Cellepora incrassata, SMITT.
Pl. III, fig. 25.

Hammerfest (1894).

WATERS has called attention to the fact that *Cellepora incrassata*, LAMARCK and *C. incrassata*, SMITT are not identical. The former is found in the Mediterranean and is supposed to be the same as *C. coronopus*, S. WOOD, while *C. incrassata*, SMITT has proved only to have arctic distribution. It occurred in the material which MC ANDREW collected in Finmark in 1856 and the species is entered by BUSK under the name *Cellepora cervicornis*.[1] WATERS does not, however, adopt this name, because a large number of forms have been given the name *Cellepora cervicornis* and *Eschara cervicornis*.

I believe I have identified the following *Cellepora* species on the Norwegian coast:— *pumicosa, ramulosa, tuberosa, dichotoma, avicularis, nodulosa, costazi, ventricosa* and *incrassata*.

Retepora beaniana, KING.

Rost III, 100 m.; Moskenstrommen I, 200 m.; The Kirk Fiord III, 70—80 m.; Balstad; Mortsund III, 100 m.; Ure I, 200—250 m.; The Ostnes Fiord, 130 m.; The Beier Fiord, 50—150 m.; Digermulen, 100—150 m.; Stonesbotn, 40—80 m.; Malangen, 100—200 m.; Hammerfest, Ingohavet, 300 m.; Breisund, 100 m.; Mehavn (1894).

Retepora cellulosa, LIN.

Malangen, 100—200 m.; Hammerfest (1894); The North Cape (1894); The Porsanger Fiord, 200 m.; Sværholt (1894).

This species has not hitherto been found by me south of Malangen.

Retepora wallichiana, BUSK.
Pl. III, fig. 29.

The Beier Fiord, 50—150 m.; Balstad; Stonesbotn, 40—80 m.; Malangen, 100—200 m.; The North Cape (1894); Nordkyn (1894). I have also found this form in Radosund, a little north of Bergen. The species is arctic in its distribution.

Cyclostomata.

Crisia eburnea, LIN.

Moskenstrommen I, 200 m.; The Kirk Fiord IV, 30—50 m.

Crisia denticulata, LAMARCK.

The Kirk Fiord, 100 m.; Malangen, 380 m.

Tubulipora liliacea, PALLAS.
Pl. III, fig. 30.

The Sag Fiord, 200 m.; on dead branches of *Isidella hipparis*: Malangen, 100—200 m.

Tubulipora penicillata?, FABR.
Pl. III, fig. 31.

The North Cape (1894); Mehavn (1894).

Idmonea atlantica, FORBES.
Pl. III, fig. 32.

The Sea N. W. of Rost, 700 m.; Moskenstrommen I, 200 m.; The Kirk Fiord, 30—50 m.; The Beier Fiord, 50—150 m.; Reine, 100 m.; Balstad, 30—50 m.; Mortsund I, 200 m.; The Ostnes Fiord, 130 m.; The Jokel Fiord I, 100 m.; Breisund 100 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

Diastopora patina, LAMARCK.

Malangen, 100—200 m.

[1] Ann. and Mag. Nat. Hist., ser. 2, vol. 18, p. 32, pl. 1, fig. 1.

Diastopora obelia, JOHNSTON.

Moskenstrommen, 90 m., on *Waldheimia*; The Kirk Fiord III, 70—80 m.; Digermulen, on stone, 150 m.; The Tys Fiord I, on *Lophohelia*, 500 m.; Malangen, 100—200 m.; Ingohavet, on sponges, 300 m.

Reticulipora intricaria, SMITT.

Sværholt (1894).

Hornera lichenoides, (PONTOP.), LIN.
Pl. III, fig. 33.

Rost II, 150 m.; Moskenstrommen, 90 m.; Reine, 100 m.; Mortsund II, 100 m.; Stonesbotn, 40—80 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Mehavn (1894).

Hornera violacea, M. SARS.

Malangen, 100—200 m.; Malangen, 380 m.

Lichenopora hispida, FLEMING.

The Kirk Fiord, 100 m.; The Tys Fiord I, on *Lophohelia*, 500 m.; Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

Lichenopora verrucaria, FABRICIUS.

Groto, on algae, 6—24 m.

Domopora stellata, GOLDFUSS.
Pl. III, fig. 34.

Reine (Lofoten), 100 m.; Malangen, 100—200 m., Malangen indicates the northern limit of the species.

Defrancia lucernaria, M. SARS.

The Kirk Fiord, 50—80 m., both living and dead colonies; The Ogs Fiord I, 100 m. (dead colony); Kvænangen II, 90 m.; The Jokel Fiord I, 100 m.; The Jokel Fiord II, 80 m.; The Porsanger Fiord, 70 m.

Ctenostomata.

Alcyonidium gelatinosum, LIN.[1]

Malangen, 100—200 m.

Alcyonidium disciforme, SMITT.
Pl. III, fig. 35.

Lyngen III, 320 m.

This peculiar species had not previously been found on the Norwegian coast.

Flustrella hispida, FABRICIUS.

The North Cape (1894), on *Fucus serratus*; Nordkyn (1894), on *Fucus serratus*. NORMAN has found this species at Svolvær, Lofoten.

Flustrella corniculata, SMITT.
Pl. III, fig. 37, 38.

1871. *Alcyonidium corniculatum*, SMITT, Krit. förteckn. ets. Öfvers. Kgl. Vet. Akad. Forh. 1871, p. 1123, pl. 20, figs. 10—16.

[1] *Alcyonidium hirsutum*, FLEM. has been found by NORMAN on *Fucus* at Svolvær, Lofoten.

1886. *Flustrella corniculata*. LORENZ. Bryozoen von Jan Mayen. p. 99.
1897. *Flustrella corniculata*. BIDENKAP. Bryozoen von Ost-Spitzbergen. Zool. Jahrb. B. 10. 1897. p. 634.
1900. *Flustrella corniculata*. BIDENKAP. Die Bryozoen von Spitzbergen und König Karls Land. Fauna arctica. Bd. I. p. 531.
1900. *Alcyonidium cervicornis*. ALICE ROBERTSON. Paper from the Harriman Alaska Expedition. Bryozoa. Proc. Wash. Acad. Science. vol. 2. p. 330. pl. 21. figs. 14—17.
1903. *Flustrella corniculata*. NORMAN. Notes on the Nat. Hist. of East Finmark. Ann. and Mag. Nat. Hist., ser. 7. vol. 11. p. 576.

Svolvær. Lofoten (1894), on algae.

NORMAN was the first to find this species on the Norwegian coast. He found it living between tidemarks at Vadsø. It is interesting that this form which had previously only been found in the arctic regions can exist as far down as Lofoten. SMITT has described the species from Spitzbergen, where it has later been taken by KÜKENTHAL and WALTER, as well as by RÖMER and SCHAUDINN. (Cf. BIDENKAP, l. c.).

Miss ROBERTSON has described a species from material from Alaska, under the name *Alcyonidium cervicornis*, which is probably the same as SMITT's species. The only thing which might suggest a difference, is that the aperture of the zooecium in *cervicornis* is mentioned as being circular, while in *corniculata* (as in *hispida*) it is a fissure which is provided with two lobes. In preserved material, however, these facts may easily be wrongly interpreted. The characteristic, branched spines (Pl. III, figs. 37, 38), which are situated one at each corner between the zooecia, from which they are separated by an intermediate wall, seem to be alike in the two forms. They appear really to be identical. Both in *hispida* and *corniculata*, there are two semicircular shaped thickened places near at the oral aperture, these probable serve the same purpose as the operculum in *Cheilostomata*.

Bowerbankia imbricata, ADAMS.
Pl. III. fig. 36.

Nordkyn (1894), on *Laminaria*.

I have a specimen from the North Ocean Expedition, st. 343, in which several colonies have grown together, forming comparatively thick branches (Pl. III, fig. 36).

The foregoing list of Bryozoa from the northern part of the Norwegian coast is not complete, but it is my opinion that it is fairly representative. The number has been increased by the addition of several species.

Of those forms described by SMITT from the numerous Swedish arctic expeditions, there are now only exceedingly few which have not been observed by me on our northern coast. The Bryozoan fauna from Lofoten to the Varanger Fiord proves to contain more arctic elements than was previously supposed.

Brachiopoda.

HERMAN FRIELE and J. SPARRE SCHNEIDER determ.
Remarks by the author.

Crania anomala, MÜLL.

The Kirk Fiord II, 70—80 m.; Mortsund (Vest Fiord), 200 m.; Digermulen, 100—150 m.; Hammerfest (1894).

G. O. SARS[1] mentions The Komag Fiord in Vest Finmarken as the northern limit for this species. Hammerfest is a little further north.

Rhynchonella psittacea, CHEMN.

Malangen, 100—200 m.; Kvænangen II, 90 m.; The Jokel Fiord III, 100 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

The southern limit for this species is The Malangen Fiord.

Terebratulina caput-serpentis, LIN.[2])

The Beier Fiord, 50—150 m.; The Tys Fiord, 500 m.; The Kirk Fiord II, 70—80 m.; Mortsund II (Vest Fiord), 200 m.; The Ogs Fiord I, 100 m.; Malangen, 100—200 m.; Stonnesbotn, 40—80 m., Kvænangen II, 90 m.; The Jokel Fiord III, 100 m.; Hammerfest (1894); Ingohavet, 300 m.; The Porsanger Fiord, 200 m.; The Kjolle Fiord (1894).

Terebratulina septentrionalis, COUTH.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Salten Fiord II, 320—380 m.; Balstad (Vest Fiord), 150 m.

Waldheimia cranium, MÜLL.

The Skjerstad Fiord III, 230 m.; The Tys Fiord, 500 m.; Røst II, 150 m.; Moskenstrommen, 90 m.; Reine (Vest Fiord), 100 m.; The Kirk Fiord IV, 30—50 m.; Balstad (Vest Fiord), Mortsund II, 200 m.; Stene (Vest Fiord), 100 m.; The Ostnes Fiord; Digermulen, 100—150 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Hammerfest (1894); Ingohavet, 300 m.; The Kjolle Fiord (1894).

Pelecypoda.

HERMAN FRIELE and J. SPARRE SCHNEIDER determ.
Remarks by the author.

Anomia ephippium, LIN.

Balstad, 80 m.; Digermulen, 100—150 m.; Malangen, 100—200 m.; Kvænangen, 90 m.; The North Cape (1894); The Porsanger Fiord, 70 m.

Anomia aculeata, MÜLLER.

The Skjerstad Fiord III, 230 m.; The Sag Fiord, 200 m.; The Kirk Fiord, 70 m.; Stonnesbotn, 40—80 m.; Malangen, 100—200 m.; The Jokel Fiord, 100 m.

Pecten islandicus, MÜLLER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord X (Misvær Fiord), 10—30 m.; Moskenstrommen, 90 m.; The Ostnes Fiord; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.; The Porsanger Fiord, 50 m.

The largest specimen from The Skjerstad Fiord X was 86 mm. in height and 84 mm. in length.

Pecten aratus, GMELIN.

Moskenstrommen, 90 m.; Balstad (Vest Fiord), 150 m.

[1]) Mollusca Regionis Arcticæ Norvegiæ, p. 8.

[2]) Some of the places here mentioned doubtless have reference to *T. septentrionalis*, SCHNEIDER having considered it to be a variety of *caput-serpentis* but FRIELE has treated it as a separate species.

The specimen from Moskenstrommen was 15 mm. in height and 14 mm. in length.

The northern limit for this species is Lofoten.

Pecten septemradiatus, Müller.

The Beier Fiord, 50—150 m.: (1 spec., 11 mm.): The Sag Fiord, 200 m. (s)[1]: Malangen, 100—200 m. (s): Gaukværo, 250 m.

The largest specimen from Gaukværo was 32 mm.

At Tromsø, Schneider only found shells, but both M. and G. O. Sars collected the species in the Varanger Fiord.

Pecten tigrinus, Müller.

The Ostnes Fiord.

This species was previously known right up to The North Cape. Norman in 1890 took it in The Lang Fiord (South Varanger)[2].

Pecten striatus, Müller.

Stønnesbotn, 40—80 m.

Havøsund (Finmark) is the northern limit for this species.

Pecten incomparabilis, Risso.

The Ostnes Fiord, 30 m.

Lofoten is the northern limit for the species.

Pecten imbrifer, Lovén.

Malangen, 380 m.: Kvænangen II, 90 m.

Pecten vitreus, Chemnitz.

The Beier Fiord, 50—150 m.: The Skjerstad Fiord III, 230 m.: The Tys Fiord, 500 m. (in quantities on *Lophohelia prolifera*): The Ogs Fiord I, 100 m.: The Kanstad Fiord, 30—90 m.

Pecten abyssorum, Lovén.

The Skjerstad Fiord IV, 330 m.: Brettesnes—Skroven, 350—400 m.: Malangen, 380 m.

Pecten similis, Laskey.

Moskenstrommen I, 200 m.: Balstad (Lofoten), 150 m.

Pecten groenlandicus, Sowerby.

Lyngen II, 250 m.: Lyngen III, 300 m.: Kvænangen, 300—343 m.

The southern limit for the species is Tromsø.

At St. Lyngen II several specimens were taken, the largest measured 22 mm., thus being very nearly as large as the specimens from Spitzbergen which are given as being 24 mm.

Lima excavata, Fabr.

Arno, 300—400 m.: Tys Fiord I, 500 m.

The largest specimen measured 135 mm.

G. O. Sars has caught this species at Skroven (Lofoten). According to Sars[3] the species is mentioned from Finmark by Mr. Andrew, but is has, however, not been taken there later.

Friele and Grieg[4] give the distribution of this species to the depths between The Hebrides end The Faroe Isles, Portugal, The Azores and Senegambia. On our coast the species is limited to the great fiord depths with their particularly constant temperature and salinity (6—7° C., about 35 ‰).

As The Vest Fiord is the most northern of the principal fiords where these physical conditions prevail, I am inclined to think that the mention of this species from Finmark must be a mistake.

The northern limit should be looked upon as Lofoten, until there is definite information that it is distributed still further northwards.

Lima loscombii, Sowerby.

Moskenstrommen, 90 m.

G. O. Sars has found shells of this species at Skroven. My catches in Moskenstrommen prove that the species still exists at Lofoten, which must therefore be considered to be its northern limit on our coast.

Limatula crassa, Forbes.

Moskenstrommen I, 200 m.

Mytilus edulis, Lin.

Nordkyn (1894). Common other places too.

Modiola modiolus, Lin.

The Skjerstad Fiord X, 10—50 m.: Hammerfest (1894): Troldfiordsund, 40 m.: Nordkyn (1894).

Modiola phaseolina, Phillippi.

Moskenstrommen, 200 m.: Reine I, 150 m.: Balstad, Stene, 120—200 m.: Henningsvær-Strommen, 20—40 m.: The Sag Fiord, 200 m.: Malangen, 100—200 m.: Troldfiordsund, 40 m.: Breisund, 100 m.

Dacrydium vitreum, Møller.

Ure I (Vest Fiord), 200—250 m.: mouth of Raftsund, 250—300 m.: The Ogs Fiord I, 100 m.: Malangen, 380 m.: Lyngen II, 250 m.

Crenella decussata, Mont.

The Skjerstad Fiord II, 100—185 m.: Gaukværo II, 25 m.: Hammerfest (s).

Modiolaria laevigata, Gray.

The Beier Fiord, 50—150 m.: The Ostnes Fiord, 20 m.: Breisund, 100 m.: The North Cape (1894).

The Beier Fiord is the southern limit for this species. I collected a small specimen here.

Modiolaria nigra, Gray.

The Beier Fiord, 50—150 m.: The Kirk Fiord II, 50 m.: Mortsund III, 100 m.: Gaukværo, 250 m.: Stønnesbotn, 40—80 m.: The Jøkel Fiord I, 100 m.: Troldfiordsund, 40 m.

Nucula tumidula, Malm.

The Skjerstad Fiord IV, 330 m.: The Skjerstad Fiord VII, 490 m.: The Salten Fiord II, 320—380 m.: Brettesnes—Skroven, 350—400 m.: Tranødybet, 607—640 m.

Nucula tenuis, Mont.

The Skjerstad Fiord VII, 490 m.: The Ogs Fiord I, 100 m. (s): The Jøkel Fiord, 100 m.

[1] (s) means that only empty shells were found.

[2] Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist. ser. 7, vol. X, p. 357.

[3] Mollusca Regionis arcticæ Norvegiæ, p. 24.

[4] Mollusca III, p. 6. The Norw. North Atl. Exp.

Leda pernula. Müller.

The Skjerstad Fiord III, 230 m.; The Kirk Fiord II, 50 m.; Svolvær, 150 m.; The Ostnes Fiord, 30—40 m.; mouth of Raftsund, 250—300 m.; The Ogs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Gaukværo II, 250 m.; Malangen, 380 m.; Stønnesbotn, 40—80 m.; Kvænangen II, 90 m.; The Porsanger Fiord, 200 m.

Leda minuta, O. F. Müller.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; Kvænangen II, 90 m.; Digermulen, 100—150 m.

Portlandia lucida, Lovén.

The Skjerstad Fiord II, 100—185 m.; The Skjerstad Fiord VII, 490 m.; Oxsund, 600 m.; The Kirk Fiord II, 50 m.; Mortsund I, 200 m.; Ure I (Vest Fiord), 200—250 m.; Risværflaket, 150—180 m.; mouth of Raftsund, 250—300 m.; Malangen, 380 m.

Portlandia intermedia, M. Sars.

The Porsanger Fiord, 200 m.

This species was first caught by M. Sars in The Varanger Fiord. The Norw. North Atl. Exp. caught it at St. 260 (The Porsanger Fiord), 261, (The Tana Fiord) and 262 (off The Varanger Fiord). Hitherto it has not been taken further westwards and southwards on the Norwegian coast than The Porsanger Fiord.

Portlandia tenuis, Philippi.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord VI, 125 m.; The Skjerstad Fiord VII, 490 m.

Portlandia lenticula, Moller.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord, 100—185 m.; The Skjerstad Fiord VI, 125 m.; The Kirk Fiord IV, 70—80 m.; Mortsund I, 200 m.; The Ogs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Malangen, 380 m.; Stønnesbotn, 40—80 m.; The Jokel Fiord II, 80 m.

Portlandia frigida, Torell.

Risværflaket, 150—180 m.

Yoldia limatula, Say.

The Kirk Fiord, 70—80 m.; Svolvær, 150 m.; The Ostnes Fiord, 30—40 m. (several specimens, the largest being 36 mm.); Stønnesbotn, 40—80 m.; The Kjolle Fiord (1894).

The southern limit for the species is Lofoten.

Malletia obtusa, M. Sars.

Moskenstrommen I, 200 m.; Brettesnes—Skroven, 300—400 m.; Tranodybet, 640 m.

The northern limit for this species is Lofoten.

Arca pectunculoides, Scacchi.

The Beier Fiord, 50—150 m.; (var. *septentrionalis*): The Skjerstad Fiord III, 230 m.; (var. *septentrionalis*): The Skjerstad Fiord VI, 125 m. (var. *septentrionalis*, the largest specimen 9.5 mm.); The Oxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrommen, 200 m.; Ure I, 200—250 m.; Mortsund I, 200 m.; Brettesnes—Skroven, 300—400 m.; The Ogs Fiord I, 100 m.; mouth of Raftsund, 250—300 m.; Tranodybet, 640 m.; Gaukværo II, 250 m.; Malangen, 100—200 m. (var. *septentrionalis*): Malangen, 380 m.; The Jokel Fiord III, 100 m.; (var. *septentrionalis*): Kvænangen, 300—343 m. (var. *septentrionalis*).

The typical form extends to Malangen, or, at any rate, to Lofoten; var. *septentrionalis* is limited southwards in the Beier Fiord.

Arca glacialis, Gray.

The Porsanger Fiord, 200 m.

According to G. O. Sars, this species has been caught at Magero by Verkrüzen. Further westwards and southwards this species has not hitherto been noticed on our coast.

Limopsis minuta, Phil.

The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; Landego, 200—450 m.; Oxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrommen, 200 m.; Balstad, 150 m.; Stene (Vest Fiord), 120—200 m.; Ure I, 200—250 m.; Skroven, 200—400 m.; The Kanstad Fiord, 30—90 m.

Friele and Grieg mentioned that this species was taken by The Norw. North Atl. Exp. at St. 290, which is situated about half way between Norway and Beeren Eiland, which is the most northern place where it is known.

Cardium nodosum, Turt.

The Kanstad Fiord, 30—90 m.

Cardium echinatum, Lin.

The Salten Fiord I, 15—20 m.

Cardium fasciatum, Mont.

The Beier Fiord, 50—150 m. (s); She Skjerstad Fiord IX, 80 m.; The Salten Fiord I, 15—20 m.; The Kirk Fiord II, 50 m.; Napstrommen, 40 m.; Henningsværstrommen, 40 m.; The Ostnes Fiord; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m.; Troldfiordsund, 40 m.

Cardium minimum, Phil.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Salten Fiord II, 320—380 m.; Moskenstrommen, 200 m.; Ure I, 200—250 m.; Mortsund, 200 m.; The Kanstad Fiord, 30—90 m.; Gaukværo II, 250 m.; Malangen, 380 m.; Lyngen III, 300 m.

Cyprina islandica, Lin.

The Salten Fiord I, 15—20 m.; Napstrommen, 40 m.; Stene (Vest Fiord), 120—200 m.; The Ostnes Fiord, 40 m.; The Ogs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Troldfiordsund, 40 m.; The Kjolle Fiord (1894).

Astarte borealis, Chemn.

Troldfiordsund, 40 m.

Astarte banksi, Leach.
(*A. compressa,* Mont.).

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord I, 30—50 m.; The Ostnes Fiord, 30 m.; Stønnesbotn, 40—80 m.; Hammerfest.

Astarte sulcata, da Costa.

The Beier Fiord, 50—150 m.; The Salten Fiord II, 320—380 m.; Rost II, 150 m.; Reine I, 150 m.; Balstad, 150 m.; Mortsund III, 100 m.; Ure I, 200—250 m.; Svolvær, 150 m.; Digermulen, 150 m.; Malangen, 100—200 m.; The Kjolle Fiord (1894).

Astarte compressa, LIN.
(*A. elliptica*, BROWN).

The Beier Fiord, 50 m.; The Ostnes Fiord, 30 m.

Astarte crenata, GRAY.
(*A. crebricostata*, FORBES).

The Skjerstad Fiord II, 185 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord VI, 125 m.; Rost II, 150 m.; The Kirk Fiord, 70—100 m.; Mortsund I, 200 m.; Stene (Vest Fiord), 120—200 m.; Risvaerflaket, 180 m.; The Ogs Fiord I, 100 m., Malangen, 100—200 m.; Lyngen II, 250 m.; Kvaenangen, 300—343 m.; Kvaenangen, 90 m.; The Jokel Fiord II, 60 m.; The Porsanger Fiord, 200 m.; The Kjolle Fiord (1894).

The specimens from The Kirk Fiord showed no signs of deformity. The largest were 34 mm. in length and 80 mm. in height. This species has not been observed on our coast further south than The Skjerstad Fiord.

Venus gallina, LIN.

The Salten Fiord I, 15—20 m.; The Salten Fiord II, 320—380 m.

Several shells were found on the beach at Vaero on 12/8 1896.

Venus ovata, PENNANT.

Rost II, 150 m.; Mortsund III, 100 m.; Svolvaer; Malangen, 100—200 m.; Svaerholt (1894).

Lucina borealis, LIN.

Napstrommen, 30—40 m. (s); Svolvaer (1894).

Shells belonging to this species were found on the beach at Vaero the 12/8 1896.

Axinus flexuosus, MONT.

The Skjerstad Fiord II, 185 m.; Landego, 200—450 m.; The Kirk Fiord, 40—100 m.; Risvaer, 150 m.; Malangen, 380 m.

Axinus sarsi, PHIL.

Risvaerflaket, 150—180 m. (s).

Axinus croulinensis, JEFF.

The Skjerstad Fiord IV, 330 m. (s); The Skjerstad Fiord VII, 490 m.

Kelliella miliaris, PHIL.

Mouth of Raftsund, 280—300 m.

This form has not been caught alive on the Norwegian coast north of Raftsund. According to SCHNEIDER[1]) shells have been found at Tromso by Dr. KRAUSE.

Montacuta substriata, MONT.

GRIEG[2]) mentions that this species has been found on several specimens of *Spatangus purpureus*.

Mactra elliptica, BROWN.

Rost I, 120 m.; Stene (Vest Fiord), 120—200 m.; Henningsværstrommen, 20—40 m.; Troldfiordsund, 40 m.; The North Cape (1894).

1) Tromsosundets Molluskfauna. Tromso Mus. Aarsh. VIII, p. 85.

2) Oversigt over det nordlige Norges echinodermer, p. 33. Berg. Mus. Aarb. 1902. No. 1.

Syndosmya alba, WOOD.

The Salten Fiord I, 15—20 m.

Syndosmya longicallis, SCACCHI.

The Salten Fiord II, 320—380 m. (s); The Folden Fiord, 530 m.; Landego, 200—450 m.; Mortsund I, 200 m.; Skroven, 200—400 m.

Syndosmya nitida, MULLER.

Mortsund I, 200 m.; Tranodybet, 640 m.; Gaukvaero II, 250 m.; Malangen, 380 m.

Tellina (Macoma) calcaria, CHEMN.

Kvaenangen II, 90 m. (s).

Solen pellucidus, PENN.

The Salten Fiord I, 15—20 m.

The northern limit for this species is Lofoten.

Neæra arctica, M. SARS.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m. FRIELE and GRIEG[1] mention that this species was only known from one place on the Norwegian coast, viz. Vadso (Varanger Fiord).

Neæra obesa, LOV.

The Beier Fiord, 50—150 m.; The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; Oxsund, 600 m.; The Kirk Fiord IV, 30—50 m.; Mortsund I, 200 m.; Brettesnes—Skroven, 350—400 m.; Risvaerflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; Tranodybet, 640 m.; Gaukvaero II, 250 m.; Malangen, 380 m.; Lyngen III, 300 m.

Neæra obesa var. *glacialis*, G. O. SARS.

The Beier Fiord, 50—150 m.

In my collection there were most likely several forms of this variety which have been classified under the chief form. (*N. obesa*, LOV.).

Neæra subtorta, G. O. SARS.

The Skjerstad Fiord VI, 125 m.; The Jokel Fiord, 100 m.

The Skjerstad Fiord is the southern limit for this species, as far as is now known.

Neæra rostrata, SPENGEL.

The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; Landego, 200—400 m.; Brettesnes—Skroven, 350—400 m.

This is one of the southern forms, which G. O. SARS has found at Hasvik on Soro.

Neæra cuspidata, OLAVI.

The Skjerstad Fiord VI, 125 m.

Poromya granulata, NYST.

Malangen, 100—200 m.

Corbula gibba, OLAVI.

The Ostnes Fiord, 20 m.

1) Mollusca III, p. 39.

Saxicava arctica, Lin.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord IV, 330 m.; The Sag Fiord, 200 m.; Balstad, 150 m.; Ure I, 200—250 m.; Svolvær (1894); Digermulen, 100—150 m.; The Ogs Fiord I, 100 m.; Malangen, 100—200 m.; The North Cape (1894); The Kjølle Fiord (1894).

Zirphaea crispata, Lin.

On the farm Sund in The Beier Fiord, on the beach.

This is one of the mussels which are used as bait.

Scaphopoda.

Herman Friele and I. Sparre Schneider determ.

Remarks by the author.

Dentalium entale, Lin.

The Skjerstad Fiord IX, 80 m.; Røst II, 150 m.; Svolvær (1894); Digermulen, 100—150 m.; Sværholt (1894).

Dentalium occidentale, Stimpson.

The Kirk Fiord II, 70—80 m.; Brettesnes—Skroven, 350—400 m.; Malangen, 100—200 m.; Lyngen III, 300 m.

Dentalium agile, M. Sars.

Landego, 200—400 m.; The Folden Fiord, 530 m.

Lofoten is the northern limit for this species.

Siphonodentalium vitreum, M. Sars.

The Skjerstad Fiord II, 185 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; Malangen, 380 m.; Lyngen II, 250 m.; Lyngen III, 300 m.; Kvænangen II, 90 m.; Kvænangen, 300—343 m.; The Jøkel Fiord I, 100 m.; The Jøkel Fiord II, 60 m.; The Porsanger Fiord, 200 m.

This arctic form has not hitherto been noticed south of The Skjerstad Fiord.

Siphonodentalium quinquangulare, Forbes.

The Sag Fiord, 200 m.; Oxsund, 600 m.; Mortsund I, (Vest Fiord), 200 m.; Brettesnes—Skroven, 350—400 m.

Placophora.

Herman Friele and I. Sparre Schneider determ.

Remarks by the author.

Hanleyia hanleyi, Bean.

The Kirk Fiord II, 50 m.; Malangen, 100—200 m.

Leptochiton cancellatus, Sowerby.

The Sag Fiord, 200 m.; Kvænangen II, 90 m.

Leptochiton cinereus, Lin.

Henningsværstrømmen, 20—40 m.; The Ostnes Fiord, 30 m., Digermulen, 100—150 m.

Trachydermon exaratus, G. O. Sars.

The Salten Fiord II, 320—380 m.

Trachydermon albus, Lin.

„Glea" (Røst); Digermulen, 100—150 m.

Trachydermon ruber, Lowe.

Troldfiordsund, 40 m.

Tonicella marmorea, Fabr.

The Kirk Fiord IV, 30—50 m.; Henningsværstrømmen, 30—40 m.; The Ostnes Fiord I, 30 m.

Gastropoda.

Herman Friele and I. Sparre Schneider determ.

Remarks by the author.

Patella vulgata, Lin.

Several large shells belonging to this species were found on the beach at Værø ($^{12}/_{3}$ 1896).

This species is found as far north as Raftsund (Lofoten) on the inner coast, according to G. O. Sars. Along the outer coast, Schneider[1]) mentions that it is found up to the 70th degree of latitude (Vandø, NW of Tromsø).

Patina pellucida, Lin.

Svolvær harbour; Sværholt (1894).

Schneider mentions that the species may be found right up to Vardø.

Acmaea testudinalis, Müll.

„Glea" (Røst); The Kjølle Fiord (1894); Sværholt (1894).

Tectura rubella, Fabr.

In a bottom sample from Hammerfest (s). The southern limit for the species is Tromsø.

Tectura virginea, Müll.

Henningsværstrømmen, 20—40 m.; The Skjerstad Fiord II, 30—50 m.

Tectura fulva, O. F. Müll.

Skroven, 200—400 m.

Lepeta coeca, O. F. Müll.

The Skjerstad Fiord IX, 30—50 m.; The Ogs Fiord I, 100 m.; The Jøkel Fiord I, 100 m.; The Porsanger Fiord.

Puncturella noachina, Lin.

The Skjerstad Fiord IX, 80 m.; The Folden Fiord, 530 m.; Røst II, 100 m.; Mortsund III, 100 m.; in a sample of bottom from Hammerfest (s).

Emarginula fissura, Lin.

The Ostnes Fiord, 20 m.

G. O. Sars mentions Hammerfest as the northern limit for the species.

Scissurella crispata, Flem.

Mortsund I, 200 m.

Margarita helicina, Fabr.

„Glea" (Røst), Oxsund, 600 m.; Kvænangen, 300—343 m.; Troldfiordsund, 40 m.; Repvaag (Porsanger Fiord), 10 m.

[1]) Tromsøsundets Molluskfauna, p. 101.

Margarita groenlandica, Chemn.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; Balstad; Henningsværstrommen, 20—40 m.; Svolvær, Risværflaket, 150—180 m.; The Ostnes Fiord; Stonnesbotn, 40—80 m.; The Jokel Fiord, 100 m.; Hammerfest; Troldfiordsund, 40 m.; The Kjolle Fiord (1894).

Margarita cinerea, Couth.

The Kirk Fiord IV, 30—50 m. (s); The Jokel Fiord III, 100 m.; Hammerfest (1894) (s).

Machæroplax obscura, Couth.

The Beier Fiord, 50—150 m. (s); Stonnesbotn, 40—80 m.; Kvænangen II, 90 m. (s); Troldfiordsund, 40 m.; Hammerfest (1894) (s).

Gibbula cineraria, Lin.

The Salten Fiord I, 15—20 m.; The Salten Fiord II, 320—380 m.; The Kirk Fiord III, 70—80 m.; Balstad, 10—35 m.; Svolvær (1894); Risværflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; Lyngen III, 300 m.

Gibbula tumida, Mont.

The Salten Fiord I, 15—20 m.; Henningsværstrommen, 20—40 m.; The Kanstad Fiord, 30—90 m.; Kvænangen II, 90 m.

Trochus occidentalis, Migh.

The Beier Fiord, 50—150 m.; Reine, 100 m.; Balstad, 10—35 m.; Malangen, 100—200 m.; The Jokel Fiord I, 100 m.; Hammerfest (1894) (s); Breisund, 100 m.; Ingohavet, 300 m.

Conulus millegranus, Phil.

Digermulen, 100—150 m.
The northern limit for this species is Digermulen.

Capulus hungaricus, Lin.

Rost II, 150 m.
I collected two dwarf-like specimens at Røst, which is the most northernly place where the species has been observed alive. The Norw. North Atl. Exp. only found shells at stations 192 and 195.

Velutina lævigata, Penn.

Svolvær (1894); Breisund, 100 m.

Velutina flexilis, Mont.

Breisund, 100 m.

Lamellaria latens, O. F. Müll.

Arno, 300—400 m.
A gigant specimen, about 50 mm.

Marsenia prodita, O. F. Müll.

Mortsund III, 100 m.; Sværholt (1894).

Onchidiopsis glacialis, M. Sars.

Tys Fiord, 500 m.

Amauropsis islandica, Gmelin.

The Beier Fiord, 50—150 m. (s); Malangen, 100—200 m. (s); Hammerfest (s); Troldfiordsund; Breisund.

Natica (Lunatia) montagui, Fabr.

The Kirk Fiord III, 70—80 m.; Balstad, 10—35 m.; Mortsund I, 100 m.; The Ostnes Fiord; Digermulen, 100—150 m.; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Stonnesbotn, 40—80 m.; Troldfiordsund, 40 m.

Natica (Lunatia) intermedia, Phil.

The Salten Fiord I, 15—20 m.
Lofoten is the northern limit for this species.

Natica (Lunatia) groenlandica, Beck.

The Salten Fiord I, 15—20 m.; The Kirk Fiord II, 50 m.; The Kirk Fiord III, 70—80 m.; The Kirk Fiord IV, 30—50 m.; Mortsund III, 100 m.; Digermulen, 100—150 m. (s); The Ogs Fiord I, 100 m.; Stonnesbotn, 40—80 m.; Lyngen II, 250 m. (s); The Porsanger Fiord, 200 m. (s).

Natica (Lunatia) affinis, Gmel.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Salten Fiord, 320—380 m.; Oxsund, 600 m.; Ure I, 200—250 m.; Ostnes Fiord (s); Gaukværo, 250 m.; Malangen, 100—200 m. (s); Kvænangen II, 90 m. (s); The Jokel Fiord I, 100 m.; The Jokel Fiord III, 100 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

Trichotropis borealis, Brod. & Sow.

Moskenstrommen I, 200 m.; Balstad, 10—35 m.; Malangen, 100—200 m.; The Jokel Fiord I, 100 m.; The Jokel Fiord II, 80 m.; Hammerfest (s); Troldfiordsund, 40 m.; The Porsanger Fiord, 200 m.

Trichotropis conica, Moll.

The Jokel Fiord.
Tromsø is the southern limit for this species.

Littorina littorea, Lin.

„Glea" (Rost), several large specimens.

Littorina rudis, Meton.

The Skjerstad Fiord IX, 80 m.; Risværflaket, 150—180 m. (s).

Var. *groenlandica*, Moll. collected at Vardo was given me by my friend Olaf Vaade.

Littorina palliata, Say.

From Olaf Vaade, factory-manager, I got specimens of this species, which were collected at Vardo.

Littorina obtussata, Lin.

„Glea" (Rost); Risværflaket, 150—180 m. (s).

Lacuna divaricata, Fabr.

The Salten Fiord I, 15—20 m.; Balstad, 10—35 m.; Henningsværstrommen, 20—40 m.; Svolvær (1894); Risværflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; Kvænangen II, 90 m.; Troldfiordsund, 40 m.; The North Cape (1894); Sværholt (1894).

Rissoa (Alvania) jeffreysi, Waller.

The Skjerstad Fiord VI, 125 m.; Hammerfest (s).

Rissoa (Onoba) aculeus, Gould.

Hammerfest (s).

Lovenella metula, Lov.

The Kirk Fiord II, 50 m.; Brettesnes—Skroven, 300—400 m.

Cerithiopsis costulata, Moll.

Hammerfest (s).

Lacocochlis granosa, Wood.

Reine I, 150 m.

Aporhais pes-pelicani, Lin.

The Salten Fiord I, 15—20 m. Several rather large specimens. G. O. Sars has occasionally caught this species in Lofoten, and M. Sars[1]) mentions that he found a specimens in the Ox Fiord. On the inner coast, from Lofoten to the Ox Fiord, the species has not been noticed; but on the outer coast it is mentioned by Schneider as being collected at Lyngo and Vando.

Scalaria groenlandica, Chemn.

The Skjerstad Fiord III, 230 m. (s); Lyngen III, 300 m.; Hammerfest (s); Troldfiordsund, 40 m.; The Porsanger Fiord, 200 m.

At Hammerfest and at the station Lyngen III empty shells of var. *loveni* were found.

Scalaria obtusicostata, Wood.

Lyngen III, 300 m. (s).

Hemiaclis ventrosa, Jeffreys.

The Sag Fiord, 200 m.

Eulimella scillæ, Scacchi.

The Folden Fiord, 530 m.

Eulima intermedia, Cantr.

The mouth of Raftsund, 280—300 m.; Oxsund, 600 m.

Eulima stenostoma, Jeffr.

Landego, 200—400 m.; Mortsund I (Vest Fiord), 200 m.; the mouth of Raftsund, 250—300 m.; The Sag Fiord, 200 m.

According to Schneider the former northern limit for this species was Tromso; but The Norw. North Atl. Exp. collected specimens not only in The Skjerstad Fiord, but also in The Vest Fiord, The Alten Fiord, The Porsanger Fiord and The Tana Fiord.

Admete viridula, Fabr.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Skjerstad Fiord IX (s); Moskenstrømmen, 200 m.; Balstad, 150 m.; Mortsund II, 200 m. (s); Stene (Vest Fiord), 100—200 m.; Gaukværo II, 250 m.; Lyngen II, 250 m.; The Jokel Fiord, 100 m.; The Porsanger Fiord, 200 m.

Mangilia (Raphitoma) anceps, Eichw.

Moskenstrømmen I, 200 m.

This is one of the southern forms which has been caught by G. O. Sars at Hasvik on Soro.

Taranis cirrata, Brugnone.

Lyngen II, 250 m.

Bela pyramidalis, Strøm.

Kvænangen II, 90 m.

[1]) Beretning om en zoologisk Reise Sommeren 1849. Sep. p. 64.

Bela sarsi, Verrill.

The Kirk Fiord IV, 30—50 m.; The Porsanger Fiord, 70 m.

Bela declivis, Lov.

The Beier Fiord, 50—150 m. (s); The Jokel Fiord, 100 m. (s).

Bela nobilis, Moller.

The Jokel Fiord I, 100 m.

Bela scalaris, Moller.

Gaukværo II, 250 m. (s); Malangen, 100—200 m. (s); Lyngen III, 300 m. (s).

Bela rugulata, Moller.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 185 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.

Bela exarata, Moller.

Lyngen II, 250 m.; Kvænangen, 300—343 m. (s).

Bela harpularia, Couth.

The Salten Fiord I, 15—20 m.; Stonnesbotn, 40—80 m. (var. *rosea*).

Bela trevelyana, Turt.

The Skjerstad Fiord VI, 125 m.

Bela tenuicostata, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; Mortsund I, 200 m.; Gaukværo II, 250 m.

Typhlomangilia nivalis, Lov.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Sag Fiord, 200 m.; Mortsund II, 200 m.; Ure I, 200—250 m.; Digermulen, 100—150 m.; Gaukværo II, 250 m.; Malangen, 100—200 m.; Lyngen III, 300 m.

Spirotropis carinata, Phil.

Moskenstrømmen, 200 m.; Balstad, 150 m.; Digermulen, 100—150 m. (s); The Sag Fiord, 200 m.; Gaukværo II, 250 m.; Malangen, 380 m.

Metzgeria alba, Jeffreys.

Moskenstrommen, 200 m.; Ure I, 200—250 m. (s); Malangen, 100—200 m.

Trophon truncatus, Strøm.

Henningsværstrømmen, 20—40 m.; Hammerfest (s).

Trophon clathratus, Lin.

The Beier Fiord, 50—150 m. (var. *gunneri*); Moskenstrommen, 200 m.; The Kirk Fiord II, 70—80 m. (s); The Kirk Fiord III; Svolvær (1894) (var. *gunneri*): Breisund, 100 m. (the typical form and var. *gunneri*): The Porsanger Fiord, 200 m.

Trophon barvicensis, Johnst.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; Moskenstrommen, 200 m. (s); Malangen, 380 m. (s).

Purpura lapillus, Lin.

The Salten Fiord I, 15—20 m.; „Glea" (Rost), on the beach; The North Cape (1894); Nordkyn (1894).

Astyris rosacea, Gould.

„Glea" (Rost), on the beach; Hammerfest (s); Breisund, 100 m. (s).

Nassa incrassata, Strom.

Svolvær (1894).

Buccinum undatum, Lin.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord I, 30—50 m.; The Skjerstad Fiord IX, 50 m. „Glea" (Rost); The Ostnes Fiord, 40 m.; Malangen, 100—200 m.; Stonnesbotn, 40—80 m.

Buccinum groenlandicum, Chemn.

The Jokel Fiord II, 60 m.
Tromso is its southern limit.

Buccinum finmarchianum, Verkr.

Kvænangen II, 90 m. (s); Breisund, 100 m.; The Porsanger Fiord, 200 m.; Sværholt (1894).

There is no certain proof that this species has been seen alive south of the Bals Fiord, where, according to Schneider, it has been caught on a fishing line.

Ukko turtoni, Bean.

The Porsanger Fiord, 200 m.

Volutopsis norvegica, Chemn.

Reine (Vest Fiord), 100 m.; Balstad II, 80 m.; The Ostnes Fiord; The Kanstad Fiord (s).

The southern limit, as known at present, for this species is The Vest Fiord.

Neptunea despecta, Lin.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.

Sipho islandicus, Chemn.

Rost I, 100 m.

Sipho gracilis, var. *glaber*, Verkrüzen.

Reine, 100 m.; Balstad; The Ostnes Fiord; Malangen, 100—200 m.; Sværholt (1894); Mehavn (1894).

Sipho turritus, M. Sars.

Reine, 100 m.; Balstad, 150 m. (s); Mortsund, 200 m. (s); Svolvær (1894).

Sipho ebur, Morch.

The Skjerstad Fiord II, 185 m. (s); The Folden Fiord, 530 m.; Arno, 300—400 m. (s); Malangen, 100—200 m.

Sipho latericeus, Moller.

The Jokel Fiord III, 100 m. (s); Breisund, 100 m.; The Porsanger Fiord, 200 m. (s).

The southern limit is Tromso.

Cylichna alba, Brown.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; Mortsund I, 200 m.; The Ostnes Fiord; The Porsanger Fiord, 200 m.

Amphisphyra expansa, Jeffr.

The Folden Fiord, 530 m.

Amphisphyra hiemalis, Couth.

The Beier Fiord, 50—150 m.; Risvær, 150—180 m.

Scaphander puncto-striatus, Migh.

The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; The Kirk Fiord III, 70—80 m.; Svolvær (1894); The Kanstad Fiord, 30—90 m.; Malangen, 380 m.; The Jokel Fiord III, 100 m.

Scaphander lignarius, Lin.

Balstad, 150 m.; Mortsund III, 100 m.

The northern limit is Lofoten. In the neighbourhood of Bergen (Herlo Fiord) the species reaches a length of 40 mm., the largest specimen from Mortsund measured 19 mm.

Philine quadrata, Wood.

The Skjerstad Fiord VII, 490 m.; Reine I, 150 m.

Philine finmarchica, M. Sars.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.

The Skjerstad Fiord is the southern limit for this species, as far as is now known.

Pleurobranchus plumula, Mont.

The Tys Fiord, 500 m.; Breisund, 100 m.

(Grieg[1]) mentions it from the Vaags Fiord (Nord Fiord) and Storm[2]) from Rodberg in the Trondhjem Fiord.

The northern limit must now be changed to the Breisund.

Nudibranchiata.[3])

Remarks by Herman Friele, who has also determ.

Calidna obvelata, O. G. Müller.
C. repanda, A. & H. (?).

Kvænangen, 90 m.

A small specimen. The teeth correspond to *C. obvelata*, but in external appearance, there seems to be some difference; I do not, however, venture to name a new species after my examination of a specimen which was possibly only imperfectly developed, and was also greatly contracted.

Dendronotus arborescens, Müller.

Rost II, 150 m.; The Porsanger Fiord, 200 m.

Dendronotus robustus, Verrill.

The Skjerstad Fiord II, 100—185 m.; The Skjerstad Fiord IV, 330 m.; Stonesbotn, 40—80 m.; The Jokel Fiord, 80 m.

Campespe major, Bergh.

The Skjerstad Fiord III, 230 m.

[1]) Skrabninger i Vaagsfjorden og Ulvesund, Ytre Nordfjord. Berg. Mus. Aarb. 1897, no. XVI, pag. 23.

[2]) Oversigt over Trondhjemsfjordens fauna, p. 13. Meddelelser fra stationsanlæggets arbeidskomite for Trondhjems biologiske station. Trondhjem 1901.

[3]) Descriptions by Mr. Friele of the new species here mentioned will soon be published.

Only one specimen of this species, which is described by Rud. Bergh in „Nudibranchien" from the Wilhelm Barents Expedition, has previously been found, and that was at Vardo.

Coryphella rufibranchialis, Johnst.

The Skjerstad Fiord, 130 m.; Groto, 6—24 m.; Repvaag, 10 m.

Coryphella robusta, n. sp., M. S.

25/4 1899, Breisund, 100 m. Two specimens.

Coryphella nordgaardi, n. sp., M. S.

The Skjerstad Fiord II, 100—185 m. Four specimens.

Coryphella sp.?

The Skjerstad Fiord IV, 330 m. One specimen.

Judging from the structure of the teeth and the edges of the jaws, it would seen that this specimen belongs to an unknown species; but it was in such a mutilated condition that its external appearance cannot be described.

Aeolida pusilla, n. sp. M. S.

Kvænangen, 90 m.

Cephalopoda.

Ommatostrephes todarus, Raf.

Jaws of this species were found in the stomachs of cods and coal fish *(Gadus virens)* at Sundero (in Vesteraalen) in February 1897.

Rossia glaucopis, Lov.

Mortsund I, 200 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Sværholt (1894).

Crustacea.

Copepoda.

The author determ.

Euryte longicauda, Philippi.

(Thorellia brunnea, Boeck).[1]

Repvaag (Porsanger Fiord), 10 m.

The species was very common at this place, the females generally had ovisacks.

Dactylopus strömi, Baird.

Repvaag (Porsanger Fiord), 10 m.

Thalestris (Dactylopus) gibba, Kroyer. (G. O. Sars determ.).

Repvaag (Porsanger Fiord), 10 m.

Harpacticus chelifer, Müller.

Repvaag (The Porsanger Fiord), 10 m.

Idya furcata, Baird.

Repvaag (The Porsanger Fiord), 10 m.

Important contributions to the knowledge of the Copepoda of northern Norway have recently been made by Prof. G. O. Sars,[1] Dr. Thomas Scott[2] and the Rev. Canon A. M. Norman. Dr. Scott has described several new species from Finmark.

Branchiopoda.

Nebalia bipes, Fabr.

Repvaag (Porsanger Fiord), 10 m.

A detailed description of *Nebalia* is given by G. O. Sars in *Fauna Norvegiæ*, Vol. 1. *(Phyllocarida* and *Phyllopoda)*.

Ostracoda.

G. O. Sars determ.

Paradoxostoma variabile, Baird.

Repvaag (Porsanger Fiord), 10 m.

Cypridina norvegica, Baird.

Oxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrommen, 180 m.; Reine (Vest Fiord), from the stomach of cod; Hola (Vest Fiord) 250 m.; Gankværo II, 250 m.

I also found this species in the stomach of cod *(Gadus callarias)* caught at Christiansund 20/2 1896 and at Sartoro 23/2 1898.

Contributions to a knowledge of the *Ostracoda* of Northern Norway have especially been made by A. M. Norman[3] and G. O. Sars.[4]

Cirripedia.

The author determ.

Lepas anatifera, Lin.

Moskeneso (Lofoten), on a glass ball.

Conchoderma auritum, Lin.

Mehavn (Finmark) on *Megaptera boops* fastened to *Coronula diadema*.

Scalpellum stroemi, M. Sars.[5]

Tranodybet, 607—640 m.; The Porsanger Fiord, 200 m.

Balanus balanoides, Lin.

Common on the rocks along the beach.

Balanus crenatus, Brug.

The North Cape (1894). Is found in tolerably deep water.

Balanus porcatus, da Costa.

Kvænangen II, 90 m.; The North Cape (1894).

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[1] Cf. Giesbrecht, Mittheilungen über Copepoden. Mittheilungen aus der zool. Station zu Neapel. 14 Vol. Nr. 1, 1900, p. 57.

[1] Crustacea of Norway, Vol. IV.

[2] Notes on some Copepoda from Arctic Seas collected in 1890 by the Rev. Canon A. M. Norman, F. R. S. By Thomas Scott, F. L. S. Ann. Mag. Nat. Hist. Ser. 7. Vol. XI.

[3] Notes on the Marine *Crustracea Ostracoda* of Norway. Ann. Mag. Nat. Hist. Ser. 6, Vol. VII, 1891, p. 108.

[4] Oversigt af Norges marine Ostracoder. Kristiania. Vid. Selsk. Forh. 1865.

[5] G. O. Sars determ.

Balanus hameri, Ascanius.

Rost I, 120 m.

The specimen was about 50 mm. in length. G. O. Sars has collected some specimens, in the Sorosund near Hammerfest, which were 90 mm. in length and 50 mm. in height.

Several (possibly all) of the specimens collected at Rost contained a very large number of nauplius larvae (24/8 1899).

Verruca strœmia, Müll.

Common in all fiords.

Coronula diadema, Lin.

Mehavn (Finmark) on the skin of *Megaptera boops*. According to Weltener,[1] this species is a thorough cosmopolitan.

Amphipoda.

J. Sparre-Schneider determ.
Remarks by the author.

Socarnes vahli, Kroyer.

Troldfiordsund, 40 m.; Breisund, 100 m.

Ambasia danielsseni, Boeck.

The Skjerstad Fiord III, 230 m.; Ure I (Vest Fiord), 200—250 m.

Aristias tumidus, Kroyer.

Reine (Vest Fiord), 150 m., *juniores*.

Calisoma hopei, A. Costa.[2]

Calisoma crenata, G. O. Sars, *Amphipoda*, p. 53, Pl. XIX, Fig. 1.

The Skjerstad Fiord IX, 80 m.

Hippomedon denticulatus, Bate.

The Salten Fiord I, 15—20 m.; Napstrommen (Lofoten) 30—40 m.

Hippomedon propinquus, G. O. Sars.

Kvænangen II, 90 m.

Orchomene serratus, Boeck.

Henningsvær I (Vest Fiord), 150 m.; The Tys Fiord I, 500 m.

Orchomene amblyops, G. O. Sars.

Mortsund I (Vest Fiord), 200 m.

Orchomenella minuta, Kroyer.

Troldfiordsund, 40 m.; Repvaag (Porsanger Fiord), 10 m.

Orchomenella pinguis, Boeck.

Repvaag (Porsanger Fiord), 10 m.

Tryphosella[3]) *höringi*, Boeck.

The Skjerstad Fiord II, 100—185 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; Mortsund (Vest Fiord), 200 m.; Ure I (Vest Fiord), 200—250 m.; Malangen, 380 m.

[1] Die Cirripedien der Arktis. Fauna arctica von Römer und Schaudinn. Vol. I, p. 302.

[2] Cf. Norman, British Amphipoda. Ann. Mag. Nat. Hist. Ser. 7, Vol. V, p. 200.

[3] Cf. Norman, On British Amphipoda, p. 205.

Schneider has used the names of Sars in „*Amphipoda*". I have made some alterations in this respect, as I have acted upon Norman's remarks in his revision of British Amphipoda.

Uristes umbonatus, G. O. Sars.
Pseudotryphosa umbonata, G. O. Sars.

Reine (Vest Fiord) from the stomach of cod.

Anonyx nugax, Phipps.

The Salten Fiord I, 15—20 m.; The Kirk Fiord II; The Kanstad Fiord, 30—90 m.; The Jokel Fiord, from the stomach of cod; Repvaag (Porsanger Fiord), 10 m.

Haplonyx cicada, Fabr.

Reine (Vest Fiord), from the stomach of cod; Svolvær (Vest Fiord), from the stomach of cod; The Jokel Fiord II.

Chironesimus debruyni, Hoek.

Kvænangen II, 90 m.

This species is previously known from The Barents Sea (Hoek); Lofoten, The Trondhjem Fiord, Christiansund (G. O. Sars).

Lepidepecreum umbo, Goes.

The Beier Fiord, 50—150 m.; Hola (Vest Fiord), 150 m.; Stonnesbotn, 40—80 m.; The Jokel Fiord II, 80 m.

Leptophoxus falcatus, G. O. Sars.

Malangen, 380 m.

This species was previously known from Bohuslen and up to the coast of Nordland. The northern limit must now be taken to be Malangen.

Paraphoxus oculatus, G. O. Sars.

The Skjerstad Fiord VII, 490 m.

Ampelisca macrocephala, Lilljeborg.

Kvænangen II, 90 m.

Ampelisca eschrichti, Kroyer.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 80 m.; The Kirk Fiord, 50 m.; The Ogs Fiord, 100 m.; The Kanstad Fiord, 30—90 m.

Ampelisca æquicornis, Bruzelius.

Malangen, 100—200 m.; Kvænangen II, 90 m. The previously known northern limit was Lofoten; this must now be changed to Kvænangen.

Ampelisca amblyops, G. O. Sars.

Malangen, 380 m.

This species was previously known from Bohuslen, and Sars has collected it in the Kristiania Fiord and the Trondhjem Fiord. Its northern limit must now be taken to be Malangen.

Haploops tubicola, Lilljeborg.

The Kirk Fiord II, 50 m.; Malangen, 380 m.

Stegocephalus inflatus, Kroyer.

Rost, from the stomach of cod; Malangen, 380 m.; Ingohavet, 300 m.; The Porsanger Fiord, 200 m.

Stegocephalus similis, G. O. Sars.

The Skjerstad Fiord VII, 190 m.; Henningsvær (Vest Fiord), from the stomach of cod; Malangen, 380 m.

The most northerly place at which Sars has collected this species is Tjøtø. Its northern limit must now be changed to Malangen.

Andania abyssi, Boeck.

Malangen, 380 m.

The northern limit must now be moved from Lofoten to Malangen.

Amphilochus tenuimanus, Boeck.

Malangen, 380 m.

Sars has caught this species at different places on the west coast right up to Selsovik, which is a little north of the arctic circle. Its northern limit will now be Malangen.

Metopa alderi, Bate.

The Skjerstad Fiord XVI; The Tys Fiord, 500 m.

Leucothoe spinicarpa, Abildgaard.

Henningsvær I, 150 m.; Tranødybet, 530 m.; Malangen, 380 m.

Sars has found this form at different places on the south and west coasts of Norway as far up as the Trondhjem Fiord. Its northern limit will now be Malangen.

Oediceros saginatus, Krøyer.

Troldfiordsund, 40 m. Occurred in very large numbers and with young.

Paroediceros lynceus, M. Sars.

The Kanstad Fiord, 30—90 m.; Stønnesbotn, 40—80 m. The southern limit for the species on our coast is, according to Sars, Appelvær.

Paroediceros propinquus, Goës.

The Beier Fiord, 50—150 m.; Lyngen II, 250 m.

Monoculodes subnudus, Norman.
(*Monoculodes falcatus*, G. O. Sars).

The Kirk Fiord III, 70—80 m.; Ure I (Vest Fiord).

Halimedon mülleri, Boeck.

Mortsund I (Vest Fiord), 200 m.; Gaukværø II, 250 m.

Halimedon acutifrons, G. O. Sars.

Mortsund I, (Vest Fiord), 200 m.; Gaukværø II, 250 m.

Halimedon megalops, G. O. Sars.

Repvaag (Porsanger Fiord), 10 m.

Halimedon brevicalcar, Goës.

Malangen, 380 m.

Bathymedon longimanus, Boeck.

(Vest Fiord), 150—180 m.

Aceros phyllonyx, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Salten Fiord, 200 m.; The Folden Fiord, 530 m.; Landego, 200—450 m.; The Kirk Fiord IV, 50 m.; Mortsund I, 200 m.; The Ogs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Gaukværø II, 250 m.; Stønnesbotn, 40—80 m.; The Jøkel Fiord I, 100 m.

Pleustes panoplus, Krøyer.

Røsthavet, 700 m.; Repvaag (Porsanger Fiord), 10 m.

Paramphitoe pulchella, Krøyer.

The Skjerstad Fiord XVI, on Hydroida.

Paramphitoe bicuspis, Krøyer.

Troldfiordsund, 40 m.

Paramphitoe assimilis, G. O. Sars.

Malangen, 380 m.

Parapleustes latipes, M. Sars.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Kanstad Fiord, 30—90 m.

Epimeria cornigera, Fabr.

The Sag Fiord, 200 m.

The northern limit is thus changed from the Trondhjem Fiord to the Sag Fiord.

Epimeria parasitica, M. Sars.

Balstad (Vest Fiord), 150 m.

As far as I know, this form has not previously been observed so far north as in Lofoten.

Epimeria tuberculata, G. O. Sars.

Malangen, 380 m.

This species was not previously found north of the Trondhjem Fiord.

Epimeria loricata, G. O. Sars.

Malangen, 100—200 m.; Lyngen II, 250 m.; Sars has collected this form at Hasvig, West Finmark. Malangen is the southern limit for the species.

Acanthozone cuspidata, Lepechin.

The Ogs Fiord, 100 m.

The southern limit for this arctic form is the Trondhjem Fiord.

Acanthonotosoma serratum, Fabr.

The Beier Fiord, 50—150 m.; Grøtø, 0—24 m.; The Kanstad Fiord, 30—90 m.; Stønnesbotn, 40—80 m.; Kvænangen, 340 m.; Troldfiordsund, 40 m.

Iphimedia obesa, Rathke.

Balstad (Vest Fiord).

Syrrhoe crenulata, Goës.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord II, 100—185 m., The Skjerstad Fiord III, 330 m.

Pardalisca cuspidata, Krøyer.

The Jøkel Fiord, in the stomach of cod.

Pardalisca abyssi, BOECK.

Ingohavet, 300 m.

Eusirus minutus, G. O. SARS.

Malangen, 380 m.

This species had previously only been found by SARS at Rodberg in the Trondhjem Fiord.

Rhacotropis aculeata, LEPECHIN.

Ingohavet, 300 m.; The Porsanger Fiord, 70 m.

Rhacotropis helleri, BOECK.

The Skjerstad Fiord II, 100—185 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; Malangen, 380 m.; Lyngen II, 250 m.; Kvænangen, 300—343 m.

Rhacotropis macropus, G. O. SARS.

The Salten Fiord II, about 200 m.; The Skjerstad Fiord IV, 330 m.; Oxsund, 600 m.; Mortsund (Vest Fiord), 200 m.; Tranodybet, 607—610 m.

Halirageoides inermis, G. O. SARS.

Mortsund I (Vest Fiord), 200 m.; The Sag Fiord, 200 m.

Halirages fulvocinctus, M. SARS.

The Skjerstad Fiord IV, 330 m.; Brettesnes—Skroven, 350—400 m.; Risværflaket, 150—180 m.; The Sag Fiord, 200 m.; Kvænangen, 300—343 m.

Apherusa tridentata, BRUZELIUS.

Troldfiordsund, 40 m.

Calliopius laeviusculus, KROYER.

Repvaag (Porsanger Fiord), 10 m.

Paratylus swammerdami, H. MILNE-EDWARDS.

Troldfiordsund, 40 m.

Melphidippa borealis, BOECK.

Malangen, 380 m.

Amathilla homari, FABR.

Balstad (1897); The North Cape (1894); Sværholt (1894).

Gammarus locusta, LIN.

Rost II, 150 m.; Balstad, 30—40 m.; Reine, from the stomach of cod.

Melita dentata, KROYER.

The Skjerstad Fiord IV, 330 m.; Troldfiordsund, 40 m.; The Jøkel Fiord II, 80 m.

Lilljeborgia pallida, BATE.

Ure I (Vest Fiord); Malangen, 380 m.

Lilljeborgia fissicornis, M. SARS

The Sag Fiord, 200 m.; Malangen, 380 m.; Lyngen III, 300 m.

Idunella aequicornis, G. O. SARS.

Kvænangen, 300—343 m.

This species has on the coast of Norway previously only been collected in the Varanger Fiord (NORMAN, G. O. SARS). The occurrence in Kvænangen is thus very interesting.

Gammaropsis erythrophthalma, LILLJEBORG.

Rosthavet, 700 m.

This form had not previously been collected so far north as the Trondhjem Fiord. It was therefore remarkable to find it on the 68th degree of latitude.

Amphithoe rubricata, MONT.

Balstad (1897); Hemmingsværstrommen (Vest Fiord), 20—40 m.; Groto, 0—21 m.

Ischyrocerus anguipes, KROYER.

Rosthavet, 700 m.; Ingohavet, 300 m.; Repvaag (Porsanger Fiord), 10 m.

Ischyrocerus minutus, LILLJEBORG.

The Skjerstad Fiord XVI.

Erichtonius abditus, TEMPLETON.

Ingohavet, 300 m.

This species is, according to SARS „not unfrequently off the south and west coast of Norway". Its northern limit will now be the sea off Ingo.

Unciola leucopis, KROYER.

Rosthavet, 700 m.

On the coast of Norway, this form had, hitherto, only been observed in the Varanger Fiord.

Ægina spinosa, BOECK.

The Skjerstad Fiord XVI; Malangen, 380 m.; Ingohavet, 300 m.; Breisund, 400 m.; The Porsanger Fiord, 70 m.

Caprella septentrionalis, KROYER.

Breisund, 400 m.; The North Cape (1894).

Caprella monocera, G. O. SARS.

The North Cape (1894).

Paracyamus boopis, LÜTKEN.

On *Megaptera boops* at Mehavn.

Literature concerning the *Amphipoda* of Northern Norway:

A. M. NORMAN, Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist., ser. 7, Vol. X, p. 479—483.

J. SPARRE-SCHNEIDER, Undersogelser af dyrlivet i de arktiske fjorde. Tromso mus. aarsh. 14.

G. O. SARS, Crustacea of Norway. Vol. I.

It is worth noticing that the majority of the Amphipoda mentioned in the foregoing list were caught in the winter. In the list only the localities and depths are given, but the dates of catch may be found in the list of dredging stations.

Isopoda.

J. Sparre Schneider determ.

Apseudes spinosus, M. Sars.

Gaukværø; Ure I (Vest Fiord), 200—250 m.

Æga psora, Lin.

Balstad, 150 m.; Mortsund (Vest Fiord); Skroven (Vest Fiord), 200—400 m.

Æga ventrosa, M. Sars.

Ingøhavet, 300 m.; two specimens, one of them with ova.

Idothea baltica, Pallas.

Hola (Vest Fiord), from the stomach of cod; Stonnesbotn, 40—80 m.; Kvænangen, 300—343 m.

Idothea emarginata, Fabr.

Stene in Bo, several specimens from the stomachs of cods; Troldfiordsund, 40 m.

Astacilla longicornis, Sowb.

Rosthavet, 700 m.

Janira maculosa, Leach.

The Tys Fiord I, 500 m.; Malangen, 380 m.

Munna fabricii, Kroyer.[1])

Repvaag (Porsanger Fiord), 10 m.

Munnopsis typica, M. Sars.

Several places in the Skjerstad Fiord; The Folden Fiord, 530 m.; Landego, 200—450 m.; Malangen, 380 m.; Lyngen II, 250 m.; Lyngen III, 300 m.; Kvænangen, 300—343 m.

Eurycope cornuta, G. O. Sars.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; Tranodybet, 607—640 m.; Malangen, 380 m.; Lyngen II, 250 m.; Kvænangen, 300—343 m.

Concerning the Isopoda of northern Norway, reference should be made to Norman[2]) and G. O. Sars.[3])

Cumacea.

G. O. Sars determ.

Lamprops fasciata, G. O. Sars.

Repvaag (Porsanger Fiord), 10 m.

Leucon nasicus, Kroyer.

Malangen, 380 m.

[1]) G. O. Sars determ.

[2]) Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist. ser. 7, vol. X, p. 478.

[3]) Crustacea of Norway, vol. II.

Eudorella emarginata, Kroyer.

The Jøkel Fiord, 80 m.

Diastylis rathkei, Kroyer.

Several places in the Skjerstad Fiord; Moskenstrommen, 200 m.; The Kirk Fiord (several places); Ure I, 200—250 m.; Mortsund I, 200 m.; Malangen, 100—200 m.; The Porsanger Fiord, 200 m.

Diastylis goodsiri, Bell.

Malangen, 100—200 m.; Lyngen II, 250 m.; The Jokel Fiord I, 100 m.

It has never previously been noticed so far south as Malangen. It was, however, known from Kvænangen (*Aurivillius*, Schneider), the Porsanger Fiord (G. O. Sars) and from the Varanger Fiord (M. Sars).

Campylaspis rubicunda, Lilljeborg.

Mortsund I (Vest Fiord), 200 m.

Literature:—G. O. Sars, Crustacea of Norway. Vol. III.

A. M. Norman, Notes on the Nat. Hist. of East Finmark. Ann. Mag. Nat. Hist. Ser. 7, Vol. X, p. 478.

Carl Zimmer, Die arktischen Cumaceen. Fauna arctica. Bd. I.

Schizopoda.

The author determ.

Boreomysis tridens, G. O. Sars.[1])

The Skjerstad Fiord VII, 490 m.; The Folden Fiord, 530 m.; Oxsund, 600 m.; Tranodybet, 640 m.; Malangen, 380 m.

Norman[2]) has caught this form in the Trondhjem Fiord, and G. O. Sars[3]) in the Vest Fiord.

Malangen is thus the most northerly place at which this species is found.

Erythrops goësi, G. O. Sars.

The Skjerstad Fiord IV, 330 m.; The Jøkel Fiord I, 100 m.

Erythrops serrata, G. O. Sars.

Mortsund I (Vest Fiord), 200 m.; Ure I (Vest Fiord), 200—250 m.

Erythrops abyssorum, G. O. Sars.

The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m.; Mortsund I, 200 m.

Pseudomma roseum, G. O. Sars.

Malangen, 380 m.

Pseudomma truncatum, E. J. Smith.

Lyngen II, 250 m.

G. O. Sars has caught it in the Bugo Fiord, a branch of the Varanger Fiord.

The southern limit for the species will now be the Lyngen Fiord.

[1]) *Boreomysis arctica* and *Hemimysis abyssicola* are included among the plankton forms.

[2]) A Month on the Trondhjem Fiord. Ann. Mag. Nat. Hist. Ser. 6, Vol. XIII, p. 274.

[3]) Monographie over Norges Mysider, h. III, p. 17.

Parerythrops obesa, G. O. SARS.

The Sag Fiord, 200 m.; Mortsund I, 200 m.

Amblyops abbreviata, G. O. SARS.

The Skjerstad Fiord VII, 490 m.

Mysidopsis didelphys, NORMAN.

Reine I (Vest Fiord), 150 m.

Mysideis insignis, G. O. SARS.

The Skjerstad Fiord, 330 m.; Ure I, 200—250 m.; the mouth of Raftsund, 250—300 m.; Malangen, 380 m.

Mysis mixta, LILLJEBORG.

The Beier Fiord, 50—150 m.; The Jøkel Fiord II, 80 m.; Stønnesbotn, 40—80 m.

Macromysis inermis, RATHKE.

Balstad (Vest Fiord).

Decapoda.

The author determ.[1]

Pasiphaea tarda, KRØYER.[2]

Landegø, 200—450 m.; Oxsund, 600 m.; Malangen, 380 m.

A female from Malangen ($^{14}/_4$ 1899) was carrying eggs without ocular spots.

Pandalus annulicornis, LEACH.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord I, 30—50 m.; Røst II, 150 m.; Moskenstrommen, 200 m.; Balstad, 30 m.; Henningsværstrommen, 20—40 m.; the mouth of the Raftsund, 250—300 m.; The Kanstad Fiord, 30—90 m.; Malangen, 100—200 m.; Stønnesbotn, 40—80 m.; Kvænangen, 300—343 m.; Breisund, 100 m.; Mehavn (1894).

Females bearing eggs with ocular spots were observed on

$^{14}/_4$ 1899, Malangen.
$^{15}/_4$ — , Stønnesbotn.
$^{21}/_3$ 1900, the Beier Fiord.

Pandalus borealis, KRØYER.

The Beier Fiord, 50—150 m.; Landegø, 200—450 m.; The Salten Fiord II, 200 m.; The Skjerstad Fiord II, 100—185 m.; Balstad, 150 m.; The Østnes Fiord, 100 m.; the mouth of the Raftsund, 250—300 m.; The Kanstad Fiord, 30—90 m.; Lyngen III, 300 m.; The Porsanger Fiord, 200 m.

Females bearing eggs with ocular spots were observed on

$^{5}/_4$ 1900, Salten Fiord II, 200 m.

Pandalus propinquus, G. O. SARS.

Balstad, 150 m.; Arnø, 300—400 m.; The Salten Fiord II, 320—380 m.; The Tys Fiord I, 500 m.; Malangen, 100—200 m.

Females bearing eggs with ocular spots occurred on

$^{14}/_4$ 1899, Malangen, 100—200 m.

This species hat not previously been noticed north of Lofoten. Malangen must now be looked upon as its northern limit.

Pandalus platyceros, BRANDT.
(= *P. leptorrhynchus*, KINAHAN).

The Salten Fiord II, 320—380 m.

[1]) In doubtful cases Prof. G. O. SARS has identified.
[2]) This species is also included in the plankton forms, vide present work, p. 37.

Pandalus brevirostris, RATHKE.

The Beier Fiord, 50—150 m.; The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; Tranødybet, 607—640 m.; Balstad, 150 m.; Mortsund I, 100 m.; Ure I, 200—250 m.; Henningsvær I, 150 m.; Skroven, 200—400 m.; The Østnes Fiord, 100 m.; the mouth of the Raftsund, 250—300 m.; Gaukværø II, 250 m.; Malangen, 380 m.

Females bearing eggs, without ocular spots, occurred on

$^{23}/_3$ 1900, The Østnes Fiord, 100 m.;
$^{26}/_3$ 1900, Balstad, 150 m.;
$^{31}/_3$ 1900, The Beier Fiord, 50—160 m.;
$^{5}/_4$ 1900, The Salten Fiord II, 320—380 m.

The species is new in Malangen, which must now be considered as its northern limit on our coast.

Caridion gordoni, BATE.

Stene (Vest Fiord), 120—200 m.; Henningsvær, 150 m.

G. O. SARS[1]) says that the species is found right up to the Varanger Fiord.

Sclerocrangon boreas, PHIPPS.

The Skjerstad Fiord XVI; The Skjerstad Fiord IX, 30—40 m.; Grøtø, 6—24 m.; The Kanstad Fiord, 30—40 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Females bearing eggs with ocular spots occurred on $^{3}/_4$ 1900, the Skjerstad Fiord IX, 30—40 m. The Skjerstad Fiord is, as far as is known at present, the southern limit for this species, but it is probable that its distribution extends further south.

Crangon crangon, LIN.

Females bearing eggs, without ocular spots, occurred on

$^{7}/_4$ 1900, Grøtø, 6—24 m.

Crangon allmani, KINAHAN.

The Beier Fiord, 50—150 m.; Røst II, 150 m.; Svolvær, (1894); The Østnes Fiord; The Kanstad Fiord, 30—90 m.; Stønesbotn, 40—80 m.; Mehavn (1894).

Females bearing eggs, without ocular spots, occurred on

$^{31}/_3$ 1900, the Beier Fiord, 50—150 m.

Pontophilus echinulatus, M. SARS.

Mortsund, 100 m. (2 specimens, about 12 mm. in length); Balstad, 150 m. (1 Female bearing eggs without ocular spots).

Pontophilus norvegicus, M. SARS.

The Beier Fiord, 50—150 m.; Arnø, 300—400 m.; Landegø, 200—450 m.; The Salten Fiord II, 320—380 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord VII, 490 m; The Folden Fiord, 530 m.; Oxsund, 600 m.; The Sag Fiord, 200 m.; Moskenstrommen, 200 m.; Balstad, 150 m.; Mortsund I, 200 m.; Brettesnes-Skroven, 350—400 m.; the mouth of the Raftsund, 250—300 m.; Tranødybet, 607—640 m.; Gaukværø II, 250 m.; Malangen, 380 m.; Lyngen III, 300 m.

Females bearing eggs occurred, without ocular spots, on

$^{22}/_2$ 1899, Mortsund I, 200 m.;
$^{5}/_4$ 1900, The Salten Fiord, 320—380 m.;
$^{17}/_2$ 1899, The Sag Fiord, 200 m.,

with ocular spots, on

$^{16}/_3$ 1900, Balstad, 150 m.;
$^{5}/_4$ 1900, The Salten Fiord, 320—380 m.

[1]) Crustacea II, p. 11. The Norw. North. Atl. Exp.

Sabinea septemcarinata, SABINE.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord I, 30—50 m.; The Skjerstad Fiord II, 100—185 m.; The Kirk Fiord II, 50 m.; The Ostnes Fiord, 130 m.; Stonesbotn, 40—80 m.; Lyngen II, 250 m.; The Jokel Fiord I, 100 m.; The Jokel Fiord III, 100 m.; The Porsanger Fiord, 200 m.; The Kjølle Fiord (1894); Mehavn (1894).

Females bearing eggs with ocular spots occurred on
21/4 1899, The Jokel Fiord, 100 m.;
27/4 1899, The Porsanger Fiord, 200 m.;
2/4 1900, The Skjerstad Fiord, 30—50 m.

var. *sarsi*, SMITH.

The Beier Fiord, 50—150 m.; Balstad, 150 m.; Stene (Vest Fiord), 120—200 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Breisund, 100 m.

Females bearing eggs with ocular spots occurred on
14/4 1899, Malangen, 100—200 m.

Hippolyte gaimardi, M. EDW.

The Beier Fiord, 50—150 m.; The Salten Fiord I, 15—20 m.; The Skjerstad Fiord IX, 30—50 m.; Groto, 6—24 m.; Napstrommen (1896), 30—40 m.; The Ostnes Fiord I, 30 m.; Risværflaket, 150—180 m.; The Kanstad Fiord, 30—90 m.; The Jokel Fiord I, 100 m.; Troldfiordsund, 40 m.; The Porsanger Fiord, 200 m.

Females bearing eggs with ocular spots occurred on
16/3 1899, Risværflaket, 150—180 m.;
17/3 —, Kanstad Fiord, 30—90 m.;
20/4 —, Jokel Fiord I, 100 m.;
25/4 —, Troldfiordsund, 40 m.;
22/3 1900, The Ostnes Fiord I, 30 m.;
3/4 —, The Skjerstad Fiord IX, 30—50 m.;
5/4 —, The Salten Fiord I, 15—20 m.;
7/4 —, Groto, 6—24 m.

Hippolyte pusiola, KRØYER.

The Salten Fiord I, 15—20 m.; Balstad (1896), 30 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Females bearing eggs, without ocular spots, occurred on
25/4 1899, the Breisund, 100 m.

Hippolyte turgida, KRØYER.

The Ostnes Fiord, 30 m.

Hippolyte spinus, SOW.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 30—40 m.; The Skjerstad Fiord XVI; Reine I, 150 m.; Balstad, 150 m.; Henningsværstrommen, 20—40 m.; The Kanstad Fiord, 30—90 m.; Gaukværo II, 250 m.; Malangen, 380 m.; Stonesbotn, 40—80 m.; Lyngen II, 250 m.; Kvænangen II, 90 m.; The Jokel Fiord, III, 100 m.; Troldfiordsund, 40 m.; Breisund, 100 m.

Females bearing eggs with ocular spots occurred on
21/4 1899, The Jokel Fiord, 100 m.;
25/4 1899, The Troldfiordsund, 40 m.;
3/4 1900, The Skjerstad Fiord, 30—40 m.

Hippolyte lilljeborgi, DANIELSSEN.
(= *H. securifrons*, NORMAN).

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord IV, 330 m.; The Skjerstad Fiord X, 10—30 m.; The Skjerstad Fiord XIII, 110 m.; The Oxsund, 600 m.; The Sag Fiord, 200 m.; Landego, 200—450 m.; The Kirk Fiord III, 70—80 m.; Mortsund, 200 m.; The Ostnes Fiord, 130 m.; Malangen, 380 m.; The Porsanger Fiord, 70 m.

Females bearing eggs with ocular spots occurred on
30/3 1900, Landego, 200—450 m.;
2/4 —, The Skjerstad Fiord III, 230 m.;
3/4 —, The Skjerstad Fiord X, 10—30 m.

Hippolyte polaris, SABINE.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord III, 230 m.; The Skjerstad Fiord X, 10—30 m.; The Skjerstad Fiord XVI; The Tys Fiord I, 500 m.; Rosthavet, 300—500 m.; Moskenstrommen, 200 m.; The Kirk Fiord III, 30—50 m.; The Ogs Fiord I, 100 m.; The Kanstad Fiord, 30—90 m.; Tranodybet, 450—530 m.; Stonesbotn, 40—80 m.; Malangen, 100—200 m.; The Jokel Fiord III, 100 m.; Ingohavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.

Females bearing eggs with ocular spots occurred on
28/3 1899, The Tys Fiord I, 500 m.;
14/4 —, Malangen, 100—200 m.;
27/4 —, The Porsanger Fiord, 200 m.;
2/4 1900, The Skjerstad Fiord II, 230 m.;
4/4 —, The Skjerstad Fiord XVI.

At several of the foregoing stations, males were found, these have been described as a separate species (*H. borealis*). In all of them the rostrum was without teeth or a slight indication of such could be seen. The lowest corner of the fore edge of Cephalo thorax was rounded.

Bythocaris simplicirostris, G. O. SARS.

Tranodybet, 607—640 m.; Malangen, 100—200 m.

Cryptocheles pygmæa, G. O. SARS.

The Folden Fiord, 530 m.; Tranodybet, 607—640 m.

At the former place females bearing eggs, without ocular spots, occurred on 6/4 1900.

Eupagurus bernhardus, LIN.

The Salten Fiord I, 15—20 m.; Groto, 6—24 m.; Napstrommen, 30—40 m.; Svolvær, 15—20 m.; Troldfiordsund, 40 m. (2 small specimens).

Females bearing eggs with ocular spots occurred on
5/4 1900, The Salten Fiord I, 15—20 m.

Eupagurus pubescens, KRØYER.

The Beier Fiord, 50—150 m.; The Skjerstad Fiord IX, 30—50 m.; The Skjerstad Fiord XVI, 10—100 m.; Rost I, 120 m.; Moskenstrommen, 200 m.; Reine, 150 m.; Balstad, 150 m.; Stene (Vest Fiord), 120—200 m.; The Ostnes Fiord, 20 m.; Digermulen, 100—150 m.; Groto, 6—24 m.; The Kanstad Fiord, 30—90 m.; Gaukværo II, 250 m.; Malangen, 100—200 m.; Kvænangen II, 90 m.; Troldfiordsund, 40 m.; Ingohavet, 300 m.; Breisund, 100 m.; The Porsanger Fiord, 200 m.; Sværholt (1894).

Females bearing eggs with ocular spots occurred on
14/4 1899, Malangen, 100—200 m.;
24/4 —, Ingohavet, 300 m.;
25/4 —, Breisund, 100 m.

Lithodes maia, LIN.

Malangen, 100—200 m.; The Kjølle Fiord (1894).

Galathea nexa. EMBLETON.

Balstad, 20 m.; Henningsværstrommen, 20—40 m.

Galathea dispersa. BATE.

The Beier Fiord, 50—150 m.

As far as I know, this species has not previously been found north of the arctic circle. The Beier Fiord must now be considered to be its limit to the north.

Galathea intermedia. LILLJEBORG.

Henningsværstrommen, 20—40 m.; Svolvær (1894).

Galathodes tridentatus. ESMARK.

The Tys Fiord I, 500 m.; Tranodybet, 450—530 m.

At both places, the species was found on *Lophohelia* bottom. Tranodybet is the northern limit, as far as is known at present.

Munida rugosa. FABR.

The Beier Fiord, 50—150 m.; Arno, 300—400 m.; Landego, 200—450 m.; The Salten Fiord II, 320—380 m.; The Folden Fiord, 530 m.; The Sag Fiord, 200 m.; The Tys Fiord I, 500 m.; Moskenstrommen, 200 m.; Reine, 150 m.; Balstad, 150 m.; Mortsund I, 200 m.; Ure I, 200—250 m.; Svolvær (1894); Brettesnes—Skroven, 350—400 m.; Digermulen, 100—150 m.; Gaukværo II, 250 m.; Malangen, 100—200 m.; Lyngen III, 300 m.

Females bearing eggs without ocular spots occurred on

16/2 1899, Brettesnes—Skroven, 350—400 m.;
24/4 — , Ingohavet, 300 m.
26/5 — , Balstad, 150 m.

Munida tenuimana. G. O. SARS.

The Folden Fiord, 530 m.; Oxsund, 600 m.; The Tys Fiord, 500 m.; Brettesnes—Skroven, 350—400 m.; Tranodybet, 607—640 m.

Hyas araneus. LIN.

The Misvær Fiord (arm of the Skjerstad Fiord), 10—50 m. (1 female carrying eggs).

Hyas coarctatus. LIN.

The Misvær Fiord, 10—50 m.; The Salten Fiord I, 15—20 m.; Røst II, 150 m.; Moskenstrommen, 90 m.; The Kirk Fiord III, 70—80 m.; Balstad, 15—30 m.; Stene in Bo, from the stomach of cod; Malangen, 100—200 m.; Stønesbotn, 40—80 m.; The Jokel Fiord, 100 m.; The Porsanger Fiord, 200 m.

Portunus depurator. LIN.

The Salten Fiord I, 15—20 m.; Troldfiordsund, 10 m.

As far as I know, this species has not previously been found so far north.

Portunus holsatus. FABR.

Stene in Bo (Vesteraalen), from the stomach of *Pleuronectes platessa.*

It is not likely that this species has been previously noted from Lofoten. Its northern limit must now be taken to be Vesteraalen.

Portunus pusillus. LEACH.

Mortsund II, 200 m.

This is also a new species for Lofoten.

Pantopoda.[1]

Dr. APPELLÖF, Bergen, determ.

Pycnogonum littorale. STRØM.

Skjerstadfiord III, 230 m.; Kvænangen, 300—343 m.; Jokelfiord II, 60 m.

Pseudopallene circularis. GOODSIR.

Skjerstadfiord X, 10—30 m.; Balstad, 30 m.; Napstrommen, 30—40 m.

Pseudopallene spinipes. FABR.

Napstrommen, 30—40 m.; Stønesbotn, 40—80 m.; Hammerfest (1894); Troldfiordsund, 10 m.; Nordkap (1894).

Nymphon glaciale. LILLJEBORG.

Mehavn (1894). New for the Norwegian fauna.

Nymphon grossipes. FABR.

Øgsfiord, 100 m.; Troldfiordsund, 10 m.; Nordkap (1894); Sværholt (1894).

Nymphon mixtum. KRØYER.

Kirkfiord II, ca. 50 m.

Nymphon leptocheles. G. O. SARS.

Morsdalfiord, 50 m.; Malangen, 380 m.

Nymphon strömi. KRØYER.

Morsdalfiord, 50—150 m.; Balstad (Lofoten); Risværflaket, 150—180 m.; Kanstadfiord, 30—90 m.; Arno, 300—400 m.; Ostnesfiord, 50—70 m.; Jokelfiord III, 100 m.

Nymphon macrum. WILSON.

Foldenfiord, 530 m.; Øgsfiord I, 100 m.; Malangen, 100—200 m.

Chaetonymphon hirtipes. BELL.

Balstad (Lofoten), 10—35 m.; Malangen, 100—200 m.; Jokelfiord III, 100 m.; Kvænangen II, 90 m.; Breisund, 100 m.; Nordkap (1894); Porsangerfiord, 200 m.

Chaetonymphon spinosum. GOODSIR.

Arno, 300—400 m.; Saltenfiord II, 320—380 m.; Morsdalfiord, 50—150 m.; Reine I (Lofoten), 150 m.; Malangen, 100—200 m.

Tunicata.

Synascidiae.

H. HUITFELDT-KAAS, Kristiania, determ.

Aplidiopsis sarsi. HUITF.-KAAS.

Hammerfest (1894).

According to HUITFELDT-KAAS[2] this species has previously been collected by M. SARS at Kristiansund and Beian.

Amaroucium mutabile. M. SARS.

Hammerfest (1894); Troldfiordsund, 10 m.

SARS collected his specimens too at Hammerfest.

[1] Cf. G. O. SARS, Pycnogonidea. The Norw. North Atl. Exp. 1876—78.
[2] The Norw. North Atl. Exp. Synascidiae, p. 15.

Ascidiae simplices.

Dr. R. Hartmeyer, Berlin, and Dr. Johan Kiær, Kristiania, determ.

Ciona intestinalis, Lin.

Moskenstrommen, 90 m.; The Tys Fiord I, 500 m.; Sunderø (1897) in the stomach of cod.

According to Kiær,[1] the species occurs all along the coast of Norway. It has however, probably never before been collected at a depth of 500 m. At several places in Lofoten, 1897 in March and in April, I found *Ciona* in the stomach of cod.

Ascidia gelatinosa, Kiær.

Mortsund I, 200 m.; Tranødybet, 607—640 m.; Oxsund, 600 m.; The Sag Fiord, 200 m.

Hartmeyer[2]) mentions this species as being found at Tromsø, which is, I believe, its most northerly locality.

Ascidia prunum, O. F. Müll.

The North Cape (1894).

Ascidia conchilega, O. F. Müll.

Mortsund I (The Vest Fiord), 200 m.

Styela rustica, Lin.

Svolvær (1894).

Dendrodoa aggregata, Rathke.

Henningsvær (from stomach of cod); Troldfiordsund, 40 m.; Breisund, 100 m.; Nordkyn (1894). In the Breisund this species was so abundant that it almost filled the dredging-net after a short draw.

Polycarpa libera, Kiær.

The Skjerstad Fiord IV, 330 m.

Kiær[3]) writes: „Found only in Komag Fiord, Ox Fiord and at Vadsø." This species must be considered as an arctic one. The Skjerstad Fiord is its southern limit, as far as is now known.

Cynthia echinata, Lin.

Nordkyn (1894).

Pisces.

Prof. Collett and the author determ.

Sebastes marinus, Lin.

$^{12}/_{2}$ 1897. Sunderø in Vesteraalen, from the stomach of cod.

Centridermichthys uncinatus, Reinh.

$^{31}/_{3}$ 1900, The Beier Fiord, 50 m. (several specimens); $^{7}/_{4}$ 1899, Reine, 100 m. (1 specimen); $^{14}/_{4}$ 1899, Malangen, 100—200 m. (1); $^{15}/_{4}$ 1899, Stønesbotn, 40—80 m. (1); $^{25}/_{4}$ 1899, Breisund, 100 m. (1).

Centridermichthys hamatus, Krøyer.

$^{6}/_{3}$ 1899. Henningsvær, 150 m. (1); $^{20}/_{4}$ 1899, The Jøkel Fiord II, 80 m. (1); $^{24}/_{4}$ 1899, Ingøhavet, 300 m. (1); $^{25}/_{4}$ 1899, Breisund, 100 m. (4).

[1]) The Norw. Atl. Exp. A List of Ascidiae simplices, p. 3.

[2]) Holosome Ascidien, p. 36. Meeresfauna von Bergen.

[3]) The Norw. North Atl. Exp. A List of Norwegian Ascidiae simplices, p. 12.

Triglops pingeli, Reinh.

$^{25}/_{4}$ 1899. Breisund, 100 m. (1).

Cottus scorpius, Lin.

Sværholt (1894); $^{20}/_{4}$ 1896, Napstrommen, 40 m.

Cottunculus microps, Collett.

$^{3}/_{5}$ 1899, The Lyngen Fiord II, 250 m. (1).

Agonus cataphractus, Lin.

$^{25}/_{4}$ 1898, Breisund, 100 m. (1).

Chirolophis galerita, Lin.

$^{3}/_{4}$ 1900, The Skjerstad Fiord X, 10—30 m. (several specimens). At the mouth of the Misvær Fiord, we got the dredging bag full of *Lithothamnia*, in whose openings a multitude of animals were hidden, there were ophiurides, asterides, worms, molluscs, crabs etc.

Among these stone algae which are generally called „ruggel" by the Norwegian fishermen, many specimens of *Chirolophis galerita* were found. Some lumps of „ruggel" were left lying on the deck during the night. The next morning, I broke up one of the lumps, and a living specimen of *Chirolophus* came into view, it had — so to say — spent a night on „dry land". When at rest, this fish bends the back part of its body sideways.

Lumpenus lampretiformis, Walb.

$^{31}/_{3}$ 1900. The Beier Fiord, 50 m. (1).

Anarrhichas lupus, Lin.

$^{23}/_{4}$ 1896. Balstad.

Contents of stomach: — *Ophiuroidea*, *Onuphis conchylega*, *Buccinum undatum*, *Eupagurus pubescens*.

Crystallogobius linearis, Düb. & Kor.

$^{10}/_{3}$ 1899. The Trold Fiord in Lofoten, several specimens from the stomach of *Gadus callarias*. The cod was 40 cm. in length.

Pleuronectes cynoglossus, Lin.

$^{15}/_{4}$ 1899. Stønesbotn, 50—80 m. (3).

Pleuronectes platessa, Lin.

$^{10}/_{4}$ 1899. Stene in Bø (Vesteraalen), several large specimens, with stomach and intestines full of shells (*Pecten*) and *Echinodermata*. There were also *Polychæta*, *Eupagurus pubescens*, *Portunus holsatus* etc.

Platysomatichthys hippoglossoides, Walb.

$^{20}/_{4}$ 1896. Balstad, from the stomach of cod.

Drepanopsetta platessoides, O. Fabr.

$^{31}/_{3}$ 1900. The Beier Fiord, 50—150 m. (several specimens).

Gadus aeglefinus, Lin.

$^{29}/_{4}$ 1897. Reine, one specimen (28 cm.) from the stomach of cod.

I have written something about the food of the haddock in my paper: — „Contribution to the Study of Hydrography and Biology on the Coast of Norway", p. 17.

Gadus callarias, Lin.

At several places we caught cod and examined the contents of their stomachs, we also bought some for the same purpose. On

$^{10}/_4$ 1899, we examined some cod which had been caught at Stene in Bo. Some were of a reddish colour, others were paler and resembled ocean-cod („skrei").

The roe was not fully developed.

In the stomachs were found *Polychæta*, *Hyas coarctatus* etc.

A single specimen had *Lernæa branchialis* on one of its gills.

On $^{20}/_4$ 1899 we bought in the Jokel Fiord 10 cod which had been fished by line in the fiord. Shape and colour were those of the ocean-cod („skrei"), in a few of the larger females the roe was very loose. Schizopods and Amphipods were found in the stomachs.

I have also referred to the food of the cod in the paper quoted above, p. 11.

Gadus virens, Lin.

In the beginning of February, 1897, I took part in a fishing expedition with nets for „skrei". In the course of this, we also caught a number of „sei" (*Gadus virens*). Cf. my paper referred to above, p. 17.

Molva molva, Lin.

Towards the end of April 1897, I went with a fisherman to fish with nets near Rost. Among the rest, we also caught large specimens of *Molva*. As a rule the stomach hang like a balloon out of its mouth, but in one instance, bones of *Gadus æglefinus* could be identified.

Brosmius brosme, Asc.

In the stomach of *Brosmius*, which was caught near Rost in April 1897, *Lithodes maja* was often found.

Lycodes sarsi, Collett.

$^{6}/_4$ 1900. The Folden Fiord, 530 m. (1).

Mallotus villosus, O. F. Müll.

On $^{25}/_4$ 1899, dead specimens were found drifting in the Troldfiordsund (between Rolfsø and Ingø). Both males and females were found, and on examination it was seen that they had spawned. It is said that it is quite usual to find dead capelan floating in Finmark in the spring, and many theories have been started to offer an explanation for this. Some think that the death of the capelan is to be accounted for by the coldness of the water; others suppose that it must be attributed to unsuitable food etc.

But none of the theories advanced seem very satisfactory.

Clupea harengus, Lin.

$^{18}/_3$ 1896. Henningsvær, from the stomach of cod.

Herring catches are made in many of the fiords in Nordland in the winter, so as to provide bait for the codfishery in Lofoten.

The supply of the socalled baiting herring („agnsild") is conveyed by small steamers. On $^{16}/_3$ 1897 I went on board one of these steamers (S/S „Svolvær") from Svolvær in Lofoten to the Ler Fiord in Helgeland, where a quantity of herrings had been caught. On $^{17}/_3$ I examined the plankton at the bottom of the fiord at the place where the catch had been made. It was not very rich. On the surface, I got a few specimens of *Oithona similis*, as well as nauplii of *Copepoda*. In a sample from 0—25 m. were found the following: —

Cal. finmarchicus r
Pseudocal. elongatus r
Acartia longiremis rr
Microsetella atlantica c
Metridia longa rr
Nauplii of Copepoda +

Temperature and salinity were found to be distributed as follows: —

$^{17}/_3$ 1897. The Ler Fiord.

	t.	s.
0 m.	3°,5 C.	33,01 ‰
10 „	3,8 „	33,73 „
Bottom 25 „	3,8 „	33,73 „

The herrings were rather meagre. I made some measurements, and found that the smallest were 15 cm. in length, the largest 20 cm., the usual length was 16, 17, 18 cm. (The measurement was made from the tip of the snout to the commencement of the division of the tail fin). Indications of roe and milt were present in the largest specimens. The stomachs were empty, but most of them had a white mass in the intestine.

One of the fiords which almost always in winter supplies Lofoten with „agnsild" is the Kvænangen Fiord. My observations in this fiord ($^{24}/_1$ and $^{19}/_4$ 1899), testify great uniformity in temperature and salinity during the winter.

This probably has much to do with the fact that plankton Copepods may be found right up to the surface of the water. At any rate, I observed quantities of *Calanus finmarchicus* in a sample from 0—5 m. on $^{24}/_1$ 1899.

As the food of the herring can thus rise so far up, it is explicable that the herring itself follows it, and comes so far up in the water that it can be reached by the tackle employed.

Anguilla vulgaris, Turt.

$^{5}/_4$ 1900. The Salten Fiord I, 15—20 m. (*juniores*).

Myxine glutinosa, Lin.

During the cod fishery at Sundero in Vesteraalen, in the beginning of February 1897, I noticed that large numbers of fish were destroyed by this destructive animal. In some cases the robbers had not had a chance of escape, but were found under the skin of the sucked out cod.

B. Bottom Samples.

a. Foraminifera.

Mr. Hans Kiær, Tromsø, determ.

At some places, we took bottom samples, and when the townet reached the bottom, we also obtained a combination of bottom mud and plankton.

These samples were sent to Mr. Ed. Thum, Leipzig, and he sorted out the *Foraminifera* and the *Diatomacea* and made excellent preparations. Mr. Hans Kiær and Mr. E. Jørgensen have classified the species thus prepared.

In the following pages, I give the list of the *Foraminifera* from Mr. Kiær's Manuscript.

With regard to the synomyms, I beg reference to the works of the author himself.[1])

11/1 1899, Moskenstrømmen. 0—150 m.
Bottom sample and plankton.

Hyperammina ramosa, Hyperammina subnodosa, Crithionina abyssorum, Halophragmium balloides, Valvulina conica, Ammodiscus tenuis, Reophax scorpiurus, Trochammina robertsoni, Trochammina nitens, Webbina clavata, Verneuilina polystropha, Textularia agglutinans, Bulimina pyrula, Bulimina marginata, Virgulina schreibersiana, Uvigerina angulosa, Cassidulina laevigata, Nodosaria laevigata, Globigerina bulloides, Truncatulina lobatula, Truncatulina refulgens, Anomalina coronata, Operculina ammonoides, Nonionina umbilicatula, Nonionina turgida.

17/1 1899, Stamsund.
Bottom sample.

Haplophragmium canariense, Haplophragmium glomeratum, Valvulina conica, Bulimina pyrula, Bulimina elipsoides, Bulimina marginata, Bolivina punctata, Cassidulina bradyi, Chilostomella ovoidea, Uvigerina pygmaea, Uvigerina angulosa, Pullenia sphaeroides, Pullenia quinqueloba, Truncatulina lobatula, Anomalina coronata, Nonionina umbilicatula, Operculina ammonoides, Cornuspira carinata, Quinqueloculina seminulum, Biloculina simplex.

17/1 1899, Stamsund, 0—150 m.
Bottom sample and plankton.

Trochammina inflata, Bigenerina sarsi A., Bulimina marginata, Bulimina convoluta, Bulimina pyrula, Bolivina punctata, Uvigerina angulosa, Sagrina dimorpha, Patellina corrugata, Cassidulina laevigata, Polymorphina compressa, Cornuspira foliacea, Nodosaria calomorpha, Lagena marginata, Lagena hexagona, Lagena apiculata, Cristellaria rotulata, Globigerina bulloides, Pullenia sphaeroides, Truncatulina lobatula, Nonionina scapha, Operculina ammonoides, Quinqueloculina seminulum, Biloculina elongata.

31/1 1899, Hola (Svolvær), 0—150 m.
Bottom sample and plankton.

Halophragmium truncatum, Trochammina robertsoni, Bolivina dilatata, Bolivina punctata, Virgulina schreibersiana, Bulimina subteres, Bulimina marginata, Cassidulina laevigata, Cassidulina crassa, Polymorphina compressa, Patellina corrugata, Lagena marginata, Lagena laevis, Lagena striata, Truncatulina lobatula, Discorbina globularis, Nonionina scapha, Operculina ammonoides, Quinqueloculina seminulum, Biloculina elongata, Biloculina oblonga, Globigerina bulloides.

31/1 1899, Hola (Svolvær), 0—150 m.
Bottom sample and plankton.

Reophax scorpiurus, Halophragmium glomeratum, Trochammina robertsoni, Valvulina conica, Valvulina fusca, Trochammina nitida, Bulimina elipsoides, Bulimina pyrula, Bulimina marginata, Bolivina punctata, Bolivina dilatata, Virgulina squamosa, Uvigerina angulosa, Sagrina dimorpha, Cassidulina crassa, Cassidulina laevigata, Lagena striata, Lagena clavata, Lagena distoma, Lagena hexagona, Lagena marginata, Globigerina bulloides, Pullenia sphaeroides, Truncatulina lobatula, Discorbina obtusa, Operculina ammonoides, Nonionina stelligera, Nonionina turgida, Triloculina tricarinata, Quinqueloculina seminulum.

31/1 1899, Lilands Bay (Østnesfjord), 0—35 m.
Bottom sample and plankton.

Trochammina sp., Spiroplecta biformis, Uvigerina angulosa, Cassidulina crassa, Cassidulina laevigata, Virgulina schreibersiana, Bulimina marginata, Bolivina dilatata, Nodulina gracilis, Polymorphina compressa, Nodosaria communis, Nodosaria calomorpha, Patellina corrugata, Lagena squamosa, Lagena williamsoni, Lagena gracilis, Lagena striata, Lagena marginata, Truncatulina lobatula, Nonionina scapha, Operculina ammonoides, Quinqueloculina seminulum.

3/2 1899, Raftsund, 250—300 m.

Hyperammina sp., Trochammina robertsoni, Valvulina fusca, Valvulina conica, Textularia agglutinans, Textularia williamsoni, Bigenerina sarsi, Bigenerina digitata, Bolivina punctata, Bolivina dilatata, Bulimina marginata, Bulimina pyrula, Bulimina elipsoides, Uvigerina angulosa, Sagrina dimorpha, Cassidulina laevigata, Cassidulina crassa, Globigerina bulloides, Pullenia sphaeroides, Pullenia quinqueloba, Orbulina universa, Nodosaria scalaris, Nodosaria communis, Lagena squamosa, Lagena marginata, Truncatulina lobatula, Rotalia soldani, Discorbina araucana, Discorbina obtusa, Nonionina umbilicatula, Operculina ammonoides, Cornuspira carinata, Quinqueloculina seminulum, Biloculina simplex, Biloculina elongata.

[1]) *Thalamophora.* The Norw. North. Atl. Exp.
Synopsis of the Norwegian Marine Thalamophora. Rep. on Norwegian Fishery and Marine Investigations, edited by dr. Hjort, Vol. I. nr. 7. 1900.

Besides these, there were also found at the same place:
Saccammina sphaerica. Rhabdammina abyssorum.

3/2 1899. Raftsund. 0—270 m.
Bottom sample and plankton.

Trochammina robertsoni. Textularia sagittula. Bigenerina sarsi. Bulimina elipsoides. Bulimina pyrula. Bulimina marginata. Bulimina convoluta. Bulimina subteres. Bolivina punctata. Virgulina schreibersiana, Cassidulina crassa. Cassidulina laevigata. Polymorphina compressa. Sagrina dimorpha. Globigerina bulloides. Pullenia sphaeroides. Nodosaria calomorpha. Lagena semistriata. Lagena marginata. Lagena gracillima. Lagena striata. Truncatulina lobatula. Discorbina araucana. Discorbina berthelotiana. Nonionina umbilicatula. Operculina ammonoides. Cornuspira foliacea. Triloculina tricarinata.

7/2 1899. Ofoten I. 360 m.

Bigeneria sarsi (A + B). *Bulimina normanni. Virgulina schreibersiana. Bolivina punctata. Bolivina dilatata. Bulimina elipsoides. Bulimina marginata, Uvigerina angulosa. Sagrina dimorpha. Cassidulina laevigata. Cristellaria rotulata. Nodosaria laevigata. Nodosaria scalaris. Nodosaria soluta. Nodosaria inflexa. Lagena marginata. Lagena striata. Lagena distoma. Lagena semistriata. Lagena hexagona. Globigerina bulloides. Pullenia sphaeroides. Pullenia quinqueloculina. Sphaeroidina bulloides. Truncatulina lobatula. Rotalia soldani. Discorbina berthelotiana. Anomalina coronata. Patellina corrugata. Nonionina stelligera. Nonionina umbilicatula. Operculina ammonoides. Cornuspira carinata. Quinqueloculina seminulum. Quinqueloculina arenacea.*

16/2 1899, Brettesnes—Skroven. 350—400 m.

I.

Hyperammina ramosa, Reophax scorpiurus. Halophragmium latidorsatum, Valvulina fusca. Webbina clavata, Bulimina marginata. Uvigerina pygmaea. Nodosaria laevigata. Anomalina coronata. Rotalia soldani. Nonionina umbilicatula. Quinqueloculina arenacea.

At the same place were also found: —
Saccammina sphaerica, Bathysiphon filiformis.

16/2 1899. Brettesnes—Skroven. 350—400 m.

II.

Trochammina sp.. *Bulimina pyrula. Bulimina marginata, Bulimina subteres, Bolivina punctata. Bolivina dilatata. Virgulina schreibersiana. Cassidulina laevigata. Cassidulina crassa, Polymorphina compressa. Uvigerina angulosa. Cornuspira* sp.. *Lagena orbignyana. Lagena distoma. Lagena marginata. Lagena striata. Globigerina bulloides, Pullenia sphaeroides. Patellina corrugata. Discorbina araucana, Nonionina umbilicatula. Nonionina scapha. Operculina ammonoides. Quinqueloculina subrotunda.*

3/3 1899. The Kirk Fiord I. 100 m.

I.

Ammodiscus incertus, Virgulina squamosa. Bulimina marginata. Cassidulina laevigata. Cassidulina bradyi. Polymorphina compressa. Bolivina punctata, Bolivina dilatata. Uvigerina angulosa. Cristellaria rotulata, Nodosaria communis. Lagena lagenoides. Lagena marginata. Globigerina bulloides. Truncatulina lobatula. Discorbina araucana. Discorbina berthelothiana. Nonionina scapha. Operculina ammonoides. Quinqueloculina agglutinans.

3/3 1899. The Kirk Fiord I. 100 m.

II.

Halophragmium latidorsatum. Halophragmium canariense. Textularia agglutinans. Textularia sagittula. Bulimina pyrula. Bulimina marginata, Bolivina dilatata. Virgulina schreibersiana. Uvigerina angulosa. Cassidulina laevigata. Cassidulina crassa. Truncatulina lobatula. Discorbina globularis. Globigerina bulloides. Nonionina scapha. Polystomella striatopunctata. Patellina corrugata. Operculina ammonoides. Quinqueloculina seminulum.

4/4 1899. The Ostnes Fiord. 10—20 m.

Reophax scorpiurus. Halophragmium canariense. Halophragmium glomeratum. Gordiammina sp., *Verneuilina polystropha. Spiroplecta biformis. Bulimina marginata. Cassidulina crassa. Cassidulina laevigata. Uvigerina angulosa. Polymorphina compressa. Lagena laevis. Lagena distoma. Lagena marginata, Truncatulina lobatula. Discorbina globularis. Rotalia beccari. Operculina ammonoides. Nonionina scapha. Polystomella striato-punctata. Quinqueloculina seminulum. Globigerina bulloides.*

4/4 1899. Moldøren. near Svolvær. 10 m.

Bolivina dilatata. Virgulina schreibersiana. Lagena squamosa. Lagena laevis. Globigerina bulloides. Patellina corrugata. Truncatulina lobatula, Truncatulina ungeriana. Discorbina vilardeboana. Nonionina stelligera, Polystomella striatopunctata, Quinqueloculina seminulum.

1899. Svolvær harbour, 10—15 m.

Bigeneria sarsi. Bolivina dilatata, Bolivina punctata. Bulimina marginata. Cassidulina laevigata. Uvigerina angulosa, Lagena hexagona. Lagena squamosa, Lagena striata. Lagena gracillima. Lagena lagenoides. Globigerina bulloides. Pullenia sphaeroides. Truncatulina lobatula. Discorbina globularis. Rotalia beccari. Polystomella striatopunctata. Nonionina stelligera, Operculina ammonoides. Quinqueloculina seminulum. Quinqueloculina subrotunda.

18/4 1899. Gaukværø (Vesteraalen). 0—180 m.
Plankton and bottom sample.

Textularia williamsoni, Cassidulina laevigata, Cassidulina crassa. Uvigerina angulata. Lagena hexagona. Cristellaria rotulata. Globigerina bulloides. Truncatulina lobatula. Truncatulina refulgens. Discorbina globularis. Nonionina stelligera. Quinqueloculina seminulum. Biloculina simplex.

19/4 1899, Stene in Bø (Vesteraalen). 10 m.

Uvigerina angulosa. Cassidulina laevigata. Truncatulina lobatula. Discorbina araucana. Nonionina stelligera. Polystomella striatopunctata. Spiroloculina planulata. Triloculina tricarinata. Quinqueloculina seminulum.

Kiær has also classified several species which were not prepared.

23/3 1900. The Ostnes Fiord.

Truncatulina lobatula. Truncatulina ungeriana. Truncatulina refulgens. Anomalina coronata. Planorbulina mediterranensis.

22/2 1899. Mortsund I. 200 m.

Nodosaria soluta, Cristellaria rotulata, Cristellaria crepidula.

28/3 1899. The Tys Fiord. 500 m.

Pulvinulina punctulata on *Lophohelia prolifera.*

18/2 1899. The Sag Fiord. 200 m.

Saccammina sphaerica.

22/3 1899. The Sea NW of Rost. 700 m.

Rupertia stabilis.

14/4 1899. Malangen. 380 m.

Astrorhiza arenacea. Discorbina globularis.

8/5 1899. Lyngen III. 300 m.

Astrorhiza arenacea.

Hammerfest (1894).

Truncatulina lobatula, Truncatulina refulgens. Truncatulina ungeriana. Discorbina globularis.

Sværholt (1894).

Discorbina globularis. Truncatulina lobatula.

27/4 1899. The Porsanger Fiord. 200 m.

Rhabdammina abyssorum.

With regard to the distribution of the *Thalamophora*, Mr. Kiær writes[1]) „In taking a survey of the occurrence of Thalamophora in all the ocean-depths investigated by the North Atlantic Expedition we find, in all, three different centres of distribution, *viz*: —

A. The southern gray clay, which includes the fiords and banks along the Norwegian coast, about as far as to 19° E. Long: and the gray clay near Iceland.

B. The northern gray clay, to which the fiords and banks along the Norwegian coast east of 19° Long., near Beeren Island and Spitzbergen belong, and the *Rhabdammina* clay.

C. The brown clay, which is divided into the *Biloculina* clay proper and the transition clay."

Kiær (l. c. p. 11) gives the following as being the forms which are of most frequent occurrence in the southern gray clay along the coast of Norway: —

Uvigerina pygmaea, U. angulosa, Truncatulina lobatula, T. refulgens, Nonionina umbilicatula, N. scapha, Lagena marginata, Pullenia sphaeroides, Quinqueloculina seminulum, Globigerina bulloides, Bolivina dilatata, Bulimina elipsoides, B. marginata and *Cassidulina laevigata.*

As characteristic of the northern gray clay, Kiær (l. c. p. 12) gives the following forms: —

Astrorhiza crassatina, Lagena apiculata, Pulvinulina karsteni, Globigerina pachyderma.

These are considered to be arctic forms. „On the other hand, there are some southern species which are either absent from the field of the northern centre or at any rate are very scarce, and do not attain to their full size, e. g. *Bulimina marginata, Uvigerina pygmaea* and *angulosa, Operculina ammonoides.*"[2])

The samples I have collected almost exclusively represent the southern gray clay, of which Thalamophor-fauna they certainly give a very complete illustration.

It is of considerable interest to see that the limit between the northern and southern gray clay on the Norwegian coast is fixed at 19° Long., which lies near Tromso. Without thinking of this fact, I have, for hydrographical and zoological reasons (cf. Part IV) fixed Malangen as the boundary fiord or rather the transition fiord between the preponderant boreal and the preponderant arctic fauna.

This division is thus confirmed by a study of the deposits.

[1]) *Thalamophora*, p. 10. The Norw. North Atl. Exp. 1876–78.

[2]) With respect to the chemical condition of the deposits, reference should be made to Schmelck's treatise „On Oceanic Deposits". The Norw. North Atl. Exp. Chemistry. A plate is adjoined giving the distribution of the deposits.

b. Diatoms in Bottom Samples from Lofoten and Vesteraalen.

By

E. Jorgensen.

In the following pages an account is given of the diatoms contained in some bottom samples from the following localities in Lofoten and Vesteraalen:

Moskenstrommen, 0—180 m. (together with plankton),
Stamsund, 0—150 m. (together with plankton),
Svolvaer harbour, 10—15 m.,
The Ostnes Fiord, 10—20 m.,
Brettesnes—Skroven, 350—400 m.,
Mouth of the Raftsund, 250—300 m.,
Stene in Bo, 10 m.,
Gaukværo, 0—180 m. (together with plankton).

Two of these, the samples from Brettesnes—Skroven and from Raftsund, were poor and consisted perhaps only of dead specimens, a good many of which naturally originate from the plankton. The samples from Moskenstrommen, Stamsund and Gaukværo were taken together with plankton.

The working through of bottom samples is a very troublesome and lengthy task, when it is done as it should be. As there was, however, not time enough to investigate the samples in the manner I consider the right one, and as — on the other hand — it was of some importance, to be able rightly to interprete the plankton, to gain a preliminary knowledge of the bottom flora, I have contented myself with the method usually adopted, and have studied the species from the valves in slides. For this purpose the material — together with a richer one from the west coast of Norway — has been prepared as slides by Mr. Thum of Leipzig, in his well-known perfect way.

For this reason, it has not been possible to discern between living (recent) and fossil species.

The species occurring in the plankton are in detail dealt with in another chapter of this work (pp. 90—108). Nevertheless, to avoid arbitrariness, I have not omitted the plankton species, but have in such cases mentioned them as originating from the plankton.

List of the species observed.

I. Centricæ Schütt.

1. *Coscinodisceæ.*

Coscinodiscus Ehrb.

C. nitidus Greg.

Cf. above p. 95.

Somewhat rare: Moskenstrommen r, Stamsund r, Raftsund r, Stene r, Gaukværo r.

Distribution: Western Europe; Balearic Islands. Greenland and Finmark (Cleve). Warmer coasts of America, Asia and Australia.

C. appollinis Ehrb. (1844).
Ehrb. Mikrogeologie pl. 35 A. XXII, f. 4.

var. compacta Rattr. Rev. of Coscinod. p. 579.
C. scintillans (Grev.) A. Schmidt Nords. Diat. p. 94, pl. 3, f. 33.

Differs from the main species (= *C. scintillans* (Grev.) in having the puncta distinctly smaller towards the margin, more numerous radial rows, the shortened ones being longer than usual. Probably is a separate species.

Rare: Moskenstrommen +, Stamsund r, Svolvaer r, Stene r.

Cosc. nitidus A. Schm. Nords. Diat. pl. III, f. 32 does not show the irregular distribution of the puncta that is characteristic of the preceding species. This form occurs in my material together with the one figured l. c. f. 33 and has a similar radiate structure, only much coarser.

Distribution: The variety is only known from Solsvik (west of Bergen, Norway). The main species, which has not been found by us, occurs in the antarctic regions.

C. concavus Ehrb. (Greg.
Greg. Diat. of Clyde 1857, p. 500, pl. X, f. 47. Ehrb. Mikrogeol., pl. 21, f. 4? non pl. 18, f. 38.

Hardly belongs to the genus *Coscinodiscus*. Rattray l. c. p. 170 remarks that the girdle aspect of this species answers to *Endictya oceanica* Ehrb. (cfr. Mikrogeologie pl. 35 A. XXVIII figs. 6, 7; A. Schmidt Atlas pl. 65, figs. 10—15).

Very rare: Gaukværo r. Diameter 86 μ; 2 areoles on 10 μ; border sharply defined, nearly 3 μ broad.

Distribution: Western Europe; Balearic Islands, Black Sea, Sea of Kara (Cleve). Warmer coasts of America and Asia.

C. leptopus Grun.
Van Heurck Synops. pl. 131, figs. 5—6.

Rare: Raftsund r. Diameter 55 μ; 5 areoles on 10 μ. Remarkable for the minute areoles on the border, like those in the genuine *C. lineatus* Ehrb. It differs on the whole from the latter species only in possessing the pseudonodule.

Coscinosira polychorda Gran and the variety of *Coscinodiscus lineatus* mentioned below have a much finer structure and less regularly straight rows of areoles.

Distribution: Mediterranean. Southern Atlantic. Pacific Ocean. Indian Ocean.

C. lineatus Ehrb., ***var.***

Cf. above p. 92.

Rare: Stamsund, r. Finer structure than in the genuine *C. lineatus*. Small: $7\frac{1}{2}$—8 areoles on 10 μ. Border narrow, striate. 15 striae on 10 μ. Areoles near the border somewhat smaller. Secondary rows somewhat flexuose.

In the sample from Svolvaer a very similar specimen was found, only with a little finer structure and marginal spines. This specimen agrees completely with *Coscinosira polychorda* GRAN, but wants the peculiar transverse processus of the latter species.

Such forms, which are perhaps solitary cells of *Coscinosira*, may easily be mistaken for *C. lineatus*.

Distribution: The main species is cosmopolitan. CLEVE and OSTRUP mention *C. lineatus* from several arctic localities: Finmark, Baren Eiland, Greenland, Spitzbergen, Kara. I should, however, think that the species has been confounded with *Coscinosira polychorda*, at any rate to some extent.

C. excentricus EHRB.

Cf. above p. 92.

Frequent: Moskenstrommen r, Stamsund +, Gaukvaero r +. Derived undoubtedly from the plankton.

Distribution: Cosmopolitan.

C. Kützingii A. SCHM.

A. SCHM. Atlas, pl. 57, f. 17. *C. marginatus* A. SCHM. Nords. Diat. pl. 3, f. 35.

As GRUNOW remarks, this species is intermediate between *C. excentricus* and the difficult group of *C. subtilis*.

Very rare: Raftsund r, Stamsund r.

Distribution: North Sea. Arctic and antarctic regions (GRUN.). Not mentioned by CLEVE as arctic. Very nearly related forms are found near Greenland (*C. adumbratus* OSTR.) and Jan Mayen (1898, E. JØRGENSEN).

C. Rothii (EHRB.?) GRUN.

GRUN. Diat. Franz Jos. Land. p. 29, pl. III (C), figs. 20 a, b, 22. *C. symmetricus* A. SCHM. Atlas pl. 57, figs. 25—27, non GREV. *Heterostephania Rothii* EHRB. α *octonaria* Mikrogeologie 35 A. XIII B, fig. 4 a.

Belongs to the difficult group of *C. subtilis* EHRB., as well as the following species and a good many more, which probably will not bear a more thorough examination.

Structure plainly fasciculate, with numerous fasciculi separated by radial lines made conspicuous by the marked inner ends of the beginnings of new rows. Small marginal apiculi in the middle of the fasciculi, one in each. Valve almost flat (occasionally undulated according to GRUNOW).

Very rare: Stamsund r, Raftsund r, Brettesnes—Skroven r. Probably a plankton form.

Distribution: Belgium, Scotland; Caspian Sea. Warmer regions of America and Asia. Southern Seas.

C. Normanni GREG.

GREG. Quart. Journ. Micr. Sc. 1859, p. 80, pl. 6, fig. 3. *C. „normanicus"* VAN HEURCK Synops. pl. 131, 1. *C. fasciculatus* A. SCHM. Nords. Diat. pl. III, figs. 41, 42; Atlas pl. 57, figs. 9, 10.

Very closely related to the preceding species. Differs in having a distinctly convex valve, finer structure (though variable in this respect), more numerous and narrow fasciculi and less distinct marginal apiculi.

It is perhaps not quite certain that this species is identical with *C. Normanni* GREG.; the name *C. fasciculatus* A. SCHM (1874) must however be abolished on account of *C. fasciculatus* O'MEARA (1867).

This species seems to me to answer tolerably well to *C. punctulatus* GREG. In specimens with fine structure the fasciculi are only seen with difficulty, while the clear, scattered dots mentioned by GREGORY l. c. are conspicuous. If this should prove correct, the *C. Normanni* GREG. is perhaps the same as *C. Rothii* GRUN.

Rather frequent: Stamsund r +, Svolvær r +, Brettesnes—Skroven r, Ostnestiord r +, Stene r. Probably a plankton species (living or fossil).

Distribution: Western Europe. America. Arafura Sea.

C. curvatulus GRUN.

Cf. above p. 92.

Derived undoubtedly from the plankton.

Very rare: Stene rr.

Distribution: Arctic regions; Northern European coasts; Balearic Islands. America and Africa.

C. stellaris ROP.

Cf. above p. 92.

Derived undoubtedly from the plankton.

Very rare: Gaukvaero r. When the conspicuous star is wanting, the species is difficult to determine.

var. *symbolophorus* (GRUN.).

C. symbolophorus GRUN. Diat. Franz Jos. Land, p. 82, pl. IV (D), figs. 3—6.

Differs from the main species in having much coarser structure.

Very rare: Moskenstrommen r, Raftsund r. Like the main species planktonic.

Distribution: The main species occurs in Western Europe, the Mediterranean and the antarctic regions, the variety in the arctic and antarctic regions.

C. concinnus W. SM.

Cf. above p. 93.

Derived undoubtedly from the plankton.

Very rare: Gaukvaero, rr; Stene, r.

Distribution: Cosmopolitan.

C. centralis EHRB., RATTR.

Cf. above p. 93.

Derived probably from the plankton.

Not unfrequent: Moskenstrommen r, Stamsund r, Raftsund r, Stene r.

Distribution: Cosmopolitan.

C. subbullicus JØRG.

C. oculus iridis auct. scand., p. p.

Cf. above p. 94.

Probably derived from the plankton.

Rare: Moskenstrommen r, Raftsund r, Gaukvaero r +.

Distribution: Arctic regions.

C. borealis BAIL.

BAIL. Americ. Journ. Sc. 1856, p. 3. A. SCHM. Atlas, pl. 63, f. 11.

Very rare: Raftsund, rr. Diameter 135 μ. Coarse structure; areoles increasing towards the border, at the centre $3^1/_2$, near the border 2 on 10 μ; the largest ones only little larger than those at the very margin. Large and very conspicuous „papillæ" (poroides).

Border sharply defined, dark, striate. The disc somewhat convex towards the border.

The specimen found only differs from SCHMIDT's figure in wanting the „central space". Instead of this space, which is, however, not mentioned by RATTRAY l. c., a large areole was present.

Distribution: Pacific Ocean, especially in the northern region (Kamtschatka Sea, BAILEY). Cape Wankarema (CLEVE).

C. decrescens GRUN.

GRUN. Diat. Franz Jos. Land, p. 28. A. SCHMIDT Atlas, pl. 61, figs. 7—9. RATTRAY l. c. p. 77.

Perhaps a plankton form, occurring with us like *C. subbulliens*.

Coarse structure, conspicuous „papillae". Recognizable through the rapid decreasing of the areoles outside of ½ radius.

Rare: Moskenstrommen r +, Stamsund r. Diameter 92 μ or less; largest areoles somewhat outside of ½ radius, 2 on 10 μ, at the centre smaller, on the border much smaller. Border broad, sharply defined, striate, with 5—6 striæ on 10 μ. Central space generally absent (answering to *var. repleta* GRUN. l. c.), sometimes present.

Distribution: Færoe Channel, Franz Josef's Land, Japan, Macassar Straits, Florida.

C. radiatus EHRB.

Cf. above p. 92.

Probably derived from the plankton.

Rather frequent: Moskenstrommen c, Stamsund r +, Svolvær r, Østnesfiord r, Gaukværø +, Stene r.

Distribution: Cosmopolitan.

var. *minor* A. SCHM.

A. SCHM. Nords. Diat. p. 94, pl. 3, f. 4. *C. decius* A. SCHM. Atlas, pl. 60 figs. 1—4.

Stamsund r, Svolvær r, Gaukværø r, Stene r.

var. *oculus iridis* (EHRB., RATTR.).

Flat. A conspicuous central rosette and often a small „central space". Areoles largest at or beyond ½ radius, hexagonal, with large „papillæ", towards the border rapidly decreasing, at the very margin small. Largest areoles 3 on 10 μ.

This form, which answers very well to *Coscinodiscus oculus iridis* EHRB. Mikrogeologie pl. 19, fig. 2, is certainly not specifically distinct from *C. radiatus*, intermediate forms being rather frequent.

Moskenstrommen r, Gaukværø r. Occurred also in other samples.

C. nodulifer JAN.

JANISCH. in A. SCHMIDT Atlas, pl. 59, f. 21.

Flat. A small, but conspicuous nodule near the centre. Areoles hexagonal, increasing from the centre to ¾ radius, here 3 on 10 μ; towards the margin rapidly decreasing, at the border 5—6 on 10 μ. Border sharply defined, striate, with 6—6½ striæ on 10 μ.

Answers very well to the figure referred to.

Rare: Raftsund +, Brettesnes—Skroven r.

Distribution: This southern species is found near the Balearic Islands and in the warmer regions of the Atlantic, Pacific and Indian Oceans.

It is very remarkable that this species occurs so far north. It is probably a plankton form, most likely a fossil one.

Actinocyclus EHRB.

A. alienus GRUN.

GRUN. in VAN HEURCK Synopsis, pl. 125, f. 12 (*var. arctica*).

Very rare: Brettesnes—Skroven r; Stene r. In structure *Coscinodiscus*-like, as GRUNOW states intermediate between *C. curvatulus* and *C. radiatus*. Central space circular, conspicuous, only with a few irregularly scattered puncta. Numerous fasciculi (over 20) with interfascicular radii, which are more or less plainly zigzag bent, especially towards the centre. Towards the margin, the fasciculi are not separated from each other, but form an even radiately structured marginal part. Very small and inconspicuous marginal apiculi. Border narrow, indistinctly striate.

Diameter 61—66 μ; rows of areoles 15 on 10 μ, at the margin closer. Ocellus marginal, evident.

Distribution: Cape Wankarema. Also mentioned from a few places of the North Atlantic and Arctic Seas.

A. Ehrenbergi RALFS.

Cf. above p. 95.

Probably derived from the plankton.

Not unfrequent: Stamsund r, Svolvær r, Gaukværø r, Stene +.

Distribution: Cosmopolitan.

A. Ralfsii (W. SM.) RALFS.

Cf. above p. 95.

More frequent in the bottom samples than in the plankton (from which however must not be concluded that it is a bottom form): Stamsund r, Svolvær r +, Østnesfiord r, Gaukværø r +, Stene r.

Distribution: Western Europe. Greenland (OSTRUP). Warmer Seas.

A. sparsus (GREG.) RATTR.

RATTR. Revis. Actinoc. 1890, p. 170. *Eupodiscus sparsus* GREG. Trans. Micr. Soc. 1857, p. 81, pl., fig. 47.

The description by RATTRAY does not answer well to the figure referred to. According to this figure, it seems chiefly to differ from *A. Ehrenbergi* in being more sparsely granulated towards the centre, so that only the interfascicular radii reach the central space. It is, however, doubtful whether it can really be kept distinct from the preceding species. Also *A. moniliformis* RALFS seems to be a species very closely related to *A. Ehrenbergi*.

Specimens which seem to belong here were found in the sample from Gaukværø, r.

A. crassus V. H.

VAN HEURCK Synopsis p. 215, pl. 124, figs. 6, 8.

VAN HEURCK's figure shows interfasciculate radii, though not so evident as those of *A. Ehrenbergi*. Smaller and coarser forms of the latter species is puzzlingly similar to *A. crassus*. It is on the whole doubtful, whether these two species always can be distinguished from each other.

A more essential difference than in the structure of the valve is found in the form of the cell (frustule). *A. crassus* has high cells, usually higher than broad, with thick walls, also in the connecting zone; here there is also a conspicuous difference in width between the two valves. *A. Ehrenbergii*, however, forms low cells, broader — often much so — than high, and the two valves have nearly the same diameter.

The valve of *A. crassus* is flat from the centre to some distance from the border, where there is a high and steep marginal zone.

Somewhat rare: Stamsund r. Raftsund r. Gaukværo r. Stene r. Occurs also in the plankton samples.

Distribution: Western Europe. After all, it is most probably identical with *Eupodiscus crassus* W. Sm. (Cf. Van Heurck l. c. and Traité d. Diat. p. 524).

Note. In the sample from Stene, several broken valves with a rather large disc occurred, somewhat similar to *Xanthiopyxis? umbonata* Grev., cf. Van Heurck Traité d. Diat. p. 512, fig. 263, which cannot, however, be referred to the genus *Xanthiopyxis* Ehrb., a doubtful genus including what are probably resting spores of *Chætoceros* (cf. Schütt. in Engler and Prantl., Natürl. Pflanzenfamil., Theil I, Abth. 1 b. p. 148). Structure rather fine, similar to that of *Coscinodiscus*; valve rather convex, with numerous large, slender, conical spines, as in the figure referred to. Undoubtedly a fossil species.

2. *Melosireæ.*

Coscinosira *polychorda* (Gran) Gran.

Cf. above p. 97.

Derived from the plankton.

Very rare: Stamsund r. Gaukværo r.

Distribution: Cf. above p. 97. As stated before (p. 196) this species seems also to occur singly, and is then easily mistaken for *Coscinodiscus lineatus*. At any rate, forms occur in which the peculiar transverse processus at the semiradius are wanting.

Thalassiosira Cl.

T. gravida Cl.

Cf. above p. 96.

In bottom samples the strong resting spores (endocysts) of this species occur, though seldom (much more so than would probably be the case, if this species generally „oversummers" on the bottom).

Rare: Stamsund r +. Svolvær r.

Distribution: Cf. above p. 96.

T. decipiens (Grun.) Jørg.

Cf. above p. 96.

Undoubtedly derived from the plankton.

Rare: Stamsund r. Svolvær r. Gaukværo r +.

Distribution (of *Coscinodiscus decipiens* Grun.): Caspian Sea. Great Britain and Ireland. West coast of Norway.

Melosira Ag.

M. granulata (Ehrb.) Ralfs.

Van Heurck Synopsis p. 200, pl. 87, figs. 10—12.

Fresh water species.

Very rare: Gaukværo, rr.

Distribution: Frequent in fresh water, especially in Western Europe. Franz Josef's Land.

M. Roeseana Rabenh.

Van Heurck Synopsis p. 199, pl. 89, figs. 1—6.

Fresh water species.

Very rare: Østnesfjord, rr.

Distribution: Common fresh water species. Greenland (Østrup).

M. Borreri Grev.

Grev. in Hook. Brit. Fl. II, p. 401. Van Heurck Synops. p. 198, pl. 85, figs. 5—8.

Very rare: Svolvær, rr (*var.* ad *hispid.* Castr.).

Distribution: Frequent on the coasts of Europe. Greenland (Cl.).

Paralia *sulcata* (Ehrb.) Cl.

Cleve Diat. Arct. Sea 1873, p. 7. *Gallionella sulcata* Ehrb., Mikrogeologie pl. 18, I.

Common: Moskenstrommen +, Stamsund c. Svolvær c. Raftsund r +, Brettesnes—Skroven r. Østnesfjord c. Gaukværo cc, Stene c.

Distribution: Frequent on the coasts of Europe and America. Arctic regions.

forma coronata (Ehrb.) Grun.

Van Heurck Synopsis pl. 91, f. 18. *Gallionella coronata* Ehrb. Mikrogeologie pl. 38, XXII, fig. 5.

Rare: Svolvær r. Stene r.

Cyclotella Kütz.

C. striata (Kütz.) Grun.

Grun. in Cleve et Grunow Arct. Diat. 1880, p. 119. Van Heurck Synopsis p. 213, pl. 92, figs. 6—10. *Coscinodiscus striatus* Kütz.

Rare: Stamsund r. Raftsund r. Stene r.

Distribution: Frequent in brackish water. Western Europe. Baltic Sea. Warmer parts of Asia and Africa.

C. comta (Ehrb.) Kütz.

Kütz. Spec. Algar. p. 21. Van Heurck Synops. p. 214, pl. 92, figs. 16—22.

Fresh water species.

Very rare: Gaukværo, rr.

Distribution: Western Europe.

Hyalodiscus Ehrb.

H. scoticus (Kütz.) Grun.

Grun. in Journ. Royal Micr. Soc. 1879, p. 690, pl. 21, f. 5. Van Heurck Synops. pl. 84, figs. 15—18. *Cyclotella s.* Kütz. Bacill. p. 50, pl. 1, figs. II, III.

Frequent: Stamsund r. Svolvær +. Gaukværo + c. Stene r +.

Distribution: Western Europe. Bosporus. Arctic regions.

H. subtilis Bail.

Bail. New Spec. p. 10. f. 12.

Perhaps only a form of the preceding species.
Very rare: Stamsund r. Stene r.
Distribution: Belgium. Scotland. Finmark (Cl.). America. Asia.

H. stelliger Bail.

New Spec. p. 10. Van Heurck Synops. p. 213. pl. 84. figs. 1—2.

Frequent: Moskenstrommen +. Stamsund r +. Svolvær r. Raftsund r. Brettesnes—Skroven r. Gaukværo r. Stene r.
Distribution: Western Europe. Virgin Isles. Spitsbergen (uncertain. Cl.).

Podosira *hormoides* (Mont.) Kutz.

Kutz. Bacill. p. 52. pl. 29. f. 84. A. Schmidt Nords. Diat. pl. 3. f. 40.
Melosira h. Mont. Fl. Boliv. 1839. p. 2.

Rare: Stamsund r. Svolvær r. Raftsund r.
Distribution: Coasts of the North Sea. Greenland. West coast of South America. Adriatic Sea.

3. *Eupodisceæ.*

Roperia *tessellata* (Rop.) Grun.

Cf. above p. 98.
Undoubtedly derived from the plankton.
Rare: Stamsund r +. Stene r r.
Distribution: Western coasts of Europe and Africa.

Auliscus *sculptus* (W. Sm.) Ralfs.

Ralfs in Pritch. Inf. p. 845. pl. 6. f. 3. *Eupodiscus s.* W. Sm. Brit. Diat. I. p. 25. pl. 4. f. 39.

Common: Moskenstrommen +. Svolvær c. Raftsund r. Brettesnes—Skroven r. Ostnesfjord r. Gaukværo c. Stene c.
Specimens occur which are very similar to *A. cælatus* Bail. (A. Schm. Atlas pl. 32. figs. 14—15), but connected with *A. sculptus* by intermediate forms: Gaukværo +. Stene r.
Distribution: Coasts of the North Sea. Western Europe. Mediterranean. America. *A. cælatus:* Warmer coasts of the Atlantic. Pacific and Indian Oceans.

Eupodiscus *argus* W. Sm.

W. Sm. Brit. Diat., p. 24. A. Schmidt Atlas, pl. 92. figs. 7—11; pl. 97. figs. 7—11. Van Heurck Synops. p. 209. pl. 117.

Very rare: Moskenstrommen. r r. only one broken valve.
Distribution: Frequent on the coasts of the North Sea and Western Europe. America.

Aulacodiscus Ehrb.

A. Kittonii Arnott.

Arnott in Pritch. Inf. p. 844. pl. 8. f. 21. A. Schmidt Atlas pl. 36. figs. 5—7.

Rare: Moskenstrommen +. Raftsund r. Brettesnes—Skroven r. Gaukværo r.
All specimens observed have 4 processus and no, or a very small or inconspicuous, „central space".
It is very remarkable that this tropical species occurs in Lofoten. Very likely fossil. At present I have no opportunity of ascertaining whether the cells have really all been empty.
Distribution: Warmer coasts of the Pacific Ocean, especially frequent on the coasts of California.

A. Johnsonii Arnott.

Arnott in Pritch. Inf. p. 844. A. Schmidt Atlas pl. 36. figs. 1. 2.
A. Kittonii var. J. Rattr. Rev. of Aulacodisc. p. 376.

Very rare: Raftsund r. Brettesnes—Skroven r.
Differs from the preceding especially in having a conspicuous central space and processus of a different shape. *A. Kittonii* is, however, said to vary considerably.
Distribution: Tropical coasts of the Indian and Atlantic Oceans.

4. *Asterolampreæ.*

Actinoptychus Ehrb.

A. undulatus (Bail.?) Ralfs.

Cfr. above p. 98.
Frequent: Moskenstrommen r +. Stamsund r +. Svolvær r. Raftsund r. Brettesnes—Skroven r. Gaukværo r. Stene r.
Distribution: Coasts of Western Europe and the North Sea. Arctic regions. Cape of Good Hope.

A. splendens (Ehrb.?) Shadb.

Shadb. in Pritch. Inf. p. 840. Van Heurck Synops. pl. 119. figs. 1—2, 4. *Halionyx splendens* Ehrb. Abh. Berl. Ak. 1844?

Very rare: Moskenstrommen r. Gaukværo r r.
Distribution: Coasts of the North Sea and the Baltic (Greifswald).

Asteromphalus *heptactis* (Bréb.) Ralfs.

Cf. above p. 98.
Undoubtedly derived from the plankton.
Very rare: Moskenstrommen r r.
Distribution: Cf. above p. 98.

5. *Biddulphieæ.*

Biddulphia Gray. V. H. (including *Amphitetras* Ehrb., *Triceratium* Ehrb., *Cerataulus* Ehrb.).

B. pulchella Gray.

Gray Arrang. of Brit. Plants. I. p. 294. Van Heurck Synops. p. 204. pl. 97. figs. 1—3.

Rare: Stamsund r. Raftsund r. Brettesnes—Skroven r. Stene r.
Distribution: Frequent on the western and southern coasts of Europe. America. Africa.

B. regina W. Sm.

W. Sm. Brit. Diat. II. p. 50. pl. 46. f. 323.

var.

B. regina A. Schm. Atlas pl. 119. f. 18 (from Balearic Isles).

The 3 median elevated parts of the valve hispid, not smooth as stated by W. Sm. both in his discription and figure.
Very rare: Stene, a single valve.

Distribution. Balearic Isles. The main species known from the coast of the isle of Skye.

B. aurita (Lyngb.) Bréb.

Cf. above p. 99.
Probably derived from the plankton.
Frequent: Stamsund +, Svolvær + c, Stene r +.
Distribution: Cf. above p. 99.

B. rhombus (Ehrb.) W. Sm.
W. Sm. Brit. Diat. II. p. 49, pl. 45, f. 320. *Denticella r.* Ehrb.

var. trigona Cl. Van Heurck Synops. pl. 99, f. 2.

Very rare: Svolvær r.
Distribution: Coasts of the North Sea and Western Europe. Finmark (Cleve).

B. turgida (Ehrb.) W. Sm.
W. Sm. Brit. Diat. II. p. 50, pl. 62, f. 38. Van Heurck Synops. pl. 104, figs. 1, 2. *Cerataulus t.* Ehrb.

Very rare: Svolvær r r.
Distribution: Coasts of the North Sea and Western Europe.

B. Smithii (Ralfs) V. H.
Van Heurck Synops. p. 207, pl. 105, figs. 1—2. A. Schmidt Atlas pl. 116, figs. 5—6. *Cerataulus S.* Ralfs in Pritch. p. 847.

Very rare: Moskenstrommen rr, Svolvær r.
Distribution: Coasts of the North Sea and Western Europe. Spitsbergen? (Cleve).

B. antediluviana (Ehrb.) V. H.
Van Heurck Synops. pl. 109, figs. 4—5. *Amphitetras a.* Ehrb., Mikrogeol. pl. 21, f. 25 a—c.

Rather frequent: Moskenstrommen +, Stamsund r, Raftsund r, Gaukværo r, Stene r.
Distribution: Common species, cosmopolitan; very rare, however, in arctic regions: Spitsbergen (rr, Cleve).

B. lata (Grev.).
Triceratium l. Grev. Trans. Micr. Soc. 1865, p. 103, pl. 9, f. 20. A. Schmidt Atlas, pl. 77, figs. 38—39. *Amphitetras l.* De Toni Syll. vol. II, sect. 3, p. 901.

Very rare: Raftsund r. Very similar to the figures referred to in Schmidt's Atlas. Side of the tetragone 67 μ. Marginal pearls 5 on 10 μ; the rows of striæ in the corners somewhat radiating, 10 on 10 μ.
Distribution: Tropical species, according to De Toni (l. c.) only known from Singapore and North Celebes.

B. favus (Ehrb.) V. H.
Van Heurck Synops. pl. 107, figs. 1—4. *Triceratium favus* Ehrb. A. Schmidt Atlas, pl. 82, f. 2.

Very rare: Raftsund, rr. Side of the triangle 92 μ; 2 areoles on 10 μ.
Distribution: Rather common species, cosmopolitan on tropical and temperate coasts. Spitsbergen (Cleve, „doubtful as an arctic species").

B. arctica (Brightw.).
Triceratium a. Brightw. Micr. Journ. 1853, p. 250, pl. 4, f. 11. A. Schmidt Atlas pl. 79, figs. 12—13.

Very rare: Stene r.

forma balæna (Ehrb.).
Zygoceros b. Ehrb. Mikrogeol. pl. 35 A, XXIII, f. 17. *Biddulphia b.* Brightw. Micr. Journ. VII (1859), p. 181, pl. 9, f. 15. Van Heurck Synops. pl. 112, f. 1.

Very rare: Stene r.
Distribution: Arctic regions. Vancouver; Cape of Good Hope (De Toni Syll. p. 921).

B. formosa (Brightw.).
Triceratium f. Brightw. Grun. in Cleve et Grun. Arkt. Diat. pp. 111—112. A. Schmidt Atlas, pl. 79 f. 2.

Very nearly related to the preceding species, from which it differs chiefly in having the centre of the valve irregularly punctate, not areolate, with scattered puncta smaller than the neighbouring areoles.
Very rare: Raftsund r.

forma balæna.

Answering to the *forma balæna* of the preceding species.
Very rare: Raftsund r.

B. alternans (Bail.) V. H.
Van Heurck Synops. p. 208, pl. 113, figs. 4—7. *Triceratium a.* Bail. Micr. Obs. p. 40, figs. 55—56.

Very rare: Stamsund r r.
Distribution: Western Europe. West Indies.

B. punctata (Brightw.) V. H.
Van Heurck Synops. pl. 109, f. 10 (*forma 3-gona*). *Triceratium p.* Brightw. Micr. Journ. 1856, p. 275, pl. 17, f. 18, non *Biddulphia punctata* Grev. 1864.

Very rare: Gaukværo, rr. Irregularly punctate with puncta very different in size, shape and distance from each other, on an average 5 on 10 μ. Side of the triangle 40 μ.
Distribution: Tropical coasts of America, Africa and Asia. The nearly related *B. sculpta* (Shadb.) V. H., which by De Toni l. c. p. 944 is considered to belong to the same species, occurs in Western Europe, the Skagerack, and the Mediterranean.

B. nobilis (Witt.).
Triceratium n. Witt. Diat. Simbirsk 1885, p. 34, pl. 10, f. 3; pl. 11, figs. 4, 7. A. Schmidt Atlas pl. 150, f. 25. Non *Biddulphia nobilis* Brun 1889.

A specimen very similar to the figure referred to in Schmidt's Atlas (from Archangel) was found: Gaukværo r r; Stene r r. Large puncta, irregular in size and shape, intermingled with minute ones. Near the margin, larger areoles. In the centre, a conspicuous inward pointing spine is found. Side of the triangle 56 μ.
A nearly related species is *Triceratium Heibergii* Grun., V. H. Synops. pl. 112, figs. 9—11 (from Mors).
Distribution: Only known fossil from Simbirsk. Perhaps also fossil in my samples (as is probably also the case with some of the other species).

B. Weissei (Grun.)

Triceratium Weissei Grun. in A. Schmidt Atlas pl. 95, f. 2.

A specimen very similar to the figure referred to (from Archangel) was found: Stene, r r (a single specimen). Rather coarse radiating structure of puncta (pearls); about 6 rows on 10 μ. Large circular central space without puncta, only one or two near the periphery. Side of the triangle 57 μ.

Might also belong to the genus *Trinacria*. I have not seen a side view of the valve.

Distribution: Only known fossil (Simbirsk, Archangel).

Isthmia Ag.

I. enervis Ehrb.

Ehrb. Inf. p. 209, pl. 16, f. 6. Van Heurck Synops. pl. 96, figs. 1—3.

Rather frequent: Moskenstrommen rr, Stamsund r, Svolvær r, Raftsund r, Brettesnes—Skroven r, Stene r. More frequent on algæ.

Distribution: Coast of Western Europe. Finmark; Spitsbergen (Cleve). West Indies; Honduras.

I. nervosa Kütz.

Kütz. Bacill. p. 137, pl. 19, f. 5. Van Heurck Traité d. Diat. 152, pl. 31, f. 891.

Very rare: Raftsund r.

Distribution: Western Europe. Denmark. Arctic regions. Honduras; San Francisko. Kerguelen.

6. *Chætocereæ.*

Bacteriastrum *varians* Laud.

Laud. Trans. Micr. Soc. 1863, XII, p. 8, pl. III, figs. 1—6.

Derived from the plankton.

Very rare: Stene r r.

Distribution: Neritic plankton species, from the western coasts of Europe. Warmer coasts of the Atlantic, Indian and Pacific Oceans. Rare off the west coast of Norway.

Chætoceros Ehrb.

C. atlanticus Cl.

Cf. above p. 100.

Derived from the plankton.

Very rare: Gaukværø r.

C. contortus Schütt.

Cf. above p. 101.

Thickened horns, most probably belonging to this species, is found now and then in the bottom samples, though seldom. Undoubtedly derived from the plankton.

C. diadema (Ehrb.) Schütt.

The characteristic resting spores of this species (*Syndendrium diadema* Ehrb.) occur rarely:

Stamsund r, Svolvær r, Gaukværø r. Derived from the plankton.

Distribution: Cfr. above p. 101. *Syndendrium diadema* Ehrb. also in Peru guano.

Stephanogonia Ehrb.

A specimen very similar to *S. actinoptychus* (Ehrb.) Grun. in Van Heurck Synops. p. 83 *bis*, figs. 2—4 was found in the sample from Moskenstrommen.

Nearly circular. Diameter 70 μ. 15 radii. On the smaller upper disc, a coarse spine seems to be found. In other respects corresponds very well to the figure referred to.

Stephanogonia polygona Ehrb. seems to be a similar form, perhaps the same. Both are probably resting spores (cfr. Schütt in Engler and Prantl, Natürl. Pflanzenf., Th. 1, Abth. 1 b, p. 117).

Distribution: Both species mentioned are known from „North America" (Ehrenberg). The figure mentioned represents a fossil specimen from Nottingham deposit.

Pyxilla baltica Grun.

A. Schm. Nords. Diat. pl. 3, f. 25. Van Heurck Synops. pl. 83, f. 2.

According to the figure in Hensen (5ter Ber. Komm. Kiel, pl. V, f. 38 e) *Pyxilla baltica* must be the resting spore (endocyst) of *Rhizosolenia setigera* Brightw.

Undoubtedly derived from the plankton.

Very rare: *Rhizosolenia setigera* is a neritic plankton diatom from the coasts of Europe (Western E., Skagerak, Mediterranean), Pacific Ocean, Indian Ocean; north of South America. — *Pyxilla baltica* is known from the Baltic, and fossil from Simbirsk.

II. Pennatæ Schütt.

7. *Synedreæ.*

Synedra.

a. ***Eusynedra*** V. H.

S. affinis Kütz.

Kütz. Bacill., p. 68, pl. 15, figs. 6, 11. Van Heurck Synops. pl. 41, f. 13.

var. tabulata (Kütz.) V. H.

V. H. Synops. pl. 41, f. 9 a. *Synedra t.* Kütz.

Very rare: Svolvær r, Ostnesfiord r.

Distribution: Frequent on the coasts of Europe. Arctic regions.

S. kamtschatica Grun.

Grun. in Cl. et Grun. Arkt. Diat. p. 106, pl. VI.

var. intermedia Grun. l. c. f. 111.

Very rare: Stamsund r.

Distribution: Kamtschatka, Finmark, Spitsbergen, Greenland, Kara Sea, East Cape.

S. ulna (Nitzsch.) Ehrb.

Van Heurck Synopsis pl. 38, f. 7.

Fresh water species.

Very rare: Svolvær r.

Distribution: Common fresh water species.

b. ***Ardissonia*** (De Not.) V. H.

S. crystallina (Ag.) Kütz.

Kütz. Bacill. p. 69, pl. 16, f. 1. Van Heurck Synops. pl. 42, f. 10. *Diatoma c.* Ag. Consp., p. 52.

Not unfrequent: Stamsund r, Svolvær +, Gaukværo r, Stene r.

Distribution: Coasts of Western Europe. The Mediterranean. Finmark.

S. superba Kütz.

Kütz. Bacill. p. 69, pl. 15, f. 13. Van Heurck Traité d. Diat., p. 316, pl. 30, f. 834.

Very rare: Ostnesfiord r, Stene r.

Distribution: Coasts of Western Europe. The Mediterranean. Finmark (*var. minor* Grun.).

S. baculus Greg.

Greg. Trans. Micr. Soc. 1867, p. 88, pl. 1, f. 54. Van Heurck Synopsis pl. 42, f. 9.

Very rare: Svolvær r.

Distribution: Coasts of Scotland and Ireland.

c. ***Toxarium*** (Bail.) V. H.

S. undulata (Bail.) W. Sm.

W. Sm. Brit. Diat. II, p. 97. Van Heurck Synops. p. 151, pl. 42, f. 2. *Toxarium undulatum* Bail. Notes on new sp. and loc. of Micr. Org. p. 15, figs. 24—25.

Not unfrequent: Stamsund r, Svolvær +, Ostnesfiord r +, Gaukværo r.

Distribution: Coasts of Europe and North America. Red Sea.

S. Hennedyana Greg.

Greg. Diat. of Clyde p. 532, pl. XIV, f. 108. Van Heurck Synops. pl. 42, f. 3.

Very rare: Stamsund r. 400 μ long.

Distribution: Coasts of Scotland and Belgium. The Mediterranean.

S. (hyperborea var.?) rostellata Grun.

Grun. Diat. Franz Jos. Land p. 54, pl. II, figs. 6 a—b.

A specimen very similar to the figure referred to was found: Gaukværo. 38 μ × 3 μ. Striæ very fine.

Distribution: Franz Josef's Land.

Thalassiothrix ***nitzschioides*** Grun.

Cf. above p. 102.

Derived from the plankton.

Very rare: Stamsund r, Gaukværo r.

Distribution: Cf. above p. 102.

Sceptroneis Ehrb.

S. marina (Greg.) Grun.

Grun. in Van Heurck Synops., pl. 37, f. 2. *Meridion marinum* Greg. Diat. of Clyde p. 497, pl. X, f. 41.

Not unfrequent: Stamsund r +, Raftsund r, Ostnesfiord r, Gaukværo r, Stene r.

Distribution: Coasts of the North Sea. Finmark. Balearic Isles.

S. kamtschatica Grun.?

Grun. in Van Heurck Synops. pl. 37, f. 6.

A species very similar to the figure mentioned occurred in the sample from Stene, r (several specimens). Usually broader than the preceding, somewhat variable in shape, at the broader end sometimes rounded, sometimes only obtuse. Valve distinctly costate with linear pseudoraphe; costæ somewhat radiating, 6—6½ on 10 μ. Length 38—40 μ, breadth 7—8 μ. Also similar to *Opephora pacifica* Grun. in V.H. Synops. pl. 44, f. 22.

Distribution: Kamtschatka. *Opephora pacifica*, perhaps the same species, in the North Pacific.

Rhaphoneis Ehrb.

R. nitida (Greg.) Grun.

Cocconeis n. Greg. Diat. of Clyde. p. 492, pl. IX, f. 26. Grun. Alg. Novara p. 99.

Rare: Stamsund r +.

Distribution: Coasts of the North Sea. The Mediterranean. Auckland.

8. *Plagiogrammeæ.*

Plagiogramma ***staurophorum*** (Greg.) Heib.

Heib. Consp. Diat. Dan. p. 55. *P. Gregorianum* Grev., Van Heurck Synops. p. 145, pl. 36, f. 2. *Denticula staurophora* Greg. Diat. of Clyde p. 496, pl. X, f. 37.

Frequent: Stamsund r, Svolvær r, Raftsund r, Ostnesfiord r, Gaukværo +, Stene +.

Distribution: Coasts of the North Sea and Western Europe. Finmark; Greenland. South America. Ceylon.

Dimeregramma Ralfs.

D. minus (Greg.) Ralfs.

Ralfs in Pritch. Inf. p. 790. Van Heurck Synops. pl. 36, f. 10, 11 a. *Denticula m.* Greg. Diat. of Clyde p. 496, pl. X, f. 35.

Somewhat rare: Stamsund r, Svolvær r, Gaukværo r, Stene r +.

var. nana (Greg.) V.H.

Van Heurck Traité p. 336, pl. 10, f. 393. *Denticula nana* Greg. l. c. f. 34.

Rare: Gaukværo r. Seems to be only a smaller form of the preceding species.

Distribution: Coasts of Western Europe. The Mediterranean.

D. fulvum (Greg.) Ralfs.

Ralfs l. c. *Denticula fulva* Greg. Diat. of Clyde, p. 496, pl. X, f. 38. Van Heurck Synops. pl. 36, f. 28.

Somewhat rare: Stamsund +, Gaukværo +, Stene r.

Distribution: Coasts of Western Europe. Sweden. The Mediterranean.

Glyphodesmis Grev.

G. Williamsonii (Greg.) Grun.

Cf. above p. 102.

Rather frequent: Moskenstrommen r, Stamsund + c, Gaukværo r, Stene r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean.

G. distans (Greg.) Grun.
Grun. in Van Heurck Synops. pl. 36, figs. 15—16. *Denticula d.* Greg. Diat. of Clyde p. 495, pl. X. f. 36.

Very rare: Stene r; Stamsund r.
Distribution: Coasts of Western Europe. Sweden. The Mediterranean.

9. *Eunotieæ.*

Eunotia Ehrb.

Fresh water species.

E. arcus Ehrb.
Van Heurck Synops. p. 141, pl. 34, f. 2.

Very rare: Stene r.
Distribution: Common fresh water species.

E. major (W. Sm.) Rabenh.
Van Heurck Synops. p. 142 pl. 34, f. 14.

Very rare: Ostnesfiord r.
Distribution: Fresh water species from Western Europe.

E. pectinalis (Dillw.?) Rabenh.
Van Heurck Synops. p. 142, pl. 33, figs. 15—16.

Very rare: Svolvær r, Gaukværo r.
Distribution: Common fresh water species.

E. prærupta Ehrb.
Van Heurck Synops. p. 143 pl. 34, f. 19.

Very rare: Ostnesfiord r, Stene r.
Distribution: Northern Europe. America.

E. bidentula W. Sm.
W. Sm. Brit. Diat. II, p. 83.

Very rare: Gaukværo r r; Stamsund r r.
Distribution: Great Britain and Ireland.

E. triodon Ehrb.
W. Sm. Brit. Diat. I. p. 16, pl. 2, f. 18. Van Heurck Synops. pl. 33, f. 9.

Very rare: Gaukværo r; Stene r.
Distribution: Northern Europe. Switzerland. Cayenne.

Ceratoneis *arcus* (Ehrb.) Kutz.
Van Heurck Traité d. Diat., p. 305, f. 69.

Fresh water species.
Very rare: Gaukværo, r.
Distribution: Common fresh water species, especially in alpine localities.

10. *Meridioneæ.*

Meridion *circulare* (Grev.) Ag.
Van Heurck Synops. p. 161, pl. 51, figs. 10—12.

Fresh water species.
Very rare: Svolvær. Only two cells of a chain.
Distribution: Common fresh water species in temperate regions.

11. *Tabellarieæ.*

Tabellaria *flocculosa* (Roth) Kutz.
Van Heurck Synops. p. 162, pl. 52, figs. 10—12.

Fresh water species.
Rare: Svolvær r, Gaukværo r, Stene r.
Distribution: Common fresh water species.

Striatella *unipunctata* (Lyngb.) Ag.

Cf. above p. 103.
Very rare: Gaukværø r.
Distribution: Frequent on the coasts of Europe. Finmark. The Red Sea. Cape Horn.

Rhabdonema Kutz.

R. minutum Kutz.
Kütz. Bacill. p. 126, pl. 21, f. 11, 4. Van Heurck Synops. p. 166, pl. 54, figs. 17—21.

Frequent: Stamsund r, Svolvær c, Raftsund r, Gaukværo r, Stene +.
Distribution: Frequent on the coasts of Europe, especially on the western and northern ones. Arctic regions. Cape of Good Hope.

R. arcuatum (Lyngb.) Kutz.
Kutz. l. c. p. 126, pl. 18, f. VI. Van Heurck Synops. p. 166, pl. 54, figs. 14—16. *Diatoma a.* Lyngb. Hydroph. p. 180, pl. 62.

Frequent: Svolvær + c, Raftsund r, Gaukværo r, Stene r +.
Distribution: Frequent on the coasts of Europe and North America. Arctic regions.

R. adriaticum Kutz.
Kutz. Bacill. p. 126, pl. 18, f. 7. Van Heurck Synops. p. 166, pl. 54, figs. 11—13. *Tessella catena* Ehrb. Mikrogeol. pl. 22, f. 65.

Rare: Svolvær r, Raftsund r r, Stene r r.
Distribution: Frequent on the coasts of Europe and America. Finmark (r r Cleve who remarks (Vegaexped. p. 484) that this species else is wanting in the arctic regions). Africa. Pacific Ocean.

Grammatophora Ehrb.

G. islandica Ehrb.
Van Heurck Synops. pl. 53, f. 7.

Not unfrequent: Stamsund r, Svolvær r, Raftsund r, Brettesnes—Skroven r, Stene r +.
Distribution: Northern and western coasts of Europe. North Pacific. Cape Horn.

G. serpentina Ralfs.
Ralfs in Ann. and Mag. XI, pl. IX f. 5. Van Heurck Synops. pl. 53, figs. 1—3.

Frequent: Moskenstrommen r +, Stamsund r, Svolvær r, Raftsund r +, Brettesnes—Skroven r, Gaukværo r, Stene r.
Distribution: Frequent on the coasts of Europe. Ceylon. Cape Horn. Antarctic regions.

G. marina (Lyngb.) Kütz.

Kütz. Bacill. p. 128, pl. 17, f. XXIV, 1—6. Van Heurck Synops. p. 163, pl. 53, figs. 10—11. *Diatoma m.* Lyngb. Hydroph. p. 180, pl. 62 A.

Rare: Stamsund r.

Distribution: Frequent on the coasts of Europe. Africa. America. Ceylon.

G. oceanica Ehrb.

Ehrb. Mikrogeol. pl. 19, f. 36 a, pl. 18, f. 87 a.

Perhaps ought to be united with the preceding species.

Frequent: Stamsund r+, Svolvær +c. Ostnesfiord r+, Gaukværo r. Stene r.

var. macilenta (W. Sm.) Grun.

Grun. in Wien Verh. 1862. Van Heurck pl. 53, 2, f. 16. *G. macilenta* W. Sm. Brit. Diat. II, p. 43, pl. 61, f. 382.

Svolvær +, Stene r.

Distribution: Frequent on the coasts of Europe. Greenland. Cape Horn. Indian Ocean.

G. arctica Cl.

Cl. Diat. Spitsb. 1867, p. 661, pl. 23, f. 1. Van Heurck Synops. pl. 53, 2, f. 3. *G. africana* Ehrb. Mikrogeol. pl. 35 A, XX, figs. 1—2. (non l. c. pl. 18, f. 86 a, b).

Very rare: Stene rr.

Distribution: Arctic regions.

12. Nitzschieæ.

Bacillaria socialis Greg.

Cf. above p. 103.

Not unfrequent: Stamsund +. The Ostnes Fiord r. Gaukværo r.

Distribution: Coast of Western and Northern Europe. Arctic regions. West Indies.

Nitzschia Hass.

a. **Panduriformis** Grun.

N. panduriformis Greg.

Greg. Diat. of Clyde p. 529, pl. XIV, f. 102. Van Heurck Synops. p. 172, pl. 58, figs. 1—3.

Rare: Svolvær r. Stene r.

Distribution: Western coasts of Europe. Baltic. Adriatic Sea. Finmark. Spitsbergen. Indian Ocean. The Red Sea. Cape Horn.

N. constricta (Greg.) Grun.

Grun. in Cl. et Grun. Arct. Diat. 1880, p. 71. *Tryblionella c.* Greg. Micr. Journ. III, p. 40, pl. 1, f. 13.

Rare: Stamsund r. Svolvær r, Gaukværo r.

Distribution: Western Europe. The Mediterranean. Cape of Good Hope. Cape Horn. Ceylon.

b. **Tryblionella** (W. Sm.) Grun.

N. navicularis (Bréb.) Grun.

Grun. in Cl. and Grun. Arct. Diat. p. 67. Van Heurck Synops. p. 171, pl. 57, f. 1. *Surirella navicularis* Bréb. in Kütz. Spec. Alg. p. 36.

Very rare: Stene r.

Distribution: Coasts of the North Sea and Western Europe. Spitsbergen (uncertain, Cl.)

N. punctata (W. Sm.) Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 69. Van Heurck Synops. p. 171, pl. 57, f. 2. *Tryblionella p.* W. Sm. Brit. Diat. 1, p. 36, pl. X, f. 76 a.

Rare: Stamsund r. Svolvær r. Stene r.

Distribution: Coasts of the North Sea and of Western Europe. The Baltic. The Mediterranean.

N. coarctata Grun.

Grun. l. c. p. 68. Van Heurck Synops. pl. 57, f. 4.

Several specimens which seem to belong here were found: Gaukværo r.

Distribution: The Mediterranean: Japan: Cape Horn.

N. (Tryblionella var.?) litoralis Grun.

Grun. in Cl. and Grun. Arct. Diat. p. 75. Van Heurck Synops. p. 172, pl. 59 figs. 1—3.

Very rare: Stamsund r.

Distribution: Frequent in fresh and brackish water.

c. **Apiculatæ** Grun.

N. apiculata (Greg.) Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 73. *Tryblionella a.* Greg. Micr. Journ. V, p. 79, pl. 1, f. 43.

Very rare: Svolvær. r.

Distribution: Coasts of the North Sea and Western Europe. Finmark. Greenland.

N. acuminata (W. Sm.) Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 73. Van Heurck Synops., p. 173, pl. 58, figs. 16—17. *Tryblionella a.* W. Sm. Brit. Diat. 1, p. 36, pl. 10, f. 77.

Rare: Svolvær r, Stene r.

Distribution: Coasts of England. The Mediterranean.

N. marginulata Grun.

Grun. l. c p.72.

var.? didyma Grun. l. c.

Van Heurck Synops. pl. 58, figs. 14—15.

Rare: Stamsund r, Svolvær r.

Distribution: Frequent on the coasts of Europe. Arctic regions. Indian Ocean. Pacific Ocean.

N. hungarica Grun.

Grun. in Wien Verh. 1862, p. 568, pl. 22, f. 13. Van Heurck Synops. p. 173, pl. 53, f. 19.

Species from brackish water.

Very rare: Svolvær. r.

Distribution: Frequent in fresh and brackish water.

d. ***Dubiæ*** Grun.

N. littorea Grun. (?)
Van Heurck Synops. pl. 59, f. 21. *N. thermalis v. littoralis* Grun. in Cl. et Grun. Arct. Diat. p. 78.

Very rare: Stamsund r. 113 μ long; 7 keel puncta on 10 μ. Similar to *N. hybrida*, but is longer and narrower, with more distant keel puncta and more excentric keel. Also Stene, r r.

Distribution: Newcastle. Lysekil (Sweden).

e. ***Bilobatæ*** Grun.

N. bilobata W. Sm.
W. Sm. Brit. Diat. I. p. 42, pl. 15, f. 113. Van Heurck Synops. p. 175, pl. 69, f. 1.

Very rare: Ostnesfiord, r.

Distribution: Frequent on the coasts of Europe (the most northern ones excepted). Pacific Ocean.

N. hybrida Grun.

Cf. above p. 103.

Perhaps derived from the plankton.

Very rare: Stamsund r.

Distribution: Cf. above p. 103.

N. Mitchelliana Greenl.

Cf. above p. 104.

Very rare: Ostnesfiord r, Stene r.

Distribution: North America. Arctic regions.

f. ***Insignes*** Grun.

N. insignis Greg.
Greg. Micr. Journ. V, p. 80, pl. 1, f. 46.

Not unfrequent: Stamsund r, Ostnesfiord r, Gaukværo r, Stene r.

Distribution: Coasts of Western and Northern Europe. Arctic regions. Adriatic Sea. Red Sea.

var. notabilis Grun.
Grun. in Cl. et Grun. Arct. Diat. p. 84. Van Heurck Synops. pl. 51, f. 5.

Very rare: Gaukværo r. 476 μ long; 9—10 striæ on 10 μ.

Distribution: The Mediterranean.

var. spathulifera Grun.
Van Heurck Synops. pl. 61, f. 3.

Very rare: Stamsund r.

Distribution: The Mediterranean. West Indies.

N. Smithii Ralfs.
Ralfs in Pritch. Inf. p. 781. Van Heurck Synops. pl. 61, f. 4.

Not unfrequent: Stamsund +, Stene r.

Distribution: Coasts of Western Europe. Adriatic Sea. Finmark (*var. marginifera* Grun.).

g. ***Spathulatæ*** Grun.

N. angularis W. Sm.
W. Sm. Brit. Diat. I. p. 40, pl. 13, f. 117. Van Heurck Synops. p. 177, pl. 62, figs. 11—14.

Rather frequent: Stamsund r, Svolvær +, Ostnesfiord r, Gaukværo +.

Distribution: Frequent on the western and northern coasts of Europe. The Mediterranean. Arctic regions. Ceylon. Cape Horn.

N. spathulata Bréb.
Bréb. in W. Sm. Brit. Diat. I. p. 40, p. 31, f. 268. Van Heurck Synops. p. 177, pl. 62, figs. 7—8.

Somewhat rare: Stamsund r, Ostnesfiord, Gaukværo r.

Distribution: Frequent on the western and northern coasts of Europe. The Mediterranean. Arctic regions.

N. distans Greg.
Greg. Diat. of Clyde, p. 530, pl. XIV, f. 103. Van Heurck Synops. pl. 62, f. 10.

Rare: Stamsund r (several specimens); Ostnesfiord r.

Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Australia. Baffin's Bay and Davis' Strait. Cape Wankarema (Cl., varieties).

h. ***Sigmata*** Grun.

N. sigma (Kütz.) W. Sm.
W. Sm. Brit. Diat. I. p. 39, pl. 13, f. 108. *Synedra s.* Kütz. Bacill. p. 67, pl. 30, f. 114.

Frequent: Stamsund +, Svolvær +, Ostnesfiord +, Gaukværo r +, Stene r.

Distribution: Cosmopolitan.

i. ***Lanceolatæ*** Grun.

N. lanceolata W. Sm.
W. Sm. Brit. Diat. I. p. 40, pl. XIV, f. 118. Van Heurck Synops. p. 182, pl. 68, figs. 1—4.

I have two times seen the wavy longitudinal lines, described and illustrated by W. Smith. They were more distinct than the transverse striæ.

Very rare: Stamsund r, Gaukværo r, Stene r.

Distribution: Frequent on the coasts of Europe, the most northern ones only excepted. Indian Ocean.

k. ***Nitzchiella*** (Rabenh.) Grun.

N. longissima (Bréb.) Ralfs.

Cf. above p. 104.

Very rare: Gaukværo r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. West Indies. Indian Ocean.

13. *Surirelleæ.*

Campylodiscus Ehrb.

C. decorus Bréb.

C. decorus Bréb. Diat. Cherb. p. 13, f. 2. Van Heurck Synops. pl. 75, f. 3.

Not unfrequent: Moskenstrømmen r, Stamsund r, Østnesfiord r, Gaukværø r.

Distribution (including the nearly related *C. Ralfsii* W. Sm.): Frequent on the coasts of Europe. Greenland. Java. Pacific Ocean.

C. Ralfsii W. Sm.

W. Sm. Brit. Diat. 1. p. 30, pl. 30, f. 257. A. Schm. Atlas pl. 14, figs. 2—3.

Differs from the preceding species in having a linear (not lanceolate) pseudoraphe. Smaller in size.

Very rare: Stene r, Stamsund r.

C. angularis Greg.

Greg. Diat. of Clyde p. 502, pl. XI, f. 53. A. Schmidt Atlas pl. 18, f. 7.

Frequent: Raftsund r, Brettesnes—Skroven r, Østnesfiord c, Stene r.

Distribution: Scotland. The Skagerak. Arctic regions.

C. Thuretii Bréb.

Bréb. Diat. Cherb. pl. 1, f. 3. Van Heurck Synops. p. 190, pl. 77, f. 1.

Frequent: Moskenstrømmen r, Stamsund +, Svolvær r +, Raftsund r, Brettesnes—Skroven r, Østnesfiord + c, Gaukværø + c, Stene r +.

Distribution: Frequent on the coasts of Europe. Arctic regions. Indian Ocean.

C. parvulus W. Sm.

W. Sm. in Brit. Diat. 1, p. 30, pl. 6, f. 56. Van Heurck Synops. p. 191, pl. 77, f. 2.

Is by some authors considered to be a form of *C. Thuretii* Bréb. (cf. De Toni Syll. p. 622) by others to belong to *C. decorus* Bréb. (cf. Van Heurck Traité p. 376).

Very rare: Stene r.

Distribution: England. Belgium.

C. eximius Greg.

Greg. Diat. of Clyde p. 503, pl. XI, f. 51.

Very rare: Stene r r. Only a broken valve.

Distribution: Coasts of Western Europe. The Mediterranean. Red Sea. Indian Ocean.

Surirella Turp.

S. gemma Ehrb.

Ehrb. Abh. Berl. Akad. 1840, p. 76, pl. IV, f. 5. Van Heurck Synops. p. 187, pl. 74, figs. 1—3.

Very rare: Gaukværø r r.

Distribution: Frequent on the coasts of Europe. Spitsbergen.

S. ovalis Bréb.

Kütz. Bacill. p. 61, pl. 30, f. 64. Van Heurck Synops. p. 188, pl. 73, f. 3.

In fresh and brackish water.

Very rare: Gaukværø r.

var. ovata (Kütz.) V. H.

VH. Synops. p. 188, pl. 73, figs. 6—7. *Surirella ovata* Kütz. l. c. p. 62, pl. 7, figs. 1—4.

Very rare: Gaukværø r.

Distribution: Common species.

S. fastuosa Ehrb.

Ehrb. Abh. Berl. Ak. 1841, p. 19. Van Heurck Synops. p. 188, pl. 73, f. 18.

Rather frequent: Svolvær +, Raftsund r, Gaukværø r, Stene r +.

var. lata (W. Sm.) VH

Van Heurck Synops. p. 188, pl. 72, f. 17. *Surirella l.* W. Sm. Brit. Diat. 1, p. 31, pl. 9, f. 61.

Frequent: Moskenstrømmen r +, Stamsund r, Svolvær r, Raftsund r, Brettesnes—Skroven r, Østnesfiord r, Gaukværø r, Stene r.

Distribution: Frequent on the coasts of Europe. Gulf of Mexico.

14. *Achnantheæ* Cl.

Achnanthes Bory.

A. longipes Ag.

Ag. Syst. p. 1. Van Heurck Synops. p. 129, pl. 26, figs. 13—16.

Very rare: Svolvær r.

Distribution: Frequent (on algæ) on the coasts of Europe. The Canary Isles.

A. brevipes Ag.

Ag. l. c. Van Heurck Synops. p. 129, pl. 26, figs. 10—12.

Rare: Stamsund r, Stene r, Østnesfiord r.

Distribution: Frequent on the coasts of Europe.

Eucocconeis Cl.

Valves ecostate, without marginal loculiferous rim. Both valves with narrow axial area, rather similar in structure.

E. pseudomarginata (Greg.) Cl.

Cl. Synops. Navic. Diat. II, p. 178. *Cocconeis p.* Greg. Diat. of Clyde p. 497, pl. IX, f. 27. *C. major* Greg. l. c. f. 28.

Rare: Stamsund r, Raftsund r, Østnesfiord r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Red Sea. Indian Ocean. Galapagos Islands. Honduras.

Heteroneis Cl. (includ. *Disconeis* Cl. l. c. p. 180 and *Actinoneis* Cl. l. c. p. 185).

Valves very dissimilar, without marginal loculiferous rim. Upper valve costate, sometimes only striate, then with broad axial area.

H. Allmanniana (Greg.).

Pinnularia A. Greg. Diat. of Clyde p. 488, pl. IX, f. 21. *Cocconeis quarnerensis* A. Schm. Nords. Diat. pl. III, f. 16; Atlas pl. 192, figs. 20—24. *Rhaphoneis q.* Grun. Wien Verh. 1862, p. 381, pl. 7, f. 21. *Navicula ovulum* A. Schm. Nords. Diat. pl. II, f. 12. *Heteroneis q.* Cl. l. c. p. 184.

„Costæ apparently marginal, strong, about 20 in 0,001", giving the appearance of a narrow marginal band of very strong costæ. Within this band, however, the valve, on close inspection, is found to be marked with similar but much fainter costæ nearly to the median line. The valve appears to be thicker near the margin than in the middle, and this perhaps is the reason why the costæ are so strong and conspicuous there." Greg. l. c.

It seems to me that there can scarcely be any doubt that *Pinnularia Allmanniana* Greg. is synonymous to *Cocconeis quarnerensis* Grun. Size, shape and structure agree very well in both species.

There seems to be a marginal rim which has, however, only faint traces of loculi.

Rare: Stamsund r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean.

H. norvegica (Grun.?)

Cocconeis norvegica Grun., Cl. Moll. Diat. no. 102 (upper valve, teste Cl.) A. Schm. Nords. Diat. pl. III, f. 18, 1 (upper figure, „*Cocconeis sp.*", upper valve).

Upper valve as illustrated l. c. by A. Schmidt. Instead of the median line (pseudoraphe), there is often a linear blank space, which sometimes (but rarely) is somewhat irregularly widened. The lower valve has a very delicate structure, consisting of close, somewhat radiating striæ, in the median part of the valve coarser and more conspicuous, about 15 on 10 μ, otherwise very faint, about 20 on 10 μ. Raphe strait, extending to the margin; the inner ends somewhat thickened, separated from each other. A rather broad hyaline border, but no loculiferous rim.

Cl. Synops. Navic. Diat. II, p. 180 mentions that he has found a frustule of *Cocconeis lyra* with an upper valve like that illustrated by A. Schm. l. c. (pl. III, f. 18, 1, upper figure). I have, however, found a frustule, showing this upper valve, in connection with a lower valve of the structure just described. There must therefore here be some mistake, if there are not two different species, with very similar upper valves.

There is a marginal rim, like a somewhat broad hyaline border, with only faint traces of loculi.

Rare: Stamsund r+ (many specimens); Stene r.

Distribution: West coast of Norway (Solsvik near Bergen).

Cocconeis Ehrb., Cl.

Valves ecostate, with a marginal loculiferous rim, dissimilar in structure.

C. scutellum Ehrb.

Ehrb. Infus. p. 194, pl. 14, f. 8. Van Heurck Synops. p. 132, pl. 29, figs. 1—3

According to Cleve exceedingly variable. It seems, however, that he has gone too far when referring so many different forms to this species, as he has done (l. c. pp. 170—171).

Not unfrequent, in different forms which only badly answer to the varieties described: Stamsund r, Svolvær +, Ostnesfiord r, Stene r.

Distribution: Cosmopolitan.

C. distans Greg., A. Schm.

Greg. Diat. of Clyde, p. 490, pl. IX, f. 23 (1857, non Micr. Journ. III, p. 39, pl. IV, f. 9, 1855 which Greg. l. c. p. 491 himself declares to be a var. of *C. scutellum* illustrated as *C. distans* by mistake). A. Schm. Nords. Diat. pl. III, figs. 22—23 (*forma minima* Perag.).

Small specimens, very well answering to the figures in A. Schm. l. c. (f. 23 entire frustule) occurred. They had no loculiferous rim, only a hyaline border. Lower valve with very faint and indistinct striæ.

There is, however, such a remarkable agreement with a form of *C. scutellum*, most probably the one, mentioned above, which at first was figured by Gregory as *C. distans*, that I do not feel quite sure if not these two forms after all belong together. The only difference seems to be the larger marginal areoles which are wanting in the true *C. distans*.

The variety of *C. scutellum* just mentioned differs remarkably from the common forms. There is a narrow marginal rim, but no loculi. Lower valve with straight raphe, stretching to the margin. Median pores somewhat separated from each other. Axial area indistinct except towards the central nodule, where it suddenly dilates into a small, round, central one. Striæ finely radiating, much curved towards the ends of the valve, most conspicuous near the margin, distinctly punctate, about 14 on 10 μ. A narrow striate border with striæ somewhat closer and less conspicuous than the marginal striæ of the valve, 15—16 one 10 μ. 38 μ × 29 μ.

Smaller specimens seem to pass insensibly into such forms, which A. Schm. has figured l. c.

Very rare: Stamsund r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Central and Arctic America. Sea of Kara.

C. lyra A. Schm.

A. Schm. Nords. Diat. pl. III, f. 19 (right figure lower valve, left figure upper valve).

As mentioned above I think there must be some mistake, when Cl. mentions having seen a frustule of this species with the upper valve of the species above named *Heteroneis norvegica*. Though I have seen no entire frustule of *C. lyra*, I should think that A. Schm.'s illustrations to which I have referred, belong together, which also answers very well to the dimensions. I have repeatedly found this upper valve in connection with a loculiferous rim with 6 loculi on 10 μ. The species consequently is no *Disconeis* Cl., but belongs to *Cocconeis* or *Pleuroneis*.

The remarkable lower valve occurred sparsely in my material, but corresponded in size and shape precisely to the supposed upper valve. Its structure is puzzlingly similar to that of small forms of *Navicula lyra var. atlantica*. On one side of the valve between the furrows and the margin, there is, however, an indistinct blank line or furrow, parallel to the main furrows, which is absent in the *Navicula* mentioned.

Upper valve with transverse and longitudinal costæ, the latter a little closer than the former. Between the costæ there is, therefore, a single row of conspicuous areolæ.

Rare: Stamsund r (both valves); Stene r (upper valve only).

Distribution: West coast of Norway.

Pleuroneis Cl. l. c. p. 181.

Marginal loculiferous rim. Upper valve costate. Between the costæ double rows of small pearls.

P. costata (Greg.) Cl. l. c.

Cocconeis c. Greg. in Q. M. J. III. 1855, p. 39, pl. 4, f. 10. Van Heurck Synops. pl. 30, figs. 11—12.

Has a broad and well developed loculiferous rim.

Rare: Stamsund r, Ostnesfiord r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Canada. Auckland.

P. pinnata (Greg.)

Cocconeis p. Greg. Micr. Journ. VII, p. 79, pl. 6, f. 1. Van Heurck Synops. pl. 30, figs. 6—7.

Lower valve: The raphe fine, straight, stretching to the ends of the valve, in the middle with clavate ends, somewhat separated from each other. Axial area not visible, central one very small, roundish. Striæ very faint, not distinctly seen on my specimens.

There is a marginal rim with rudimentary loculi which are less than half developed, but very well visible, 4 on 10 μ. A distinct hyaline border. This species seems on the whole to be closely related to *Pleuroneis costata* though undoubtedly a separate species.

P. britannica (Næg.) Cl.

Cl. l. c. p. 181. *Cocconeis b.* Kütz. Sp. Alg. p. 890. Van Heurck Synops. pl. 30, figs. 1—2.

Very rare: Stamsund r r.

Distribution: England. The Mediterranean. The Barbadoes.

Rhoicosphenia Grun.

R. curvata (Kütz.) Grun.

Grun. Alg. Novara p. 8. *Gomphonema c.* Kütz 1833. *Gomphonema minutissima* Ehrb. Mikrogeologie pl. 35 A, XII, f. 5, non *G. minutissima* Grev. (earlier name, = *G. exiguum* Kütz.).

In fresh or brackish water. A coarser form (var. *marina* Van Heurck Synops. pl. 26, f. 4) marine.

Very rare: Svolvær r, Ostnesfiord r.

Distribution: Cosmopolitan in fresh and brackish water.

15. *Gomphonemeæ.*

Gomphonema Ag.

G. constrictum Ehrb.

Ehrb. Abh. Berl. Ak. 1830. Van Heurck Synops. p. 123, pl. 23, f. 6.

Very rare: Svolvær r.

Distribution: Common fresh water species.

G. exiguum Kütz.

Kütz. Bacill. p. 84, pl. 30, f. 58.

var. pachyclada (Breb.) VH. Synops. pl. 25, figs. 31—32.

Gomphonema p. Breb. Consid. p. 21.

Very rare: Stene r r.

Distribution: West coast of France. Arctic regions.

G. kamtschaticum Grun.

Grun. Casp. Sea Alg. p. 12. Van Heurck Synops. 25, f. 29.

Very rare: Svolvær, r r. Valve 45 × 8 μ, narrow, clavate, with rounded broader end. Axial area narrow, dilated to an oblong central area. Striæ little radiating, coarser outside the central area, about 15 on 10 μ, in the middle only 11.

Distribution: (Marine). Arctic America and Asia. Iceland.

16. *Naviculeæ.*

Auricula ***complexa*** (Greg.) De T.

De Toni Syll. p. 347. *Amphipora complexa* Greg. Diat. of Clyde p. 508, pl. XII, f. 62, Van Heurck Traité d. Diat. p. 267, pl. 29, f. 807.

Probably derived from the plankton.

Very rare: Ostnesfiord r.

Distribution: Cf. above p. 108.

Tropidoneis Cl.

T. maxima (Greg.) Cl.

Cl. Synops. Navic. Diat. I, p. 26. *Amphiprora m.* Greg. Diat. of Clyde p. 507 pl. XII, f. 61. Van Heurck Synops. p. 120, pl. 22, figs. 4—5.

Somewhat rare: Stamsund r, Svolvær r, the Ostnesfiord r, Stene r +, Gaukværo r.

Distribution: Coasts of the North Sea and Ireland. The Mediterranean. Finmark (var. *dubia* Cl. et Grun.). Indian Ocean.

T. lepidoptera (Greg.) Cl.

Cl. l. c. p. 25. *Amphiprora l.* Greg. Diat. of Clyde p. 505, pl. XII, f. 59 a, b (non c). Van Heurck Synops. p. 120, pl. 22, figs. 2—3.

Not unfrequent: Stamsund +, Svolvær r, the Ostnesfiord r, Stene r +, Gaukværo r.

Distribution: Coasts of the North Sea and Western Europe. Finmark. The Mediterranean. West Indies. Indian Ocean. Pacific Ocean.

Donkinia Ralfs.

D. recta (Donk.) Grun.

Grun. in Van Heurck Synops. p. 119, pl. 17, f. 9. *Pleurosigma r.* Donk. Micr. Journ. VI, p. 23, pl. 3, f. 6. *Gyrosigma r.* Cl. Synops. Navic. Diat. I, p. 119.

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Florida. Pacific Ocean. Indian Ocean.

D. carinata (Donk.) Ralfs.

Ralfs in Pritch. Inf. p. 921. Van Heurck Traité d. Diat. p. 248, pl. 35, f. 912. *Pleurosigma c.* Donk. Micr. Journ. VI, p. 23, pl. 3, f. 5; Cl. l. c. p. 44.

Rare: The Ostnesfiord r, Stene r, Gaukværo r.

Distribution: Coasts of the North Sea and Ireland. Sea of Kara. Davis' Strait. Balearic Islands.

Pleurosigma W. Sm.

a. ***Eupleurosigma.*** Striæ in three directions (transverse and oblique).

P. nubecula W. Sm.
W. Sm. Brit. Diat. I. p. 64. pl. 21. f. 201.

var. subrecta Cl.
Cl. Synops. Navic. Diat. I. p. 35. *Pleurosigma s.* Cl. in Cl. et Grun. Arct. Diat. p. 53. pl. 3. f. 72.

Very rare: Stamsund. r. 254 μ × 24 μ; oblique striæ 18 on 10 μ, angle more than 60°, transverse striæ indistinct. Raphe central, almost straight. Somewhat broader in the middle, with obtuse ends.

Distribution (of the variety): Finmark. Greenland. Sea of Kara. Balearic Islands.

P. elongatum W. Sm.
W. Sm. Brit. Diat. I. pl. 20. f. 199. Peragallo Monogr. Pleuros. pl. II. figs. 20—21.

Very rare: The Ostnesfiord r.

Distribution: Coasts of the North Sea and Ireland. Baltic. Arctic regions. The Mediterranean. Caspian Sea. North America, east coast. Pacific Ocean. Indian Ocean.

P. rigidum W. Sm.
W. Sm. Brit. Diat. I. p. 64. pl. 20. f. 198. Peragallo l. c. pl. VI. figs. 4—6.

Very rare: Stamsund r. Gaukvaero r.

Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. West Indies. Straits of Magellan.

P. Normanni Ralfs.
Ralfs in Pritch. Inf. p. 919. *P. affine* Grun. in Cl. et Grun. Arct. Diat. p. 51. Van Heurck Synops. pl. 18. f. 9.

Frequent: Stamsund r. Svolvær c. the Ostnesfiord + c. Stene c. Gaukværo +.

Distribution: Coasts of the North Sea. The Mediterranean. Spitsbergen. Davis' Strait. East coast of North America. Pacific Ocean. The Red Sea.

P. strigosum W. Sm.
W. Sm. Brit. Diat. I. p. 64. pl. 21. f. 203; pl. 23. f. 203. Perag. l. c. pl. V. figs. 1—2.

Very rare: Stamsund r. Svolvær r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Africa. America.

P. formosum W. Sm.
W. Sm. Brit. Diat. I. p. 63. pl. 20. f. 195. Van Heurck Synops. p. 116. pl. 19. f. 4.

Rare: Stamsund r. Stene r. Gaukvaero r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. The Red Sea. Indian Ocean. Pacific Ocean. West Indies.

P. speciosum W. Sm.
W. Sm. Brit. Diat. I. p. 63. pl. 20. f. 197. Perag. l. c. pl. II. figs. 13—16.

Very rare: Stene. r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean. West Indies.

b. ***Gyrosigma*** (Hass.).

P. attenuatum (Kutz.) W. Sm.
W. Sm. Brit. Diat. I. p. 68. pl. 22. f. 216.

var. scalprum Gaill. et Turp.
Gaill. et Turp. Mem. du Mus. XV. pl. X. XI. f. 3. *P. acuminatum* W. Sm. Brit. Diat. I. p. 66. pl. 21. f. 209.

Very rare: The Ostnesfiord. r.

Distribution (of the variety): North Sea, brackish and marine.

P. balticum (Ehrb.) W. Sm.
W. Sm. Brit. Diat. I. p. 66. pl. 22. f. 207. *Navicula b.* Ehrb. Abh. Berl. Ak. 1830. p. 114.

Very rare: Stamsund r. Svolvær r r.

Distribution: Cosmopolitan in warm and temperate regions.

Rhoicosigma Grun., Per.

R. arcticum Cl.
Cl. Diat. Arct. Sea p. 18. pl. III. f. 16. Peragallo Mon. Pleur. pl. X. figs. 16—17. *Gyrosigma a.* Cl. Synops. Navic. Diat. I. p. 119.

Frequent: Stamsund r. the Ostnesfiord + c. Gaukvaero c.

Distribution. Scotland. West coast of Norway, frequent. Arctic regions.

Scoliotropis Cl.

S. latestriata (Breb.) Cl.
Cl. Synops. Navic. Diat. I. p. 72. *Amphiprora l.* Breb. in Kutz. Sp. Alg. p. 93. *Scoliopleura l.* Grun. in Van Heurck Synops. pl. 17. f. 12.

Very rare: Stamsund r. Stene r.

Distribution: Coasts of the North Sea and Western Europe. Caspian Sea. East coast of North America. West Indies. California.

Scoliopleura *tumida* (Breb.) Rabenh.

Rabenh. Fl. Eur. Alg. p. 229. Van Heurck Synops. p. 112. pl. 17. figs. 11. 13. *Navicula t.* Breb. in Kutz. Sp. Alg. p. 77; Cl. l. c. p. 155.

Very rare: Gaukvaero. r.

Distribution: Coasts of the North Sea and Western Europe. Franz Josef's Land. Black Sea. Ceylon. Sidney.

Pseudoamphiprora Cl.

Cl. Synops. of Navic. Diat. I. p. 71.

According to Cleve the following species has 2 chromatophores peculiar in shape and position.

P. stauroptera (Bail.) Cl.
Cl. l. c. *Amphora stauroptera* Bail. Smiths. Contrib. VII. p. 8. figs. 14—15. *Amphiprora obtusa* Greg. Diat. of Clyde p. 506. pl. XII. f. 60 and f. 59 c („*Amphiprora lepidoptera*" Greg., non f. 59 a. b.). A. Schm. Nords. Diat. pl. III. f. 1.

Very rare: Stamsund r. the Ostnesfiord r.

Distribution: North Sea. Finmark. Sea of Kara. Nova Scotia. Sidney. (Cl. l. c.).

Caloneis Cl.

Cl. Synops. Navic. Diat. I. p. 46.

Valve striate; striæ parallel, except at the ends, crossed on each side of the raphe by one or more longitudinal lines. Connecting zone not complex.

C. liber (W. Sm.) Cl.

Cl. l. c. p. 54. *Navicula l.* W. Sm. Brit. Diat. I. p. 48. pl. 16. f. 133.

var. linearis (Grun.) V.H.

V.H. Synops. pl. 12. f. 35. *Navicula l.* Grun. Verh. 1860, p. 546. pl. 3. f. 2.

Frequent: Stamsund +. Svolvær +c. the Ostnesfiord r+, Raftsund r. Stene r+. Gaukværo +.

Distribution: Cosmopolitan.

var. maxima (Greg.)

Navicula m. Greg. Diat. of Clyde p. 487. pl. IX. f. 18. A. Schm. Nords. Diat. pl. II. f. 41.

Frequent: Stamsund + c. Stene r+.

Distribution: Coasts of the North Sea and Western Europe.

var. elongata (Grun.) Cl.

Cl. l. c. p. 55. *Navicula e.* Grun. in A. Schm. Nords. Diat. p. 91, pl. II. f. 42.

Very rare: Stamsund r.

Distribution: Coasts of the North Sea. Indian Ocean. Colon.

C. consimilis (A. Schm.) Cl.

Cl. l. c. p. 57. *Navicula c.* A. Schm. Nords. Diat. p. 91. pl. II. f. 46.

Very rare: Stamsund r.

Distribution: North Sea. Balearic Islands.

C. amphisbæna (Bory.) Cl.

Cl. l. c. p. 58. *Navicula a.* Bory Encycl. méth., t. 2. Van Heurck Synops. p. 102. pl. XI. f. 7.

Very rare: Stene. r.

Distribution: In brackish and fresh water, frequent especially in Northern and Western Europe. Caspian Sea.

C. brevis (Greg.) Cl.

Cl. l. c. p. 61. *Navicula b.* Greg. Diat. of Clyde, p. 478. pl. IX. f. 4. A. Schm. Nords. Diat. pl. II. f. 15.

Very rare: Stamsund r. the Ostnesfiord r. Stene rr.

Distribution: North Sea. Arctic regions.

C. blanda (A. Schm.) Cl.

Cl. l. c. p. 62. *Navicula b.* A. Schm. Nords. Diat. p. 90. pl. II. f. 27.

Very rare: Stamsund rr. the Ostnesfiord r.

Distribution: Coasts of the North Sea. Black Sea. Indian Ocean. Pacific Ocean.

C. musca (Greg.) Cl.

Cl. l. c. p. 65. *Navicula m.* Greg. Diat. of Clyde. p. 479. pl. IX. f. 6. A. Schm. Nords. Diat. p. 86, pl. I. f. 15.

Very rare: Stamsund r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian and Pacific Oceans. West Indies.

Schizonema Ag.

S. Grevillei Ag.

Ag. Consp. p. 18. Van Heurck Synops. p. 110. pl. 16. f. 2.

Rare: Stamsund r. Svolvær r.

Distribution: Coasts of the North Sea and Western Europe, frequent. Arctic regions. West Indies. California. Kerguelen.

S. crucigerum W. Sm.

W. Sm. Brit. Diat. II. p. 74. pl. 56. fig. 354; pl. 57. f. 356. Van Heurck Synops. p. 110. pl. 16. f. 1.

Rare: Svolvær. r.

Distribution: Coasts of the North Sea and Western Europe. The Baltic.

Stauroneis Ehrb.

S. salina W. Sm.

W. Sm. Brit. Diat. I. p. 60. pl. 19. f. 188. Van Heurck Synops. p. 68. pl. X. f. 16.

Rare: Stamsund r. Stene r.

Distribution: Coasts of the North Sea. The Baltic. The Mediterranean. Black Sea.

S. Gregorii Ralfs.

Ralfs in Pritch. Inf. p. 913. Van Heurck Synops. p. 68. pl. A (suppl.). f. 4. *S. amphioxys* Greg. Micr. Journ. IV. p. 48. pl. V. f. 23.

Rare: Stamsund r. Gaukværo r.

Distribution: Coasts of the North Sea. Black Sea. Caspian Sea. East coast of North America. Sea of Kara.

S. phœnicenteron Ehrb.

Ehrb. Am. pl. II. 5. f. 1 etc. Van Heurck Synops. p. 67. pl. IV. f. 21 (*var. genuina* Cl. Synops. Navic. Diat. I. p. 149).

Very rare: Stene. r.

Distribution: Fresh water species, especially frequent in Northern and Western Europe. America. New Zealand.

Navicula Bory.

a. ***Orthostichæ*** Cl. Synops. Navic. Diat. I, p. 107.

Valves with small puncta, arranged in parallel transverse striæ and also forming straight longitudinal ones, crossing the former at right angles.

N. cuspidata Kütz.

Kütz. Bacill. p. 94, pl. III. figs. 24, 37. Van Heurck Synops. p. 100. pl. XII. f. 4.

Very rare: Stamsund r. the Ostnesfiord r.

Distribution: Common fresh water species.

b. ***Punctatæ*** Cl. l. c. II, p. 37.

Coarse puncta, arranged in transverse striæ (radiate at the ends) but not in straight longitudinal rows.

N. humerosa Bréb.

Bréb. in W. Sm. Brit. Diat. II. p. 93. Van Heurck Synops. p. 98. pl. XI. f. 20.

Very rare: Raftsund r.

Distribution: Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean. Black Sea. Caspian Sea. The Red Sea; Indian Ocean. Sidney. Cameroon.

N. monilifera Cl.

Cl. l. c. p. 43. *N. granulata* Bréb. in Donk. Micr. Journ. VI. p. 17. pl. III. f. 19. non *N. granulata* Bail.

Very rare: The Ostnesfiord r.

var. heterosticha Cl.

Cl. l. c. *N. granulata* A. Schm. Atlas. pl. 6. figs. 15—16.

Very rare: Raftsund. r.

Distribution (of the main species): North Sea. Ceylon. Madagascar. The var. only known from Hungary, fossil.

N. latissima Greg.

Greg. Micr. Journ. IV. p. 40. pl. V. figs. 4. 4 . A. Schm. Nords. Diat. pl. I. f. 30.

Frequent: Moskenstrommen r +. Svolvær r. the Ostnesfiord r. Raftsund r. Stene r +.

Distribution: Coasts of the North Sea. Finmark. The Mediterranean. Black Sea. Indian Ocean. Pacific Ocean.

N. punctulata W. Sm.

W. Sm. Brit. Diat. I. p. 52. pl. 16. f. 151. Van Heurck Synops. p. 98. pl. 11. f. 16.

Very rare: Stamsund r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Caspian Sea. America. Indian Ocean.

N. fraudulenta A. Schm.

A. Schm. Atlas pl. 70. f. 60; Nords. Diat. pl. III. f. 18_2 (without name).

Rare: Stamsund r +. Many specimens.

Distribution: North Sea. Sebastopol.

c. **Lineolatæ** Cl. l. c. II. p. 10.

Radiate or parallel striæ, transversely lineate.

N. radiosa Kütz.

Kütz. Bacill. p. 91. pl. IV. f. 23. Van Heurck Synops. p. 83. pl. 7. f. 20. Incl. *Pinnularia acuta* W. Sm. Brit. Diat. I. p. 56. pl. XVIII. f. 173.

Rare: Stene. r.

Distribution: Frequent fresh water species, especially in Northern and Western Europe. Asia, Africa, America.

N. peregrina Ehrb.

Ehrb. Am. p. 133. pl. I_4. figs. 5—6. A. Schm. Atlas pl. 47. figs. 57—60.

Very rare: Gaukværo. r.

Distribution: Brackish water. Coasts of the North Sea. Baltic. Adriatic Sea. Arctic regions. America. Pacific Ocean. Indian Ocean.

var. kefwingensis (Ehrb.) Cl.

Cl. l. c. p. 18. *Pinnularia k.* Ehrb. Berl. Ak. 1840. p. 20. *Navicula k.* A. Schm. Atlas pl. 47. figs. 61—62.

Very rare: Svolvaer. 144 μ long.

Distribution: Brackish water: Scotland.

N. digito-radiata (Greg.) A. Schm.

A. Schm. Nords. Diat. p. 92. pl. III. f. 4. *Pinnularia d.* Greg. Micr. Journ. IV. pl. 1. f. 32.

Frequent: Stamsund +. Svolvaer r. the Ostnesfiord r. Stene r.

Distribution: Coasts of the North Sea. Arctic regions. Caspian Sea. New York.

N. directa W. Sm.

W. Sm. Brit. Diat. I. p. 56. pl. 18. f. 172. A. Schm. Atlas pl. 47. figs. 4—5 (*var. genuina* Cl. l. c. p. 27).

Rare: Stamsund r +. the Ostnesfiord r. Stene r.

Distribution: Coasts of the North Sea. Arctic regions. Yokohama.

var. remota Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 39. A. Schm. Nords. Diat. pl. III. f. 2.

Somewhat rare: Stamsund +. the Ostnesfiord r. Gaukvaero r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Red Sea. Central America.

var. subtilis (Greg.) Cl.

Cl. Vega p. 467. *Pinnularia s.* Greg. Diat. of Clyde. p. 488. pl. IX. f. 19.

Rare: Stene r. Gaukvaero r.

Distribution: Scotland. Arctic regions.

N. finmarchica (Cl. et Grun.) Cl.

Cl. l. c. p. 28. *Stauroneis f.* Cl. et Grun. Arct. Diat. p. 47. pl. III. f. 63.

Very rare: Stene. r r. Very similar to the figure quoted, though wanting the fainter or blank lateral areas. Also very similar to *N. transitans forma minuta* Cl. Vega pl. 36. f. 37.

N. frigida Grun.

Grun. in Cl. et Grun. Arct. Diat. p. 39. Grun. Diat. Franz Jos. Land. p. 103. pl. 1. f. 25. *Navicula kariana v. frigida* Cl. l. c. p. 28.

Probably derived from the plankton.

Rare: Stamsund. r +.

Distribution: Arctic regions. Cf. above p. 105.

N. cancellata Donk.

Donk. Brit. Diat. p. 55. pl. 8. figs. 4 a. b. A. Schm. Nords. Diat. pl. II. figs. 36—37.

Very variable, probably also including *N. zostereti* and *N. northumbrica*.

Very frequent: Moskenstrommen +. Stamsund +. Svolvær +. the Ostnesfiord +. Raftsund r. Stene + c. Gaukværo c c.

Distribution: Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean. Indian Ocean. Pacific Ocean. Kerguelen.

var. *Gregorii* (Ralfs.) Grun.
Grun. in Cl. and Grun. Arct. Diat. p. 37. *Navicula Gregorii* Ralfs in Pritch. Inf. p. 901. A. Schm. Nords. Diat. pl. II, f. 22.

Very rare: Stamsund r. Gaukværo r.
Distribution: Coasts of the North Sea. Baltic. Arctic regions. Pacific Ocean. Kerguelen.

N. northumbrica Donk.
Donk. Micr. Journ. I. p. 9, pl. I. f. 5. A. Schm. Atlas pl. 47. figs. 19—20.

Very rare: Stamsund r. Stene r r.
Distribution: North Sea.

N. zostereti Grun. (?)
Grun. in Wien. Verh. 1860 p. 528. pl. IV. f. 23. A. Schm. Atlas pl. 47, f. 43.

Rare: Stamsund r. Stene r. Gaukværo r.
Distribution: The Mediterranean. Indian Ocean. Pacific Ocean. Brazil.

N. fortis (Greg.) Donk.
Donk. Brit. Diat. p. 57, pl. 8. f. 8. *Pinnularia f.* Greg. Micr. Journ. IV. p. 47. pl. V. f. 19. A. Schm. Atlas pl. 46. figs. 37—39.

Perhaps only a coarse variety of *N. cancellata*.
Very rare: Stene. r.
Distribution: North Sea. Arctic regions (Spitsbergen. Finmark. Greenland).

N. rostellata (Greg.) A. Schm.
A. Schm. Nords. Diat., expl. ad pl. II („N. rostellaria Greg. ?") *Pinnularia r.* Greg. Diat. of Clyde p. 488, pl. IX. f. 20.

Very rare: Stene. r. Probably the same species as the following one. There does, however, really exist a form answering to Gregory's figure, without a central transverse area.
Distribution: Coasts of the North Sea.

N. crucifera Grun.
A. Schm. Atlas pl. 46. figs. 50—53; Nords. Diat. pl. II. f. 31 („*rostellaria* Greg.?")

Must be reckoned as a variety to the preceding species (or vice versa).
Very rare: Stamsund r: Gaukværo r.
Distribution: Coasts of the North Sea. Baltic. The Mediterranean. Sumatra.

N. distans (W. Sm.) Cl.
Cl. l. c. p. 35. *Pinnularia d.* W. Sm. Brit. Diat. I. p. 56. pl. 18. f. 169.

Very rare: Raftsund r. Stene r.
Distribution: North Sea. Arctic regions.

N. compressicauda A. Schm.
A. Schm. Nords. Diat. p. 91. pl. II. f. 35; Atlas pl. 46. f. 62.

The peculiar aspect of the ends of the valve is due to the convexity. The valve is boatshaped with sharp stems, at the bottom of which the terminal nodules are situated. Thus they are rather distant from the very ends.
Rare: Stamsund r +.
Distribution: Coasts of the North Sea. Morocco. The Mediterranean.

N. superimposita A. Schm.
A. Schm. Nords. Diat. p. 90, pl. II. f. 34; Atlas pl. 46. f. 61.

In many respects answering to the preceding species, though undoubtedly distinct.
Very rare: Stamsund. r. Several specimens observed.
Distribution: West coast of Norway. Baltic. Morocco. China.

N. opima Grun.
N. fortis var.? opima Grun. Novara p. 100, pl. I A. f. 13. *N. opima* A. Schm. Atlas pl. 46. figs. 24—26.

Very rare: Stamsund. r.
Distribution: West coast of Norway. Baltic. Arctic regions. Barcelona.

d. ***Lævistriatæ*** Cl. l. c. p. 66.

Radiate striæ, not distinctly punctate nor lineolate. Valve more or less lanceolate.

N. palpebralis Bréb.
Bréb. in W. Sm. Brit. Diat. I. p. 50, pl. 31. f. 273. Van Heurck Synops. p. 96. pl. 11. f. 9.

Rare: Stamsund r +. Moskenstrømmen r. Gaukværo r.
Distribution: Coasts of the North Sea. The Mediteranean. East coast of North America. Davis' Strait. Galapagos Islands.

var. *Barclayana* (Greg.) VH.
VH. Synops. p. 97. pl. 11. f. 12. *Navicula B.* Greg. Diat. of Clyde p. 480. pl. IX. f. 9.

Rare: Stamsund. r.
Distribution: Coasts of the North Sea. The Mediterranean.

var. *semiplena* (Greg.) Cl.
Cl. l. c. p. 70. *Pinnularia s.* Greg. Micr. Journ. VII. p. 84. pl. VI. f. 12.

Rare: Stamsund. r.
Distribution: Scotland. Finmark. Spitsbergen.

var. *angulosa* (Greg.) VH.
Van Heurck Synops. pl. 11. f. 10. *Navicula a.* Greg. Micr. Journ. IV. p. 42, pl. V. f. 8. A. Schmidt Nords. Diat. pl. II. f. 19.

Rather frequent: Stamsund +. Stene r. Gaukværo r +.
Distribution: Coasts of the North Sea and Western Europe. The Mediterranean.

var. *minor* Grun.
Grun. in Cl. et Grun. Arct. Diat. p. 30. pl. 1. f. 23. *Navicula m.* Greg. Diat. of Clyde p. 477. pl. IX. f. 1.

Rare: Stamsund r. Gaukværo r.
Distribution: Finmark. Belgium.

N. præsecta A. Schm.
A. Schm. Nords. Diat. pl. II. f. 20.

Recalls the *var. semiplena* of the preceding species (cf. Cl. l. c. p. 70), but has a much finer structure. Striæ 15 on 10 μ. An obscure line is to be seen between the central area and the margin. Perhaps a species of *Caloneis*.

Very rare: Stamsund r. 53 μ long.

Distribution: West coast of Norway. Bohuslän (Sweden).

e. **Lyratæ** Cl. l. c. p. 52.

N. prætexta Ehrb.

Ehrb. 1840. Mikrogeolog. pl. 19. f. 28 (*Pinnularia p.*). Van Heurck Synops. p. 92. pl. IX, f. 13.

Not unfrequent: Moskenstrommen +. Stamsund r. Svolvær r. Raftsund r. Stene r.

Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. Kerguelen. Cape Horn. America.

N. Hennedyi W. Sm.

W. Sm. Brit. Diat. II. p. 93. A. Schm. Nords. Diat. pl. 1. f. 11.

Very variable.

Frequent: Stamsund c. the Ostnesfiord r. Brettesnes—Skroven r. Raftsund +, Stene r +.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. Atlantic Ocean.

var. circumsecta Grun.

Grun. in A. Schm. Nords. Diat. p. 89. pl. I. figs. 36, 42 (*N. polysticta var. c.*).

Frequent: Stamsund + c. Raftsund r. Stene +.

Distribution: Coasts of the North Sea. Finmark. The Mediterranean. Red Sea. Indian Ocean. America.

Besides, a fine variety from Stamsund, r. with short marginal striæ between the main ones.

N. spectabilis Greg.

Greg. Diat. of Clyde p. 481. pl. IX. f. 10. A. Schm. Atlas. pl. 3, figs. 20—21.

Though usually easily recognizable, this species is scarcely distinct from all forms of the very variable *N. lyra* (cfr. Cl. l. c. p. 60).

Not unfrequent: Moskenstrommen r +. Stamsund r +. Svolvær r. Raftsund r, Stene r +.

An analogous variety to that of *N. Hennedyi*, with more numerous marginal striæ, occurs (Stene, r).

Distribution: Coasts of the North Sea. Greenland. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. Cape Horn.

N. abrupta (Greg.) Donk.

Donk. Brit. Diat. p. 13. pl. II. f. 6. A. Schm. Nords. Diat. pl. I. f. 37. *N. lyra var. a.* Greg. Diat. of Clyde p. 486. pl. IX. figs. 14. 14 b.

Frequent: Moskenstrommen r, Stamsund r. Svolvær + c. the Ostnesfiord c, Raftsund r, Stene +. Gaukværo + c.

Distribution: Coasts of the North Sea. Finmark. Spitsbergen. The Mediterranean. Black Sea. Red Sea. Indian Ocean. China.

N. clavata Greg.

Greg. Micr. Journ. IV, p. 46. pl. V. f. 17. A. Schm. Nords. Diat. pl. 1. f. 33.

Characteristic form, though hardly specifically different from certain varieties of *N. lyra*.

Not unfrequent: Moskenstrommen r, Stamsund r. Svolvær r. the Ostnesfiord r. Raftsund r +. Stene r.

Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. East coast of America.

N. lyra Ehrb.

Ehrb. Amer. p. 131, pl. 1. 1. f. 9. Van Heurck Synops. p. 93, pl. 10, f. 1. *N. lyra var. Ehrenbergii* Cl. l. c. p. 63.

Somewhat rare: Moskenstrommen r. Stamsund r +. Svolvær +. the Ostnesfiord r. Stene r.

Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. America.

var. elliptica A. Schm.

A. Schm. Nords. Diat. pl. 1. f. 39. Van Heurck Synops. pl. 10, f. 2.

Very frequent: Stamsund +. Svolvær +. Raftsund +. Brettesnes—Skroven r. Stene c. Gaukværo +.

Distribution: Coasts of the North Sea. The Mediterranean. Red Sea. Indian Ocean. Philippines.

var atlantica A. Schm.

A. Schm. Nords. Diat. pl. 1, f. 34.

Very characteristic. Recalls sometimes *N. abrupta*, but always easy to distinguish from that species.

Rare: Stamsund r +. Moskenstrommen r.

Distribution: Coasts of the North Sea.

N. forcipata Grev.

Grev. in Micr. Journ. VII, p. 83, pl. VI. figs. 10—11. A. Schm. Nords. Diat. pl. 1. f. 15, pl. II. figs. 16. 18.

Frequent: Stamsund c, Raftsund r. Stene r. Gaukværo + c.

Distribution: Coasts of the North Sea, frequent. Greenland. The Mediterranean. Black Sea. Red Sea. Cape of Good Hope. Indian Ocean. Pacific Ocean. Florida.

var. versicolor (Grun.) Grun.

Grun. in V. H. Synops. pl. X, f. 6. *Navicula v.* Grun. in A. Schm. Nords. Diat. pl. II. f. 17.

A very well marked variety.

Rare: Stamsund. +.

Distribution: North Sea. The Mediterranean. Sumatra.

N. pygmæa Kütz.

Kütz. Sp. Alg. p. 77. Van Heurck Synops. p. 94. pl. 10. f. 7.

It is hardly possible to keep this species distinct from certain varieties of the preceding species (cfr. Cl. l. c. p. 66).

Very rare: Stamsund r. Stene r.

Distribution: Brackish water: Coasts of the North Sea. Baltic. Arctic regions. America.

Pinnularia Ehrb.

a. **Capitatæ** Cl. Synops. Navic. Diat. II, p. 75.

P. microstauron Ehrb.

A. Schm. Atlas pl. 44. f. 16.

Very rare: Raftsund. r.

Distribution: Fresh water species. Arctic regions. Northern Europe. North America.

P. nobilis Ehrb.

Ehrb. Berl. Ak. 1840, p. 214. A. Schm. Atlas pl. 43, f. 1.

Rare: Stene r; the Ostnesfiord r.

Distribution: Fresh water species, especially frequent in Northern and Western Europe.

b. ***Divergentes*** Cl. l. c. p. 77.

P. legumen Ehrb.

Ehrb. Mikrogeol. pl. II, 2, f. 12. *Navicula l.* A. Schm. Atlas pl. 44, figs. 44—47.

Very rare: The Ostnesfiord, r.

Distribution: Fresh water species, frequent especially in Northern and Western Europe. Africa. Asia. Australia. America.

P. divergens W. Sm.

W. Sm. Brit. Diat. I, p. 57, pl. 18, f. 177. *Navicula d.* A. Schm. Atlas pl. 44, f. 9.

Very rare: The Ostnesfiord, r.

Distribution: Fresh water species, frequent especially in Northern and Western Europe. Asia. Australia. America.

c. ***Distantes*** Cl. l. c. p. 80.

P. lata (Bréb.) W. Sm.

W. Sm. Brit. Diat. I, pl. 18, f. 167. *Frustulia lata* Bréb. Cons. p. 18.

Frequent: Svolvær r, Raftsund r, the Ostnesfiord r, Stene + c.

Distribution: Fresh water species. Arctic regions. Western Europe. Switzerland. Australia.

P. borealis Ehrb.

Ehrb. Am. pl. I, 2, f. 6. *Navicula b.* A. Schm. Atlas pl. 45, figs. 15—21.

Very rare: Stamsund, rr.

Distribution: Frequent fresh water species, especially in arctic and alpine regions: Northern and Western Europe; Switzerland. Asia, Africa, America and Australia.

d. ***Marinæ*** Cl. l. c. p. 94.

P. quadratarea (A. Schm.) Cl.

A. Schm. Nords. Diat. p. 90, pl. II, f. 26. *Navicula pinnularia* Cl. Svensk. N. Diat. p. 224, pl. IV, figs. 1—2 (earlier name).

Frequent: Stamsund +, Svolvær r, the Ostnesfiord r, Stene r +, Gaukværo + c.

Distribution: Coasts of the North Sea. Arctic regions, frequent. The Mediterranean. Australia.

P. claviculus (Greg.) Cl.

Cl. l. c. p. 96. *Navicula c.* Greg. Diat. of Clyde, p. 478, pl. IX, f. 5. A. Schm. Nords. Diat. pl. II, f. 28.

Rare: Stamsund r +, Gaukværo r.

Distribution: Coasts of the North Sea. Sweden. Balearic Islands.

P. cruciformis Donk.

Donk. Micr. Journ. (n. s.) I, p. 10, pl. I, f. 7. A. Schm. Nords. Diat. pl. II, f. 25.

Rare: Stamsund r, Svolvær r, Gaukværo r.

Distribution: Coasts of the North Sea. Finmark. Baltic. West Indies. Cape Horn. Seychelles.

P. Trevelyana (Donk.) Rabenh.

Rabenh. Fl. Eur. Algar. I, p. 210. *Navicula T.* Donk. Micr. Journ. I, 1861, p. 8, pl. I, f. 2.

Rare: Stamsund r, Svolvær r, Stene r.

Distribution: Coasts of the North Sea. Florida. Japan.

Diploneis Ehrb., Cl. Synops. Navic. Diat. I, p. 76.

The material examined was especially rich in forms of this beautiful genus. For the sake of greater clearness, they are arranged in the two groups Didymæ and Ellipticæ, although these groups by some intermediate forms pass into each other.

a. ***Ellipticæ*** V. H. Synops.

D. hyalina (Donk.) Cl.

Cl. l. c. p. 80. *Navicula h.* Donk. Micr. Journ. I, p. 10, pl. I, f. 6. A. Schm. Atlas pl. 70, figs. 1—5.

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea. Finmark.

D. coffeæformis (A. Schm.) Cl.

Cl. l. c. p. 81. *Navicula c.* A. Schm. Nords. Diat. p. 88, pl. I, f. 22; pl. II, f. 13.

Perhaps a variety of the following species.

Rare: Stamsund, r +.

Distribution: Coasts of the North Sea. Naples. Macassar Straits.

D. suborbicularis (Greg.) Cl.

Cl. l. c. p. 81. *Navicula Smithii var. s.* Greg. Diat. of Clyde p. 487, pl. IX, f. 17.

Somewhat rare: Stamsund +, Svolvær r.

Distribution: Coasts of the North Sea. Davis' Strait. The Mediterranean. Caspian Sea. Indian Ocean. America.

D. eudoxia (A. Schm.)

Navicula e. A. Schm. Atlas pl. VIII, f. 40, pl. 70, f. 71. *N. mediterranea* A. Schm. Nords. Diat., pl. II, f. 10, non Kütz. *D. contigua var. eudoxia* Cl. l. c. p. 83.

This beautiful species is so easily recognizable and seems to be so well distinguished from the following that I prefer to keep them separate instead of referring both to *D. contigua*, as Cl. (l. c. p. 82) does.

Rare: Stamsund r +, Raftsund r.

Distribution: West coast of Norway. The Mediterranean. Red Sea. Indian Ocean. Galapagos Islands.

D. sejuncta (A. Schm.).

Navicula s. A. Schm. Nords. Diat. p. 87, pl. I, f. 18. *N. eugenia* A. Schm. Atlas pl. 8, figs. 44—45. *Diploneis contigua* (A. Schm.) *var eugenia* Cl. l. c. p. 83.

This species is certainly a *Diploneis*, not a *Caloneis* as Cl. l. c. supposes. A. Schm. (Nords.) compares it with *D. nitescens* and mentions it (*N. eugenia*) another time (Atlas l. c.) as a connecting link between *D. nitescens* and *D. eudoxia*.

Horns of the central nodule not plainly separated. Now and then, the division line is, however, seen. Costæ apparently lineate; the very faint longitudinal lines form a single row of alveoli between the costæ. Sometimes the valves are a little constricted in the middle.

I can find no essential difference between this form and *N. eugenia*. The costæ in the latter are stated to be 8—9 on 10 μ, in the former 12. The structure of *D. sejuncta* is, however, somewhat variable, and answers perhaps best to 10 costæ on 10 μ.

There is also a remarkable agreement in their occurrence, as both are mentioned from Campeachy Bay.

Very rare: Stamsund r+, here in rather large numbers.

Distribution (of *N. sejuncta* A. SCHM.): West coast of Norway (Hvidingsø). Campeachy Bay.

Distribution of *N. eugenia* A. SCHM.: Ceylon. Macassar Straits. Campeachy Bay.

D. notabilis (GREV.) CL.

CL. l. c. p. 93. *Navicula notabilis* GREV. Micr. Journ. XI. p. 18. f. 9.

var. expleta A. SCHM.

A. SCHM. Nords. Diat. pl. 1, f. 20. pl. II. f. 11.

Rare: Stamsund r. Raftsund r. Stene r. Gaukværo r.

Distribution: Coasts of the North Sea. The Mediterranean. Black Sea. Red Sea. Indian Ocean. Pacific Ocean. West Indies. Brazil.

D. fusca (GREG.) CL.

CL. l. c. p. 93. *Navicula fusca* A. SCHM. Atlas pl. 7. figs. 2–3 (*var. norvegica* CL. l. c.).

This species is exceedingly variable and includes probably *D. hyperborea* and *D. æstiva*. Even the limit towards *D. Smithii* seems not to be reliable.

Frequent: Moskenstrommen r. Stamsund +. Svolvær +. the Ostnesfiord r. Raftsund r. Stene r. Gaukværo +.

var. Gregorii CL. l. c. p. 94.

Navicula Smithii var f. GREG. Diat. of Clyde IX, f. 15.

Large, beautiful form. Differs from the main species in the same way as *D. major* CL. from *D. Smithii*. Central nodule elongated; terminal nodules distant from the ends.

Very rare: Stamsund. r.

Distribution: Coasts of the North Sea. Naples.

D. hyperborea (GRUN.) CL.

CL. l. c. p. 95. *Navicula hyperborea* GRUN. Wien Verh. 1860 p. 531. pl. III. f. 16.

Furrows swelling round the central nodule.

Rare: Stene r, the Ostnesfiord r. Stamsund r.

Distribution: Bohuslän (Sweden).

var. excisa A. SCHM.

Navicula fusca v. excisa A. SCHM. Nords. Diat. pl. II. f. 9.

Beautiful and characteristic form. Large, conspicuous pearls as in *D. fusca var. Gregorii*.

Rare: Stamsund, r+.

Distribution: West coast of Norway.

D. Smithii (BREB.) CL.

CL. l. c. p. 96. *Navicula Smithii* BREB. in W. SM. Brit. Diat. II. p. 92. A. SCHM. Atlas pl. 7. figs. 16–17.

Exceedingly variable, probably also including *D. major* and *D. borealis*.

Very frequent: Moskenstrommen r. Stamsund c. the Ostnesfiord r, Raftsund r. Stene c. Gaukværo c.

Distribution: Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean. Indian Ocean. Pacific Ocean. Central America.

D. major CL.

CL. l. c. p. 96. *Navicula Smithii* A. SCHM. Atlas. pl. VII. f. 19.

Beautiful form, but hardly anything other than a coarse variety of *D. Smithii*. It seems quite impossible to keep it distinct from large forms of the latter species, with coarser structure.

The central nodule is usually broadened, broader than the distance between the horns, while it, in *D. Smithii*, is of equal breadth. The terminal nodules are generally distant from the ends, while they in *D. Smithii* lie close to them. Both these characteristics are, however, unreliable. Thus forms occur, which, on account of the structure and the terminal nodules, should be referred to *D. major*, but on account of the form of the central nodule to *D. Smithii*, and vice versa.

Not unfrequent: Moskenstrommen +. Stamsund r+. Stene r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean.

D. borealis (GRUN.) CL.

CL. l. c. p. 96. *Navicula Smithii var. borealis* GRUN. Diat. Franz Jos. Land p. 56. pl. I. f. 40.

Furrows swelling round the central nodule.

Frequent: Stamsund cc. Stene r. the Ostnesfiord r. Gaukværo r.

My specimens differ somewhat from GRUNOW's figure, especially in the central nodule, which is not elongated. The double rows of pearls between the costæ are very delicate, but are now and then distinctly seen. Agree very well with the description in GRUNOW l. c.

Distribution: Sweden (Bohuslän). Arctic regions. Java.

D. litoralis (DONK.) CL.

CL. l. c. p. 94. *Navicula l.* DONK. Brit. Diat. p. 5. pl. I. f. 2. A. SCHM. Nords. Diat. pl. I. figs. 24–25 („*var. subtilis*").

Very rare: Stamsund. r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Indian and Pacific Oceans.

D. nitescens (GREG.) CL.

CL. l. c. p. 97. *Navicula Smithii var. nitescens* GREG. Diat. of Clyde p. 487. pl. IX. f. 16.

Somewhat rare: Stamsund +. Stene r. Gaukværo r.

Distribution: Coasts of the North Sea. The Mediterranean. Black Sea. Indian Ocean. Pacific Ocean. Central America.

b. ***Didymæ*** VH. Synops.

D. constricta (GRUN.) CL.

CL. l. c. p. 83. *Navicula c.* GRUN. in Wien Verh. 1860. p. 535. pl. III. f. 18. *N. Donkinii* A. SCHM. Nords. Diat. pl. I. f. 12. pl. II, f. 8.

Coarser structure than in the following species, horns of the central nodule more divergent, and obtuse angles in the lateral contour. At a certain focus, a few very indistinct oblique longitudinal costæ are sometimes to be seen.

Not unfrequent: Stamsund +c. the Ostnesfiord r. Stene r.

Distribution: Coasts of the North Sea. Finmark. Balearic Islands. Ceylon. Florida.

D. incurvata (Greg.) Cl.

Cl. l. c. p. 84. *Navicula i.* Greg. Micr. Journ. IV. p. 41, pl. V, f. 13. A. Schm. Nords. Diat. pl. I, figs. 10—11; pl. II, f. 6.

Frequent: Stamsund + c. Stene r +.

Distribution: Coasts of the North Sea. Finmark. America.

D. interrupta (Kütz.) Cl.

Cl. l. c. p. 84. *Navicula i.* Kütz. Bacill. p. 100, pl. 29 f. 93. A. Schm. Nords. Diat. pl. I, f. 8.

Somewhat rare: Stamsund r. the Ostnesfiord r. Raftsund r. Stene r.

Distribution: Brackish water. Coasts of the North Sea. Baltic. Arctic regions. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. East coast of America.

D. lineata (Donk.) Cl.

Cl. l. c. p. 85. *Navicula l.* Donk. Micr. Journ. VI. p. 32, pl. III, f. 17. A. Schm. Nords. Diat. pl. I, figs. 16—17.

Rare: Stamsund r. Stene r. Both forms illustrated by A. Schm. l. c., occur.

Distribution: Coasts of the North Sea. The Mediterranean.

D. subcincta (A. Schm.) Cl.

Cl. l. c. p. 86. *Navicula s.* A. Schm. Nords. Diat. pl. II, f. 7.

Very variable. Structure coarse, coarser than in the preceding species.

Frequent: Svolvær r +. the Ostnesfiord r +. Raftsund r. Stene + c.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Indian Ocean.

var. *media* (Grun.)

Navicula bomboides var. media Grun. Arct. Diat. p. 41, pl. III, f. 54; Diat. Franz Jos. Land pl. I, f. 39 (*N. subcincta*). *Diploneis entomon* Cl. Synops. Navic. Diat. I. p. 87.

Two, or a few, broad, irregular longitudinal costæ, anastomosing through oblique ones.

This form is very remarkable. By Cleve it has been referred to *D. entomon* (cf. under that species), by Grunow as a variety to *D. bomboides*. Grun. has, however, noted the close relationship to *D. subcincta*. As this species is very variable as regards the development of longitudinal costæ, and often shows similar peculiarities as the present variety, I have thought it best to consider the latter a variety of *D. subcincta*, though it is, on the whole, so characteristic that it might very well be regarded as a separate species.

I also think I have seen forms distinctly transitional to *N. subcincta*. Such forms are, however, rare.

Not unfrequent: Stamsund r +. the Ostnesfiord r +. Raftsund r. Stene r.

Distribution: Arctic regions.

D. entomon.

Regarding the interpretation of this name Cl. l. c. is not quite clear. His species seems to be = A. Schm. Nords. Diat. pl. I, f. 14, a figure, on which the longitudinal costæ are very indistinct. Cl. quotes, however, also A. Schm. l. c. f. 13, a figure which undoubtedly represents another species. A. Schm. himself remarks that these two figures cannot be referred to the same species, but that Grunow considers them to be *D. entomon* Ehrb.

Cleve's species is partly identical with *D. bomboides var. media* Grun. (in Cl. et Grun. Arct. Diat. p. 41, pl. III, f. 54), a form, which, according to Grunow, is an intermediate one between *D. bomboides* and *subcincta*. This *var. media* I have referred to *D. subcincta* (cf. above). It is hardly essentially different from that form from Franz Jos.'s Land, which Grun. illustrates (Diat. F. J. L. pl. I, f. 39) as *Navicula subcincta*. In this figure the irregular ramification of the longitudinal costæ is seen, producing two anostomosing ones.

The figures from A. Schm. Atlas (pl. 13, figs. 48—49) referred to by Cl. l. c. represent a species, which I have not seen, and which hardly occurs with us.

D. entomon of Van Heurck Traité p. 195, pl. 26, f. 732 is a different species, identical with A. Schm. Nords. Diat. pl. I, f. 13. This figure seems, however, to represent a form of *D. constricta*. The furrows, especially, answer very well to the latter species. Van Heurck who is on the whole conservative on the question of species, also mentions the near relationship between *D. entomon* and *D. incurvata*, a species which again is very nearly connected with *D. constricta*.

When Cleve l. c. remarks that *D. entomon* by intermediate forms passes into *D. splendida*, this also shows clearly that his species is different from that of A. Schmidt (f. 13) and Van Heurck.

The furrows of *D. entomon* Cl. answer very well to those of *D. bomboides*, less so to those of *D. splendida*.

I have, however, never seen specimens where it was doubtful, whether they should be referred to *D. entomon* Cl. (= *bomboides var. media* Grun.) or *D. bomboides*.

D. entomon Ehrb. Mikrogeologie pl. 33. XVII, f. 13 has the shape of *D. constricta*, but very narrow furrows. *D. entomon* Ehrb. l. c. may be Van Heurck's species (A. Schm. Nords. Diat. pl. I, f. 13); the specimen seems to lie somewhat obliquely, which may have caused the median constriction of the furrows.

D. splendida (Greg.) Cl.

Cl. l. c. p. 87. *Navicula s.* Greg. Micr. Journ. IV, p. 44, pl. V, f. 14. A. Schm. Nords. Diat. pl. I, figs. 3—4; pl. II, f. 2.

This beautiful species is very similar to *D. bomboides*, but the furrows do not swell in the middle and narrow evenly elliptically off towards the ends. The costæ, besides, distinctly cross the furrows at the sides of the central nodule (i. e., in the furrows are here distinct transverse costæ), while these furrows else are almost smooth. The median structure of the valve generally is a little coarser, the areoles here somewhat larger.

I have seen no distinct transition between *D. splendida* and the other species.

Somewhat rare: The Ostnesfiord r +. Raftsund r. Stene r +.

Distribution: Coasts of the North Sea. Arctic regions (Finmark, Baren Eiland, Spitsbergen, Greenland). Indian Ocean. Pacific Ocean. West Indies. Florida.

D. bomboides (A. Schm.) Cl.

Cl. l. c. p. 88. *Navicula b.* A. Schm. Nords. Diat. pl. I, f. 2.

Similar to the preceding species, but the furrows swell slightly round the central nodule, and the structure here is like that of the other parts of the valve. The furrows are also more protracted towards the ends, and not conspicuously crossed by transverse costæ at the sides of the central nodule.

Always easy to distinguish from the preceding species.

Frequent: Stamsund + c, Brettesnes—Skroven r +, Raftsund r +, Stene r +.

Distribution: Coasts of the North Sea. Alexandria. Indian Ocean. Pacific Ocean. Central America.

D. didyma (Ehrb.) Ehrb.

Ehrb. Mikrogeolog. pl. 19, f. 32. *Pinnularia d.* Ehrb. Kreuleth. p. 75. *Navicula didyma* A. Schm. Nords. Diat. pl. 1, f. 7.

Not unfrequent: Moskenstrommen r, Svolvær r +, the Ostnesfiord r, Raftsund r, Stene r.

Distribution: Especially in brackish water. Coasts of the North Sea. Arctic regions. Baltic. Black Sea. Caspian Sea. Indian Ocean. Pacific Ocean. Cape Horn. West Indies.

D. bombus Ehrb.

Ehrb. Mikrogeol. pl. 19, f. 31. *Navicula b.* Greg. Diat. of Clyde. p. 484, pl. IX, f. 12. *N. gemma* A. Schm. Nords. Diat. pl. 1, f. 1; pl. 11, f. 1.

Frequent: Moskenstrommen r +, Stamsund c, Svolvær +, the Ostnesfiord r, Raftsund r, Stene +, Gaukværo r +.

Distribution: Coasts of the North Sea and Western Europe. Finmark. The Mediterranean. Black Sea. Caspian Sea. Indian Ocean. Pacific Ocean. America.

D. chersonensis (Grun.) Cl.

Cl. l. c. p. 91. *Navicula c.* Grun. in A. Schm. Atlas pl. 12, f. 40; pl. 69, f. 21. *Navicula apis* (Donk.) A. Schm. Nords. Diat. pl. 1, f. 9.

Not unfrequent: Stamsund +, Svolvær r, Gaukværo r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean. West Indies. Florida.

D. crabro Ehrb.

Mikrogeol. pl. 19, figs. 29 a, b (non c). A. Schm. Nords. Diat. pl. 1, figs. 5—6; pl. 11, f. 4. *D. crabro var. multicostata* (Grun.) Cl. l. c. p. 102. *Navicula multicostata* Grun. Wien Verh. 1860, p. 524, pl. III, f. 13.

Rather frequent: Moskenstrommen r, Stamsund +, the Ostnesfiord +, Raftsund r, Stene r, Gaukværo r +.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. West Indies.

var. *pandura* (Bréb.) VH.

Van Heurck Synops. pl. 9, f. 1. *Navicula pandura* Bréb. Diat. Cherb. f. 4. A. Schm. Nords. Diat. pl. 11, f. 3.

Peculiar form with tongue-shaped segments.

Very rare: Gaukværo, r r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Red Sea. Indian Ocean. Pacific Ocean. America.

Frustulia Ag.

F. rhomboides (Ehrb.) De Toni.

De Toni Syll. p. 277. *Navicula rhomboides* Ehrb. Amer. pl. 3, 1, f. 15. *Vanheurckia r.* Bréb. Ann. Soc. phyt. Belg. I, p. 204. V. H. Synops. p. 112, pl. 17, figs. 1—2.

Very rare: Svolvær r, Brettesnes—Skroven r.

Distribution: Fresh water species, rather common.

Stenoneis *inconspicua* (Greg.) Cl.

Cl. Synops. Navic. Diat. I, p. 124. *Navicula? i.* Greg. Diat. of Clyde p. 478 pl. IX, f. 3. *N. fistula* A. Schm. Nords. Diat. pl. II, f. 29.

Frequent: Moskenstrommen r, Stamsund r, Gaukværo + c.

Distribution: Coasts of the North Sea. Bohuslän (Sweden). Balearic Islands. Arctic regions.

Trachyneis *aspera* (Ehrb.) Cl.

Cl. Synops. Navic. Diat. I, p. 191. *Stauroptera a.* Ehrb. Amer. pl. I, figs. 1—2; Mikrogeol. pl. 35 A, XXIII, f. 13. *Navicula a.* Van Heurck Synops. pl. X, f. 13 (var. *genuina* Cl.).

Common: Moskenstrommen r, Stamsund + c, Svolvær +, the Ostnesfiord c, Raftsund r +, Stene c, Gaukværo +.

Distribution: Cosmopolitan.

Mastogloia Thw.

M. exigua Lewis.

Lewis Proc. Ac. Nat. Sc. Philad. 1861 p. 65, pl. II, f. 5. Van Heurck Synops. p. 70, pl. 4, figs. 25—26.

Very rare: Svolvær, r.

Distribution: Brackish and marine: Baltic. Belgium. Atlantic coast of America. Behring Island.

M. Smithii Thw.

W. Sm. Brit. Diat. II, p. 65, pl. 54, f. 341. Van Heurck Synops. p. 70, pl. 4, f. 13.

Very rare: Svolvær, r.

Distribution: In brackish water. Baltic. England. Saxony. Caspian Sea. Australia.

M. apiculata W. Sm.

W. Sm. Brit. Diat. II, p. 65, pl. 62, f. 387. A. Schm. Atlas pl. 185, f. 43; pl. 186, f. 23.

Very rare: Svolvær, r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean. Black Sea. China.

17. *Cymbelleæ.*

Cymbella Ag.

C. cistula (Hempr.) Kirchn.

Van Heurck Synops. p. 64, pl. 2, figs. 12—13.

Very rare: Brettesnes—Skroven, r.

Distribution: Fresh water species, frequent in arctic, northern or alpine localities. Also in slightly brackish water.

C. cymbiformis (Ag.?) V. H.

Van Heurck Synops. p. 63, pl. II, figs. 11 a—c.

Very rare: Stamsund r, the Ostnesfiord r.

Distribution: Frequent fresh water species, especially from Northern and Western Europe. Arctic regions. Asia. Africa, America and Australia.

Amphora Ehrb.

Amphora Cl. s. s. Synops. Navic. Diat. II. p. 100.

Valves with transverse rows of coarse puncta, forming longitudinal lines, or strong transverse costæ, crossed by longitudinal ones. Connecting zone simple.

A. proteus Greg.

Greg. Diat. of Clyde p. 518, pl. XIII. f. 81. A. Schm. Atlas, pl. 27, f. 3.

Very variable.

Frequent: Stamsund +, Svolvær r, Raftsund r, Stene +, Gaukværo + c.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Black Sea. The Atlantic. Indian and Pacific Oceans.

var. contigua Cl.

Cl. l. c. p. 103. A. Schm. Atlas, pl. 28, f. 4.

Perhaps a separate species.

Not unfrequent: Stamsund r, Svolvær r, the Ostnesfiord r.

Distribution (of *var. contigua* Cl.): North Sea. The Adriatic. Labuan. New Caledonia.

A. robusta Greg.

Greg. Diat. of Clyde p. 519, pl. XIII. f. 79.

Not unfrequent: Stamsund r, the Ostnesfiord +.

Distribution: Coasts of the North Sea. Spitsbergen. The Mediterranean. Macassar Strait. Pacific Ocean.

A. ovalis Kütz.

Kütz. Synops., figs. 5—6. Van Heurck Synops. p. 59, pl. I. f. 1.

Very rare: Stamsund, r.

Distribution: Fresh or slightly brackish water. Frequent in Northern and Western Europe. Arctic regions.

b. Diplamphora Cl. l. c. p. 107.

Connecting zone complex, with more or less numerous longitudinal divisions and transverse striæ or costæ. Valves with transverse costæ, or rows of puncta, on the dorsal side with one or two longitudinal lines.

A. crassa Greg.

Greg. Micr. Journ. V. p. 72, pl. I. f. 35; Diatoms of Clyde p. 524, pl. XIV. f. 94. A. Schm. Atlas pl. 39, f. 30.

Rare: Stamsund r, Svolvær r, Stene r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Indian Ocean. China.

var. solsvigiensis Petit.

Petit Diat. Cap Horn. p. 120, pl. X. f. 15, p. p. A. Schm. Atlas pl. 48, f. 17.

Beautiful form.

Very rare: Stamsund, r. 111 × 18 μ; costæ $4^1/_2$ on 10 μ, lineate. Strong longitudinal line. The costæ answer to the fig. 18 in A. Schm. Atlas, the margin of the ventral side to fig. 17 (these figures thus correspond to different focussing).

A. Græffii Grun.

Grun. in A. Schm. Atlas pl. 25, fig. 40.

Very rare: Stamsund, r. 63 × 14 μ; striæ 17 on 10 μ, crossed on the dorsal side by a blank line. Ends little protracted. Axial area a little constricted in the middle.

Not unfrequent: Stamsund r +, Stene +, Gaukværo r.

Distribution: Naples. Indian Ocean. Pacific Ocean.

A. Grevilleana Greg.

Greg. Micr. Journ. V, p. 73, pl. I. f. 36. Diat. of Clyde p. 522, pl. 13, f. 89. A. Schm. Atlas pl. 25, f. 41. *A. fasciata* Greg. l. c. pl. 13, f. 90 (cfr. Cl. l. c.).

Rare: Stamsund r, Stene r.

Distribution: Coasts of the North Sea and Western Europe. Spitsbergen. The Mediterranean. Pacific Ocean. Central America.

A. sulcata Bréb.

Bréb. Diat. Cherb. f. 8. Greg. Diat. of Clyde p. 523, pl. XIII, figs. 92, 92 b. Cl. l. c. p. 112.

Very rare: Stamsund r, the Ostnesfiord r. 15 striæ on 10 μ. 74 μ long. Corresponds exactly to the figures and description in Gregory l. c. Also tolerably well answering to Cleve's species.

Distribution: West coast of Europe. Balearic Islands.

A. Mülleri A. Schm.

A. Schm. Atlas pl. 26, f. 31. *A. monilifera* Greg.? Diat. of Clyde, p. 511, pl. XII, f. 69.

Very rare: Stamsund, r. Valve 73 × 11 μ, with $7^1/_2$ striæ on 10 μ, obtuse. The ventral side as illustrated by A. Schm., rather narrow, towards the ends broader, then again narrowing. The raphe is not so distinctly bent as in the figure. On the broader part of the ventral side, inside the marginal striæ, there is a band of short striæ, as in *A. proteus*, separated from the marginal striæ by a blank line. Dorsal striæ, as in the figure mentioned, crossed by a broad blank, longitudinal line. Another sharp line is seen close to the dorsal margin.

Distribution: West coast of Norway (Hvidingsø).

A. alata Perag.

Perag. Diat. de Villefr. p. 41, pl. II. f. 11. Van Heurck Traité d. Diat. pl. 24, f. 677.

Very rare: Stamsund, r.

Distribution: West coast of Norway. Morocco. The Mediterranean. Macassar Straits. America.

A. binodis Greg.

Greg. Diat. of Clyde p. 510, pl. XII. f. 67. Cl. l. c. p. 124.

Very rare: Stamsund, r. 34 μ long. Completely answering to the illustration in Greg. l. c.

Distribution: Scotland. Balearic Islands.

c. Halamphora Cl. l. c. p. 117.

Connecting zone complex. Raphe close to the ventral margin. Transverse, punctate striæ, not crossed by any longitudinal line. Ends of the valve usually rostrate or capitate.

A. macilenta Greg.

Greg. Diat. of Clyde p. 510, pl. XII, f. 65. Cl. l. c. p. 121.

Answers best to *A. crydensis* Greg. l. c. p. 512, pl. XII, f. 71, which by Cleve l. c. — probably rightly — is considered a variety of *A. macilenta*. Frustule 48 × 19 μ, with rather narrow connecting zone. 11 striæ on 10 μ.

Very rare: Stamsund, r.

Distribution: Coasts of Sweden and Scotland. The Mediterranean. Macassar Straits.

A. eunotia Cl.

Cl. Diat. Arct. Sea. p. 21, pl. III, f. 17. *A. cymbifera var.* A. Schm. Atlas pl. 25, f. 35.

Very rare: Stamsund, r.

Similar to an *Amphora terroris*, with distinctly punctate transverse striæ. Valve 80 × 15 μ; its ends a little capitate-rostrate. Striæ 7½ on 10 μ.

Distribution: Bohuslän (Sweden). Arctic regions. Indian Ocean.

A. costata W. Sm.

W. Sm. Brit. Diat. I, p. 20, pl. 30, f. 253. Greg. Diat. of Clyde p. 527, pl. XIV, f. 99. *A. inflata* Grun. in A. Schm. Atlas pl. 25, figs. 29—30.

Rare: Stamsund, r.

Frustule 34 × 16 μ, coarse structure; 9—10 striæ on 10 μ; many longitudinal division lines. Ends protracted.

Distribution: Coasts of the North Sea. Mediterranean. Sumatra. East coast of America. Galapagos Islands.

A. terroris Ehrb.

A. erebi Ehrb. Microgeol. pl. 35 A, f. 2. *A. cymbifera* Greg. Diat. of Clyde p. 526, pl. XIV, f. 97. A. Schm. Atlas pl. 26, f. 33; pl. 39, f. 18; pl. 25, figs. 17—19, 33—34, 36.

Not unfrequent: Stamsund +, the Østnesfiord r, Gaukværo r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. Macassar Straits. Gulf of Mexico.

d. ***Oxyamphora*** Cl. l. c. p. 125.

Complex connecting zone. Valves acute with the raphe close to the ventral margin. No dorsal longitudinal lines. Usually delicate structure of transverse or slightly radiate striæ with puncta arranged in undulating, longitudinal lines. Ventral side usually of still finer structure than the dorsal side. Often a stauros.

A. acuta Greg.

Greg. Diat. of Clyde p. 524, pl. 14, f. 93. A. Schm. Atlas pl. 26, figs. 19—20.

Not unfrequent: Stamsund r, the Østnesfiord r, Raftsund r, Gaukværo r.

Distribution: Coasts of the North Sea. Arctic regions. The Mediterranean. China. Straits of Magellan.

A. groenlandica Cl.

Cl. l. c. p. 128, pl. IV, f. 1.

No stauros.

var.

Median striæ 12 on 10 μ, towards the ends of the valve somewhat closer. Puncta elongated, 10 on 10 μ.

Very rare: Stamsund, r.

Distribution of the main species: Davis' Strait.

A. ostrearia Bréb.

Bréb. in Kütz. Spec. p. 94. A. Schmidt Atlas pl. 26, f. 23. Van Heurck Synops. p. 55, pl. I, f. 25 (*var. typica* Cl. l. c. p. 129).

Rare: Stamsund, r; Gaukværo, r.

Distribution: Coasts of the North Sea. Finmark. The Mediterranean. Indian Ocean. Pacific Ocean.

A. lævis Greg.

Greg. Diat. of Clyde p. 514, pl. XII, figs. 74 a—c. A. Schm. Atlas, pl. 26, f. 10.

Rare: Stamsund, r (+).

Distribution: Coasts of the North Sea. Finmark. Balearic Islands. Java.

var. lævissima (Greg.) Cl.

Cl. l. c. p. 130. *Amphora lævissima* Greg. Diat. of Clyde, p. 513, pl. XII, f. 72. A. Schm. Atlas pl. 26, figs. 3, 13—14.

Rare: Stamsund r, Stene r.

Distribution: Coasts of the North Sea. Finmark. Sea of Kara.

e. ***Amblyamphora*** Cl. l. c. p. 130.

Connecting zone complex. Valves obtuse with the raphe diverging dorsally. No longitudinal lines. Fine puncta, arranged in transverse striæ. Structure not finer on the ventral part of the valve.

A. obtusa Greg.

Greg. Micr. Journ. V, p. 72, pl. I, f. 34. A. Schm. Atlas pl. 40, figs. 4—7, 11—13.

Very rare: Stamsund, r.

Distribution: Coasts of the North Sea. The Mediterranean. Black Sea. Red Sea. Indian Ocean. China. East coast of America.

A. spectabilis Greg.

Greg. Diat. of Clyde, p. 516, pl. XIII, figs. 80 a, c. A. Schm. Atlas pl. 40, figs. 18—23.

Not unfrequent: Stamsund +, Stene r, Gaukværo r.

Distribution: Coasts of the North Sea. The Mediterranean. Indian Ocean. Pacific Ocean. West Indies. Davis' Straits.

f. ***Psammamphora*** Cl. l. c. p. 132.

Connecting zone simple. Else as *Amblyamphora*.

A. ocellata Donk.

Donk. Micr. Journ. 1861 (n. s.) I, p. 11, pl. I, f. 11. Van Heurck Synops. p. 56, pl. I, f. 26 (*var. typica* Cl. c. p. 133).

Somewhat rare: Stamsund r, Svolvær r, the Østnesfiord r +, Gaukværo +.

Distribution: Coasts of the North Sea. Sweden. The Adriatic.

g. ***Cymbamphora*** Cl. l. c. p. 134.

Connecting zone simple. Valves of rather delicate structure. No longitudinal lines. Raphe close to the ventral margin.

A. angusta Greg.? Cl.

Cl. l. c. p. 135. Greg.? Diat. of Clyde p. 510, pl. XII, f. 66 (*var. typica* Cl.).

Rare: Stamsund, r. Hardly Gregory's species.

Distribution: Scotland. Arctic regions. East coast of North America. West Indies.

var. ventricosa (Greg.) Cl.

Cl. l. c. p. 135. *Amphora v.* Greg. Diat. of Clyde p. 511, pl. XII, f. 68.

Not unfrequent. Moskenstrømmen r. Stamsund r. the Ostnesfiord r +. Stene r. Gaukværo +.

Answers completely to Gregory's species, but is very variable.

Distribution: Coasts of the North Sea. Sweden. Arctic regions. The Mediterranean. Red Sea.

Epithemia Bréb.

E. turgida (Ehrb.) Kütz.

Kütz. Bacill., pl. 5, f. 14. Van Heurck Synops., pl. 31, figs. 1—2. *Navicula t.* Ehrb. 1830.

Fresh water species.

var. Westermanni (Ehrb.) Grun.

Grun. in Wien Verh. 1862, p. 325. Van Heurck Synops. p. 138, pl. 31, f. 8. *Navicula W.* Ehrb. 1833.

Very rare: Gaukværo, r; Moskenstrømmen, r.

Distribution: In brackish water. Coasts of the North Sea.

E. argus (Ehrb.) Kütz.

Kütz. Bacill. pl. 29, f. 55. Van Heurck Synops. pl. 31, figs. 15—17. *Eunotia argus* Ehrb., Mikrogeol. pl. XV A, f. 59.

Very rare: Brettesnes—Skroven r. Gaukværo r.

Distribution: Fresh water species; also in brackish water. Frequent, especially in Northern Europe and in alpine localities.

E. zebra (Ehrb.) Kütz.

Kütz. Bacill. pl. 5, f. 12; pl. 30, f. 5. Van Heurck Synops. pl. 31, figs. 9, 11—14. *Eunotia z.* Ehrb. Inf. p. 191, pl. 21, f. 19.

Very rare: Gaukværo r. Stene r.

Distribution: Common fresh water species.

E. musculus Kütz.

Kütz. Bacill. pl. 20, f. 6. Van Heurck Synops. pl. 32, figs. 14—15.

var. constricta (Bréb.) V. H.

Van Heurck Synops. p. 140; Traité d. Diat. p. 297, pl. 9, f. 360. *Epithemia c.* Bréb. in W. Sm. Brit. Diat. I, p. 14, pl. 30, f. 248.

Very rare: Svolvær r. Gaukværo r.

Distribution: Coasts of the North Sea and Western Europe. The Mediterranean.

E. gibberula Kütz.

Kütz. Bacill., pl. 30, f. 3. Van Heurck Traité d. Diat., p. 297, pl. 30, f. 825.

Rare: Svolvær, r.

var. producta Grun.

Van Heurck Synops. pl. 32, figs. 11—13.

Rare: Stamsund, r.

Distribution: Marine, also in brackish and fresh water (*var. producta* Grun.), frequent in Europe and America.

***Rhopalodia** gibba* (Ehrb.) Otto Müll. 1895.

Epithemia gibba Kütz. Bacill. p. 35, pl. 4, f. 22. Van Heurck Synops. p. 139, pl. 32, figs. 1—2.

var. ventricosa (Kütz.) Grun.

Grun. in Wien Verh. 1862, p. 327. *Epithemia ventricosa* Kütz. Bacill. pl. 30, f. 9.

Very rare: Gaukværo, r; the Ostnesfiord, r.

Distribution: Common fresh water species.

General remarks on the character of the bottom diatom flora.

The most striking facts regarding the distribution of the diatoms in the foregoing list of bottom species are, that the arctic forms are rare and that the flora, on the whole, has a much more pronounced southern character than would be expected from the geographical situation. This is in sharp contradistinction to the character of the diatom flora during „the diatom inflow" of plankton species in spring (cf. above p. 88), when the actual arctic species predominate.

Generally speaking, the bottom flora shows a remarkable agreement with that of the east coast of Scotland. It is especially striking that a great many of the species described by Gregory in Diatoms of the Clyde (1854) are common to these two regions, situated at a rather considerable distance from each other. On the other hand, these species also occur on the west coast of Norway, at any rate most of them. It may, consequently, be concluded that the characteristic western bottom flora of diatoms which inhabit the coasts of the North Sea extend to the north as far as to past the Vest-Fiord, probably, however, but little farther.

For the sake of clearness, I divide the species found into 6 groups:

I. The actual arctic species, only found in the arctic region.

II. Species with a western and arctic distribution.

III. Species with a very wide distribution, occurring from southern regions right up into the arctic one. Some of these species seem to be cosmopolitan. In Europe, the species belonging to this group are generally found from the Mediterranean to the arctic regions.

IV. Western species, especially known from the coasts of the North Sea, but not before mentioned from the arctic zone.

V. Species with a southern and western distribution, generally occurring from the Mediterranean — or still farther to the south — to the coasts of the North Sea.

VI. Species with only southern distribution, not before found so far north as on the coasts of the North Sea.

Most of the species observed belong to group III, and many of these species will probably later on be found to have a still wider distribution than is at present known. For such more or less decidedly cosmopolitan species, a thorough treatise on their varieties and forms is a very important and valuable work, indispensable when one wishes to obtain an accurate knowledge of the distribution of identical and closely related species. Notwithstanding the extensive material consisting of an immense number of facts and observations, often made with the utmost care and accuracy as to details in structure, we are still obliged to acknowledge with regret that our knowledge of the individual variations and real constancy of the various distinguishing characters is very deficient.

These species play an unimportant part with regard to the character of the flora. It is, however, an interesting fact that, apparently, so many species of diatoms are common to most seas of the world. Even if a good many of these widely distributed species, on a more thorough examination, should prove to consist of similar, but separate species, having different areas of distribution, there will still remain a great number of species which, in Europe, occur from the Mediterranean to the Arctic Sea. It must, however, be remembered that the valves of diatoms are almost of eternal duration and that thus fossil valves will enlarge the apparent area of distribution of the still living species.

Most of the species of this group III are probably recent ones, a great number of them being observed alive on the west coast near Bergen.

Next to group III it is group V, which contains the greatest number of species. Many of them have a predominating southern distribution, but occur, more or less frequently, as far north as the coasts of the North Sea. To this group belong the following (a few of which might perhaps rightly be reckoned to another group):

Coscinodiscus Rothii.
Biddulphia pulchella (a broken valve, Tromso, Cl.).
B. regina (only exceptionally found as far north as Scotland).
B. fucus (once found in Spitsbergen).
B. alternans.
B. punctata.
Synedra undulata.
S. Hennedyana.
Raphoneis nitida.
Dimeregramma minus.
D. fulvum.
Glyphodesmis distans.
Grammatophora serpentina.
Nitzschia punctata.
N. acuminata.
N. bilobata.
N. lanceolata (α).
Campylodiscus eximius.
Surirella fastuosa.
Achnanthes longipes.
Pleuroneis distans.
P. britannica.
Donkinia recta.
Pleurosigma rigidum.
P. formosum.
P. speciosum.
P. balticum.
Scoliotropis latestriata.
Caloneis consimilis.
C. blanda.
C. musca.
Stauroneis salina.
Navicula moniliformis.
N. latissima.
N. compressicauda.
N. superimposita.
N. palpebralis α, var. *Barclayana*, var. *angulosa.*
N. praetexta.
N. clavata.
N. forcipata var.
Pinnularia claviculus.
P. Trevelyana.
Diploneis coffeiformis.
D. lineata.
D. (*contigua* var.) *eudoxia.*
D. notabilis (var. *expleta*).
D. fusca var. *Gregorii.*
D. major.
D. nitescens.
D. sejuncta.
D. didyma.
D. chersonensis.
D. crabro et var. *pandura.*
Mastogloia apiculata.
Amphora proteus var. *contigua.*
A. macilenta.
A. costata.
A. binodis.
A. sulcata.
A. alata.
A. obtusa.
A. spectabilis.
A. ocellata.
Epithemia musculus.

Many of these species were for the first time described and illustrated in the work by Gregory above mentioned.

All these species have not previously been mentioned from the arctic zone. To this group should properly also most of those be reckoned which are previously known from the arctic zone, but only from the coast of Nordland („Finmarken").

Less numerous are the species of a mere western European distribution, group IV. Such species are, however, on the whole not numerous. Here belong the following species:

Coscinodiscus apollinis var. (west coast of Norway).
C. Normanni. C. fasciculatus A. Schm.
Actinocyclus crassus.
Actinoptychus splendens.
Biddulphia turgida.
Synedra baculus.
Nitzschia litorea.
N. navicularis (Spitsbergen?).
Campylodiscus parvulus.
Cocconeis lyra (west coast of Norway).
Pleurosigma attenuatum (?).
Caloneis liber.
Schizonema cruciger um (?).
Navicula northumbrica.
N. peregrina var. *kefvingensis.*
N. praesecta (west coast of Norway).
Diploneis hyperborea var. *excisa* (west coast of Norway).

These species, the first and the last ones only excepted, are common to Great Britain and Norway.

A closely related group is group II, including species with a predominating western area, though also occurring right up to the arctic zone. These are the following:

Coscinodiscus Kützingii.
Hyalodiscus scoticus.
Biddulphia rhombus.
B. Smithii.
Nitzschia apiculata.
Campylodiscus angularis.
Rhoicosigma arcticum.
Caloneis brevis.
Navicula directa et var. *subtilis.*
N. fortis.
N. distans.
N. palpebralis var. *semiplena.*
N. pygmaea.
Diploneis hyalina.
Amphora laevis.

The genuine arctic species, belonging to group I, are few:

Coscinodiscus borealis.
Actinocyclus alienus?
Biddulphia arctica.
Synedra kamtschatica m.
S. rostellata.
Grammatophora arctica.
Nitzschia Mitchelliana.
Gomphonema kamtschaticum.
Amphora groenlandica.
Diploneis entomon Cl., p. p. (=
D. subcincta var. *media*).

All these species, except the last one, are besides very rare.

At last we have the remarkable group VI of only southern forms, partly only known from regions situated far to the south or even only from the tropical zone. Their distribution (as earlier known) extends northwards only as far as to the Mediterranean. To this group belong:

(*Coscinodiscus leptopus* *cerus*).
C. nodulifer.
Aulacodiscus Kittoni.
A. Johnsonianus.
Biddulphia regina var.
B. lata.
Nitzschia (*insignis* var.) *spathulifera*
N. coarctata.
N. (*Smithii* var.) *notabilis.*
Amphora Graeffii.

There may, however, be some doubt as to whether the forms observed of *Biddulphia lata* and *Amphora Graeffii* are identical with those, which usually occur in southern regions. Moreover, *Coscinodiscus leptopus*, *Nitzschia spathulifera*, *N. coarctata*, *N. notabilis* and *Biddulphia regina* var. are all very rare and scarce. There remain, however, *Coscinodiscus nodulifer* and the two species of *Aulacodiscus*, all of which occur in comparatively large numbers, and in several samples. These species are easily recognizable, and have a pronounced tropical area of distribution.

Probably these species are all fossil, but I cannot at present with certainty decide this. *Coscinodiscus nodulifer* has most probably occurred as a plankton species.

All the species of groups IV, V and VI, a considerable number of species in all, have not before been known from the arctic zone.

Index.

IV. COMBINATION

OF

HYDROGRAPHICAL AND BIOLOGICAL FACTS.

NOTES.

In this section I have given some facts, which it has occurred to me might be of practical interest. It is, however, quite impossible to define clearly between practical and purely scientific marine investigations.

A. The natural Conditions of the Fiords.

One of our historians relates, that in a fragment of an ancient Irish annal it is told, that in the year 872 „one of the two Norwegian kings in Dublin, Ivar, went with a large army from Ireland to Lochlann (Norway) to aid his father who was at war with the king of Lochlann."[1])

It must be said that the ancient Irish had found a particularly suitable name for the land, which is also in modern tourist language made famous as „the land of fiords". The Norwegian series of fiords presents many interesting problems to the naturalist too, and a thorough examination of them will undoubtedly serve to throw light on many questions.

If one sets to work to make a thorough scientific investigation of a fiord, the facts obtained may be divided into three principal groups; those concerning the shape and situation of the fiord (topography), or concerning the medium with which the fiord basin is filled (hydrography) or concerning the plants and animals contained in it (biology). The object in view, in case of such an examination, should be to gain the greatest possible insight into the biological phenomena, but in order to attain this end, one will be compelled to study most carefully the topographical and hydrographical conditions of the fiord. As a part of the *topography* of the fiords one must, I think, consider such things as their geographical position, proportionate size, subdivisions, relative depths, the occurrence of barriers, rocks under water, holms and islands. In addition to these things, the nature of the bottom and the surrounding hills, the geological history of the fiord (e. g. the rise and fall in the shore line) etc., must be taken into consideration as belonging to the topography of a fiord. To the *hydrography* of the fiords may be reckoned all the facts and qualities concerning the medium which fills their basins, such as salinity, temperature, gascity, transparency, the motions of the water (currents, waves, tides), formation of ice, inflow of rivers or streams etc. Finally, atmospherical conditions must also be taken into consideration as playing an important part in the physical state of a fiord (e. g. temperature, downfall, prevailing winds, atmospheric pressure etc.).

The *biology* of the fiords will include vegetable and animal life in their waters, at the bottom and in the bottom mud. The plan here suggested for the examination of a fiord must, I think, be taken to be tolerably complete, and I will look upon it as a guide in my future work. I must, however, at once confess that the investigations I have hitherto made in northern Norway do not make it possible to fill in very much of the frame work I have set up in the foregoing lines. I will, nevertheless, build up the skeleton in the hope that it may be solidly covered later on.

a. Topographical Notes.

The Geographical survey of the Norwegian coast has given us maps, in which very much of what I call the topography of the fiords is made clear. But the complete mapping out of the northern fiords is not yet finished. A good deal of information about the fiords will also be found in Prof. A. Helland's[2]) topographical works, and a description of the ground through which the fiords have dug their way, will be found in „Det nordlige Norges geologi" (The Geology of Northern Norway) by Dr. H. Reusch. The problem of the fluctuations in the shoreline are treated in detail by Dr. Andreas Hansen.[3]) In a hydrographical paper concerning the western fiords,[4]) I have touched upon the effect which changes in the level of the sea have upon these inner parts of the fiords which are connected with the principal fiord by comparatively shallow currents.

As regards these currents, it seems pretty generally to be the case that they have forced their way through moraines, which in many instances cause the comparative continement. Helland[1]) mentions examples of this, in Kvænangen, both the „Stor"- and „Lille strømmen" having forced themselves through old moraines. It is most probable, that the majority of the so-called „strømme" (currents) in the fiords, run over such moraines.

With respect to the situation of a fiord, it is not only its geographical latitude which is of importance for its vegetable and animal life, a very weighty factor is also its relative position to the prevailing current in the surrounding ocean. Let us make an experiment. We cut a section along the 22nd degree of longitude (E of Greenwich) towards the boundary line of Finland and continue to cut along the boundary to Jacob's river on the south side of the Varanger Fiord. Then we turn this section around the point where the longitudinal line and the shore line of the continent intersect, so that the fiords of Finmark will lie in a direction which is approximately E—W. These fiords will then undoubtedly undergo a change in their biology, and notwithstanding that they were

[1]) Loch = lake, fiord.

[2]) Lofoten og Vesteraalen. Tromsø amt.

[3]) Norges geol. undersøgelses aarbog f. 1896—99.

[4]) Studier over naturforholdene i vestlandske fjorde. I. Hydrografi. Berg. Mus. aarb. 1903, no. 8.

[1]) Tromsø amt. II. p. 349.

now further north, the change would quite certainly be such that several boreal species would occur there, while some of the arctic ones would die out, or possibly retire into the innermost parts of the fiords. Such a change would take place, because the fiords in this way would have been brought into closer contact with the heat axis of the northwards flowing current.

On the relative depths of the fiords, I have made some remarks in the first part of this work, and reference should also be made to the coast maps. The Finmark fiords are of rather a different character than those in Nordland and Tromso amts, for they are comparatively shallow. An explanation of this has been given by Dr. ANDREAS HANSEN[1]) who writes: — „When the highland ceases in Finmarken, the fiords too acquire another character. They become broader and shallower, less typically formed basins in the loose schist, beds, indeed, for less active and less concentrated glacier-streams, because here, in the low plateau country, there were not originally such deep cañons to determine the course of the glaciers, as on the western slope of the mountains." As a general rule it may be said that there is a deep channel in the fiords with a muddy bottom. On either side, there is a bank or edge of land, which in some cases is evenly sloped, but generally has a most uneven surface. It is, nevertheless, in many instances, possible in a definite section to speak of the angle of inclination of the bank of land.

It is clear that, the depth being the same, the side surfaces will increase in proportion to the diminution of the angle of inclination, as will be seen from the figure below, which represents a transverse section through a fiord.

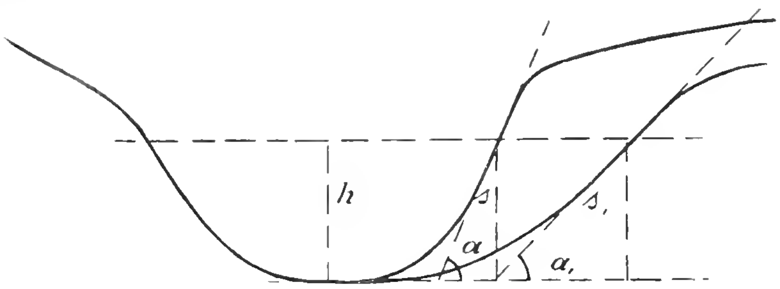

Fig. X.

If in the one case, the line of intersection between the side-area and the transverse section be s and the angle of inclination α, and in another case the corresponding values be s_1 and α_1 we get: —

$$s = \frac{h}{\sin \alpha}$$

$$s_1 = \frac{h}{\sin \alpha_1}$$

$$s : s_1 = \sin \alpha_1 : \sin \alpha.$$

Are the side surfaces (S and S_1) taken to have equally long ground lines, or if one will, shore lines, but with different angles of inclination (α and α_1) one gets, according to elementary geometrical law: —

$$S : S_1 = s : s_1 \text{ but hence follows: —}$$

$$S : S_1 = \sin \alpha_1 : \sin \alpha.$$

[1]) Norway, Official Publication for the Paris Exhibition 1900, p. 17.

The side surfaces are thus in inverse proportion to the sinus of the angles of inclination.

Eg. $\alpha = 90^0$, $\alpha_1 = 30^0$, and then: —

$$S : S_1 = \frac{1}{2} : 1$$

$$S_1 = 2\ S.$$

When the angle of inclination is 30^0, the side surface will thus be double as large as it is when the land bank is perpendicular.

This little mathematical exposition is valuable in so far as it plainly shows that the space which is available for the distribution of animals depends, to a great extent, upon the angle of inclination of the edge of land. And it gains in interest when it is remembered that experience proves that the edges, both in the ocean and the fiords, teem with animal life.

The presence of islands, holms, rocks etc. in a fiord must also be said to be important factors in the animal life of a fiord. They all tend to increase the extent of the particularly productive areas.

Another important factor in the vegetable and animal life of a given district, is the occurrence of a belt of skerries („skjærgaard"). With respect to navigation, such belts of skerries act as powerful breakwaters. And as such they are biologically too of importance, and of course the many islands, holms and rocks, with their rich algae vegetation, greatly increase the number of specially productive surfaces.

Mr. M. FOSLIE of Trondhjem has kindly given me some information about the influence of such a „skjærgaard" on algae. He writes that where there is none it will, amongst other effects, also be found that the number of species is less. If the coast be an open one, a number of species which require more or less protected spots is as a rule absent. With Mr. FOSLIE's permission, I quote a part of his letter to me, he writes: — „Those species which are principally found on the open coast, will also generally be found inside the „skjærgaard" or in the larger fiords, but usually in the most exposed places, and even there they are not so strong and well developed as on the ocean coast. An illustration may be found in the large Laminarians. *L. hyperborea* and *L. digitata* are always large and strong in the open sea, but decrease in size and change their shape the further in one finds them. A total absence of some „breakwater" or other often results in the tearing away of large quantities of algae, which the autumn and winter storms drive ashore. I have, for instance, seen immense masses of Laminaria cast in, especially in Berlevaag and Loppen. On the other hand, there are species which are less hardy, and they are smaller on the open coast than in more sheltered places, even if they are found on the coast. They then go further down, where the rush of the waves is less. Therefore, especially along the coast of East Finmark, there are many places where vegetation seems to be poor and only to consist of a few species, while there is comparatively rich vegetation in fairly sheltered bays."

An exceedingly important factor in the hydrography and biology of the fiords, is their relative position to the prevailing summer and winter winds, and a closer study of these things will probably throw light upon many matters which hitherto have been uncertain.

b. Hydrographical Notes.

In the first part of this work, a number of hydrographical data from the fiords will be found. Now I will mention a few more details, and treat of some things which have not yet been mentioned. First then, some remarks on the influence which the prevailing winds, waves and tidal currents exert on vegetable and animal life in the sea.

In a very interesting paper, Mr. F. W. Harmer has recently explained the importance of the prevailing winds as a geological factor.[1]) Mr. Harmer calls attention to the fact that dead shells are not found in large numbers on the eastern shores of the counties of Norfolk and Suffolk, although there is no want of molluses in the adjacent sea. The reason for this absence of shells is found by Mr. Harmer in the fact that the prevailing winds at present are westerly. On the contrary, the presence of Crag beds on the east coast presupposes a different prevailing wind from that which is now the case.

„Easterly gales might have been prevalent in that part of the North Sea, rather than those from a westerly quarter, as at present." In another paper, Mr. Harmer[2]) has drawn attention to the tidal currents as a geological factor.

He points to the state of things in the Irish Sea, „where an accumulation of dead shells on the Turbot bank, off the coast of Antrim, is caused by the tidal currents which sweep with much velocity through the narrow channel separating Ireland from Scotland." The fact that in some places in Coralline Crag, layers of large shells may occur, while at other places smaller shells are predominant, is considered in the light of tidal currents, for Mr. Harmer says: — „Shells are sorted out by currents of varying strength as pebbles in beds of gravel; small specimens would therefore have accumulated in one place, larger ones in another, and comminuted shells, or fine calcareous sand in a third."

Wind and current are not of little importance in dynamical geology, on account of their carrying power. But just this characteristic causes these factors also to have an influence, in different ways, upon living creatures. The course of a current offers particularly favourable conditions for the nourishment of plankton-eaters, and a current-facies of animals may be spoken of. It is true that animal life is not profuse where the deposits of material are greatest, but, on the whole, it is correct to say that the bed of a current is profusely supplied with animal life.

In a purely theoretical light, the supply of plankton for a given animal must be in proportion to the velocity of the current. It is, at any rate, evident that the motions of the water are of great importance in connection with the supply of nourishment for plankton-eaters.

Dr. Edward Browne[3]) has drawn attention to the fact that medusae, which are kept in an aquarium where the water is undisturbed, will at first swim quickly about, „but in a few hours, it sinks to the bottom, apparently tired out. After an interval of rest, it takes another swim, and again sinks to the bottom. This is repeated until the medusa becomes exhausted; then it stays at the bottom and slowly dies." This unfortunate state of things has been remedied by Dr. E. T. Browne and Dr. E. J. Allen having succeeded in constructing an apparatus by means of which the movements of the water have been skilfully imitated. Mr. Dannevig's hatching apparatus is constructed on a similar principle. With regard to the force of the tidal currents, it will easily be seen that this will depend upon the height of the tide, i. e. the difference between ebb and flow. In the north of Norway, this difference is, on an average, about 2 mtrs., and as a consequence of this, the tidal currents are considerably strong in the narrow channels and in the smallest parts of the fiords. Based upon material furnished by the Norwegian „Gradmaalingskommission",[1]) I will give some figures which show the average difference between high and low tide in succession in 1884 and 1885.

	1884.	1885.
Stavanger	0,424 m.	0,427 m.
Bergen	0,988 „	0,975 „
Kabelvaag	2,040 „	2,014 „
Vardo	2,195 „	2,175 „

Generally speaking, it may be said that the tidal wave runs northwards along the coast, and the tidal currents flow into the fiords when the tide rises and outwards when it falls.

In the channels of the „skjærgaard", it may be taken as a general rule, that the direction of the current is northerly or easterly when the tide rises, westerly or southerly when it falls. But it must be remarked that in many channels the direction of the current changes a little after the water has been at its highest and lowest. In the currents running between the islands of Lofoten (Gimsostrom, Napstrom, Sundstrom etc.) the water at first flows northwards when the sea is at half-high-tide and turns again at half-low-tide. The same is said to be the case in the currents which connect the Skjerstad and Salten Fiords. The best known of these is the socalled „Saltstrom", which surpasses even „Moskenstrommen" in force.

I have attempted, in an article on the two mael streams in Norway, (de to store malstromme i Norge)[2]) to explain the change in the direction of currents at half-high and half-low-tide, and have theoretically worked out the following conclusion: — If the inner part of a fiord be connected by a current with the principal fiord, and the direction of this current be changed after high and low tide, the difference between ebb and flow will be less inside than outside the said current.

Thus, the difference between the niveau at high and low water should be less in the Skjerstad than in Salten Fiord. I have not as yet had an opportunity of verifying this theoretical conclusion.

Concerning the direction of the surface stream along the coast of Norway, Mohn's current map is very instructive.[3]) The following amusing little story shows that there, in the summer, may be an easterly current along the coasts of Finmarken. Sophus Tromholt[4]) relates that in the beginning of the eighties S.S. „Nordstjernen" was in the summer wrecked on Knivskjælodden, a little west of the North Cape, and very soon sank. A couple of months later, the vicar of Næsseby had rowed out a little way in

[1]) Influence of Winds upon Climate during the Pleistocene Epoch. Quart. Journ. Geol. Soc., vol. LVII, 1901, p. 408.

[2]) A Sketch of the later tertiary History of East Anglia. Proc. Geol. Assoc., vol. XVII, 1902, p. 425.

[3]) On Keeping Medusae alive in an Aquarium. Journ. Mar. Biol. Assoc., N. S. Vol. V, no. 2. 1898.

[1]) Cf. Vandstandsmaalinger, h. IV, p. 124.

[2]) „Naturen" 1901, p. 305.

[3]) The North Ocean, pl. XLIII.

[4]) Under Nordlysets Straaler, p. 557. Copenhagen 1885.

the Varanger Fiord and suddenly he caught sight of a little box floating in the water. On closer examination, he found, to his great surprise, that his own name and address was written on it.

It had been sent by the „Nordstjernen" from Kristiania, and after the wreck of the vessel „the clever little box" had found its own way to its destination, which is a fanciful expression of the fact that winds and waves had carried it to the inner part of the Varanger Fiord.

Outside the prominent rocks of Finmarken, the tidal currents are very strong, the direction being easterly when the tide rises, and westerly during its fall.

I have had personal experience too of the strength of tidal currents. In the summer of 1894, in the course of a zoological expedition in Finmarken, I was out in a little boat on August 14th and had three men with me. I intended to pass Nordkyn going west. We had been sailing a little while, but the wind ceased and we were obliged to try to row; this was exactly opposite Nordkyn. The stream was, however, against us, and it proved to be utterly impossible for us to make any headway. Fortunately the water was so shallow just here that we were able to anchor until the current slackened.

That the tidal currents have a considerable carrying capacity, I have also noticed in Nygaardsstrommen at Bergen, very near the Biological station. Not only large mussels but mediumsized specimens of a star-fish (*Asterias rubens*) now and then sail along with this current. So it is not strange that bottom forms, as for instance *Foraminifera*, are often found in plankton. Currents and winds play also an important part in the fact that plankton is heaped up in quantities at certain special places. A closer study of this subject will undoubtedly throw light on things connected with the catch of plankton-eaters, such as herrings, sprats etc.

Lately, it has become clear to me that the downfall plays an important part in the hydrography and biology of the fiords. My thoughts were first turned in this direction, when I noticed that an increase of salinity occurred in the fiords of northern Norway, from January and throughout the spring. In the fiords in the neighbourhood of Bergen too, I have seen that the surface salinity is greatest in the winter, as the downfall then is least and there is a portion which does not exert its influence for the time. One would then expect that the great difference in downfall in the west and north of Norway would be remarkably felt, and this is clearly shown to be the case.

A closer study of the downfall also gives an explanation of the fact that the deeper layers in the Porsanger Fiord have such a low temperature. According to GRAN,[1] Dr. HJORT found on the 24th of August 1900 the following conditions in Osterbotten, which is connected by a shallow channel with the rest of the Porsanger Fiord: —

d.	*t.*	*s.*
0 m.	$7^0.00$ C.	under 32.00 ‰
20 „	$4^0.13$ „	33.51 „
50 „	÷ $0^0.07$ „	34.24 „
90 „	÷ $1^0.02$ „	34.29 „

According to MOHN,[2] the annual average temperature at Kistrand, which is in the inner part of the same fiord, is $0^0.8$ C.

[1] Das Plankton des norwegischen Nordmeeres. Rep. Norw. Fish. and Marine Investigations, vol. II, nr. 5, 1902, p. 142.

[2] Klimatabeller for Norge, I, p. 18.

The annual average downfall for the years 1896—1902 at Olderoen at the end of the Porsanger Fiord is reckoned to be 374 mm.[1]. In the years 1899 and 1900, the downfall for the different months was found to be as follows:[2]) —

Olderoen.
Downfall.

	1899	1900
	mm.	mm.
January	18	16
February	22	15
March	25	28
April	12	2
May	11	5
June	2	24
July	62	94
August	30	69
September	11	23
October	20	17
November	32	67
December	10	49
Year	255	409

As a consequence of the slight downfall in the winter, the salinity of the surface layers constantly increases, and in this way there is a tendency to great regularity both in the temperature and salinity of the layers.[3]) But under these circumstances, the cooling of the surface by means of the vertical current will be felt far down. (Cf. Hydrography, p. 17) and the cold of the arctic winter will, in this way, penetrate down into the deeper layers. When the state of things is like that in Osterbotten, where a shallow channel effects the connection with the fiord, the warm undercurrents cannot penetrate. Then too, the summer downfall is much more effective than that of the winter, so the mixing on the surface in the summer will serve to prevent the summer heat from penetrating downwards. Taken together, these things will, I think, explain Dr. HJORT's surprising statement of ÷ 1.02 at a depth of 90 mtrs. in Osterbotten, and will also give a clue to the fact that most of the arctic animals are found in the inner parts of the fiords. It should also be remembered that the longer a fiord is, the more will the continental influence be felt.

In western Norway, a different state of things is found in such shut-in basins as Osterbotten. I have studied conditions in the Lyse and the Mo Fiords, both of which belong to districts which form centres for the maximum downfall in Norway. At the station Nedrebo, in the Lyse river district, the average fall from 1896—1902 was 2 169 mm.; and at the station Farstveit, in the Mo river district, it was 2 733 during the same period.

I beg to refer to what I have recently written about these fiords.[4]) Now I will only mention that while the bottom water in Osterbotten contains degrees of cold from the winter, the bottom

[1] Nedbøriagttagelser i Norge, aarg. VIII, 1902, p. 125.

[2] Cf. Nedboriagttagelser, aarg. V. VI.

[3] Cf. Hydrogr. Tables nrs. 833—846.

[4] Studier over naturforholdene i vestlandske fjorde. I. Hydrografi. Berg. Mus. Aarb., nr. 8. 1903.

water in the Mo and Lyse Fiords had a temperature corresponding to the average annual atmospheric temperature of the place. Also in the latter fiords, submarine ridges prevent the warm bottom water from penetrating in, and, moreover, the supply of fresh water in the winter is so great that the vertical current is prevented from assuming any large proportions. The transmission of heat downwards takes place principally by conduction. A maximum in the autumn and a minimum in the spring find their way gradually downwards, and finally an average is reached, which corresponds to the annual average atmospheric temperature.[1] The Skjerstad Fiord must probably be classed with the Mo and Lyse Fiords. The bottom water is homotermic (cf. Hydrography, p. 14), the supply of fresh water is sufficient to prevent the winter cold from penetrating down into the depths.

The station Sulitjelma, in the Vatnbygd river district, had an average fall of 1 097 mm. in the years 1896—1902, and the station Graddis, in the Salt river district, during the same period had an annual average of 533.[2] According to MOHN,[3] the annual average temperature at Bodø is 4°.1 C. and at Ranen 3.5. On August 17th 1877, the Norwegian North Atlantic Expedition found that the temperature in the Skjerstad Fiord at a depth of about 500 mtrs. was 3.2. On April 4th 1900, I registered at the same depth 3°.15 C. If one now considers these two atmospheric averages, it would seem that 3.2 is a probable value for the annual average temperature of the air in the Skjerstad Fiord.

If we, however, imagine the large basin of the Skjerstad Fiord moved to the inner part of the Porsanger Fiord, and with the same connections with the latter as it now has with the Salten Fiord, we should certainly find that the bottom temperature would be considerably lower than that of the annual average of atmospheric temperature in the inner part of the Porsanger Fiord. For, from what has already been said, it will be seen that the supply of fresh water at the latter place is not sufficient to prevent an evening out of its salinity in the winter, thus allowing the winter cold to exert its influence on deeper layers of water.

In some of the lesser fiords adjacent to the Vest Fiord, I have also noticed that the bottom temperature has been lower than the annual average atmospheric temperature, which would imply that somewhat of the winter cold has found its way downwards.

Examples of this fact may be found in Rombaken, Skjomen, the Ogs Fiord etc. Such places excel in many arctic forms. These fiords have already been referred to, and I would call attention to what has been said about them in previous pages and also to Pl. 19, where the curves VI, VII, VIII represent the conditions of temperature in Skjomen, the Ogs and Skjerstad Fiords. The curves for Skjomen and the Ogs Fiord are especially characteristic on account of their slight bend, which is a sign of a uniform salinity.

The temperature curves for Tranødybet, the Tys Fiord and Oxsund are given so that comparisons may be made. (Pl. 19, curves I, II, IV, V), all the curves are very much bent in the upper layers, where there is great variation in salinity, but in the layers where there is uniform salinity they become almost a straight line. Curves III and IV, which represent the conditions of temperature in March 1899 in the sea off Røst and in the Tys Fiord, show plainly that a higher temperature prevails in the deeper layers in the fiords than in the corresponding depths in the Norwegian Sea. As I have already stated, the reason for this is to be found in the fact that such fiords as the Tys Fiord are of such a formation as excludes the arctic bottom water from the Norwegian Sea, but gives admittance to the warm Atlantic waters which fill the basins. Then too the fresh water which flows into the fiord from the land, is sufficiently large in quantity from the Bokn Fiord to the Vest Fiord to prevent the winter cold from penetrating downwards to any considerable depth.

There is another thing which one might suppose to be, to some extent, dependent upon the variation in downfall, I mean the height of the water on the coasts.

From „Vandstandsobservationer", published by „den norske gradmaalingskommission" I have on pl. 20 drawn some curves, which give the monthly average height of the water at Kabelvaag and Vardø in the years 1882, 1884 and 1885.

The measurements have been made with selfregistering instruments at 0, 1, 2, 3 etc. hours after the moon's culmination and from these results the average has been calculated. Taking it for granted that the 0 points have been unaltered, and that the instruments in other respects too have been quite reliable, one must be able, by help of the data thus obtained, to form a wellfounded opinion of the variations in the rise and fall of the water, in the course of the year, on the northern coasts. A glance at the curves (I—VI, Pl. 20), will show that there is at any rate one thing which cannot possibly be accidental, the curves show a definite tendency to a minimum in April. Similarly, too, a maximum can be arrived at for the months November—January, while the remaining variations suggest accidental causes.

On the same plate the curves representing the average monthly downfall at Svolvær, which is situated near Kabelvaag and Vardø, are given. Both these curves show a decrease during the first months of the year up to May, in which month the year's minimum downfall is reached. The Svolvær-curve shows a maximum in November, and the Vardø-curve in October. There is this point of resemblance between the water-heights and downfall curves, that they generally show a decrease during the first months of the year, respectively up to April and May, but it cannot at all be said that the decrease in heights is caused solely by the decrease in downfall. Of course the variations in downfall exert some influence on the height of the coast water, but as regards the north of Norway, it will easily be seen on comparing the curves that this influence is by no means sufficient to account for the great differences in height. It should be remembered that 1 cm. is taken as the unit for the height, and 1 mm. for the downfall curves.

At Svolvær, the amplitude of the curve representing the average, monthly downfall is 8.3 cm., the corresponding value at Vardø is 5.3 cm. The observations made of heights have not been so complete that it has been possible to calculate the normal average for each month, but on the basis of the amplitudes of the Kabelvaag and Vardø curves, we get: —

	Amplitude.		Amplitude.
Kabelvaag 1882	61 cm.	Vardø 1882	52 cm.
— 1884	60 „	— 1884	35 „
— 1885	45 „	— 1885	47 „

These figures show, with all desirable clearness, that the variations in the course of the year are so considerable, that they

[1] Cf. Studier over naturforholdene i vestlandske fjorde, p. 46.
[2] Cf. Nedbøriagttagelser i Norge, aarg. VIII, p. 125.
[3] Klimatabeller for Norge I, p. 18.

can only in a slight degree be caused by the variations in downfall from one month to another. The principal cause must be looked for in another direction, and one naturally turns one's attention to the distribution of atmospheric pressure, which, as is well known, determines the motions in the air — atmospheric currents —.

Dr. ANDREAS HANSEN[1]) has called attention to the fact that the maximum atmospheric pressure in the spring and the minimum height of the water, and the minimum midwinter barometric altitude and the greatest height of the water are, practically speaking, correspondent.

Prof. MOHN[2]) in his meteorology, has given the atmospheric pressure curves at Stykkisholm, in Iceland, and Gjesvær, near the North Cape, and with respect to the course of these curves, he says that, on both sides of the Norwegian Sea, the atmospheric pressure is lowest in the winter and highest in May.

The lowest atmospheric pressure from January—May, we should expect to find somewhere in the Norwegian Sea, and this is seen to be the case from MOHN's chart (l. c. p. 173) where a minimum is given at the NE of Iceland. This minimum is maintained, according to Prof. O. PETTERSSON,[3]) by the upper layers of water in the Norwegian Sea giving off heat to the atmosphere.

At any rate, it appears to be certain that the distribution of the atmospheric pressure on land and sea during the winter causes such winds as help to sweep the water away from the coasts.

It is probable that the most important causes of the annual fluctuations in the height of the water on the northern coasts may be found in the different distribution of atmospheric pressure in summer and winter and the winds which are dependent upon this.

On pl. 21, I have given the down-fall curves for 1899 with crossed lines for the stations at Svolvær, Skomvær, Tromsø and Alten, and have based them upon „Nedboriagttagelser" (Observations on Downfall) published by the Norwegian Meteorological Institute. Similarly, the normal curves for the same stations are given in straight lines for a period of observation from 13 to 29 years.

From these curves, it will be seen that, in a single year, there may be great divergence from the normal downfall.

It is evident that the fluctuations in the amount of downfall exert an influence on the temperature and salinity of the sea. By increasing the height of the water in the fiords, the downfall also has some influence in producing currents. In the chapter dealing with the cod fishery in Lofoten, I will try to prove that there is a correspondence between the fishery results and the variations in the distribution of atmospheric pressure, and will, in so doing, use the height of the downfall as a measure of the influence of the winds.

c. Biological Notes.

The problem of the vertical distribution of living beings has occupied many biologists. I will not here treat of it at length, but only mention a few facts.

As far back as 1835, MICHAEL SARS[4]) divided our seaweed belt into the following 4 zones: — (1) That of the *Balanus*, (2) that of the *Patella*, (3) of the corals, and (4) that of the *Laminaria*. The greater depths had at that time been so little examined, that SARS could not attempt any division of the life found there. Since 1835, however, this subject has occupied the attention of many, and several divisions have been made. But I will only give here the one I prefer. Dr. STUXBERG has, in his book „Evertebratfaunan i Sibiriens Ishaf", accepted the same division for the animals as F. R. KJELLMAN[5]) for algae, viz: —

(1) *The littoral zone.*

That part of the bottom, which is laid bare at low water, and which in Norwegian is called „fjæren".

(2) *The sublittoral zone.*

From low water mark to the lower limit for algae.

(3) *The elittoral zone.*

All that is below the lower limit for algae.

According to P. BOYE,[1]) the dividing line between the sublittoral and elittoral zones is fixed by KJELLMAN at a depth of about 40 m. in Bohuslen, and this figure seems to suit the conditions on the southwest coast of Norway too. „On the coasts of Nordland and Finmark", says M. FOSLIE in a letter to me, „algae may generally be found down to 40—50 m., but vegetation mostly occurs to a depth of only about 30 m."

With regard to the vertical distribution of animals, STUXBERG fixes the limit between the sublittoral and elittoral zones in the Siberian polar waters at 30—40 fathoms, but I think it is best to keep to the algologists' limit, for a large number of animals is found in the seaweed zone. As far as I know, Norwegian algologists have accepted KJELLMAN's division, and I would suggest that zoologists also should test its practicability for animals too. If it be necessary to have a finer division, MICHAEL SARS's zones should be given a new trial.

As algae vegetation only reaches down to a certain depth, the quantity will to some extent depend upon the inclination of the bottom. On a rock which forms an angle of 30° with the horizon, there will, other things being equal, be much more algae than if the rock were perpendicular. The space between the shore line and the lower algae limit, which may be called the growing area for algae, has a definite proportion to the angle of inclination. Here again the same remarks as on page 230 are applicable, and the same mathematical explanation stands good. It will be found that the growing areas are in inverse proportion to the sinus of the angles of inclination.

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1) Skandinaviens Stigning. Norges Geol. Unders. Aarb. f. 1896—99.

2) Kristiania 1902.

3) Die hydrographischen Verhältnisse der oberen Wasserschichten des nördlichen Nordmeeres. Bihang t. K. Svenska Vet. Akad. Handlingar B. 23, afd. II, nr. 4

4) Beskrivelser og Iagttagelser, p. VI.

5) STUXBERG refers to KJELLMAN's treatise: — Ueber die Algenvegetation des Murmanschen Meeres an der Westküste von Novaja Semlja und Waigatsch. Nova Acta Reg. Soc. Scient. Ups., Ser. III, vol. extra ordinem editum. Upsala 1877.

1) Bidrag til Kundskaben om Algevegetationen ved Norges Vestkyst, p. 3. Berg. Mus. Aarb. 1894—95. No. XVI.

Notes on the animal life in some of the fiords examined.

In the small fiords surrounding Sandhorno, a few dredgings were made, and the result was so far satisfactory as to enable us to form an opinion of the character of the animal life in these fiords. Of annelides, the following were noticed: — *Harmothoë impar, Lepidonotus cirrosus, Phyllodoce maculata, Nephthys ciliata, N. cocca, Onuphis conchylega, Leodice norvegica, Arenicola marina, Potamilla neglecta, Filigrana implexa, Sternaspis fossor.* In „fjaeren" near Sund farm, several specimens of *Echiurus pallasi* were taken.

Of echinoderms[1]) were taken e. g. *Ctenodiscus crispatus* and *Solaster syrtensis*, and of brachiopods and molluscs: — *Terebratulina caput serpentis, T. septentrionalis, Pecten islandicus, P. septemradiatus, Modiolaria laevigata, Leda minuta, Portlandia tenuis, P. lenticula, Arca pectunculoides, Cardium fasciatum, C. minimum, Astarte banksi, A. sulcata, A. compressa, Neaera arctica, N. obesa, N. obesa var. glacialis, Saxicava arctica, Zirphaea crispata, Margarita groenlandica, Macharoplax obscura, Trochus occidentalis, Amauropsis islandica, Natica affinis, Admete viridula, Bela declivis, B. rugulata, B. tenuicostata, Typhlomangelia nivalis, Trophon clatratus var. gunneri, T. barvicensis, Buccinum undatum, Neptunea despecta, Amphisphyra globosa, A. hiemalis.* Of *Amphipoda* may be mentioned: — *Lepidepecreum umbo, Ampelisca eschrichti, Paroediceros propinquus, Aceros phyllonyx, Parapleustes latipes, Acanthonotosoma serratum, Syrrhoë crenulata.* Of *Decapoda:* — *Pandalus annulicornis, P. borealis, P. brevirostris, Crangon almani, Pontophilus norvegicus, Sabinea septemcarinata, S. septemcarinata* var. *sarsi, Hippolyte gaimardi, H. spinus, H. lilljeborgi, H. polaris, Eupagurus pubescens, Galathea dispersa, Munida rugosa.* Of fish in these small fiords, the following were taken: — *Centridermichthys uncinatus, Drepanopsetta platessoides* and *Lumpenus lampretiformis.* Especially characteristic for the fiord between Sandhorno and Gildeskaal was the large number of *Decapoda.* There was a good fishing place for *Sebastes marinus* in the fiord. There are several boreal forms among the above mentioned animals, but a more thorough examination than I was able to make would probably show that the arctic forms are in the majority.

The Skjerstad Fiord has a fauna which corresponds to that of the fiords surrounding Sandhorno. There too, we made several hauls so that we got a more perfect result. Of *Coelenterata* which were noticed the following may be mentioned:

Lucernaria quadricornis, Alcyonium digitatum, Paraspongodes fruticosa, Cladiscus gracilis, Paraedwardsia arenarea, Actinostola callosa. Of *Echinodermata:* — *Antedon tenella, Ophiura robusta, Ctenodiscus crispatus, Psilaster andromeda, Hippasterias phrygiana, Solaster papposus, Asterias mülleri, Strongylocentrotus droebachiensis, Spatangus purpureus* etc. Of *Polychaeta:* — *Harmothoë impar, H. oerstedi, Leanira tetragona, Eumida sanguinea, Glycera capitata, Onuphis conchylega, Nereis pelagica, Leodice norvegica, Brada villosa, Eumenia crassa, Nicomache lumbricalis, Pectinaria hyperborea, Maldane biceps, Terebellides strömi, Telepus circinnatus, Potamilla neglecta.* Of Brachiopods and Mollusks were observed: — *Waldheimia cranium, Terebratulina septentrionalis, Anomia aculeata, Pecten islandicus, P. vitreus, Nucula tumidula, N. tenuis, Leda pernula, L. minuta, Portlandia lucida, P. tenuis, P. lenticula, Arca pectunculoides, Cardium fasciatum, C. minimum, Astarte banksi, A. crenata, Axinus flexuosus, A. croulinensis, Neaera arctica, N. subtorta, N. cuspidata, Saxicava arctica, Dentalium entale, Siphonodentalium vitreum, Tectura virginea, Lepeta caeca, Puncturella noachina, Natica affinis, Littorina rudis, Rissoa jeffreysi, Scalaria groenlandica* (s), *Admete viridula, Bela rugulata, B. trevellyana, B. tenuicostata, Typhlomangelia nivalis, Trophon barvicensis, Buccinum undatum, B. finmarchianum* (?), *Neptunea despecta, Sipho ebur* (s), *Cylichna alba, Philine quadrata, Philine finmarchica, Dendronotus robustus, Campespe major, Coryphella rufibranchialis, C. nordgaardi.*

Amphipoda: — *Ambasia danielsseni, Calisoma crenata, Tryphosa höringi, Paraphoxus oculatus, Ampelisca eschrichti, Stegocephalus similis, Metopa alderi, Monoculodes longirostris, Aceros phyllonyx, Paramphitoë pulchella, Parapleustes latipes, Syrrhoë crenulata, Rhacotropis helleri, R. macropus, Halirages fulvocinctus, Melita dentata, Ischyrocerus minutus, Aeginella spinosa.*

Isopoda: — *Munnopsis typica, Eurycope cornuta.*

Schizopoda: — *Boreomysis tridens, Erythrops goësi, E. abyssorum, Amblyops abbreviata, Mysideis insignis.*

Decapoda: — *Pasiphaea tarda, Pandalus annulicornis, P. borealis, Sclerocrangon boreas, Pontophilus norvegicus, Sabinea septemcarinata, Hippolyte gaimardi, H. spinus, H. lilljeborgi, H. polaris, Eupagurus pubescens, Hyas araneus, H. coarctatus.*

Monascidia: — *Polycarpa libera.*

In the Skjerstad Fiord, as already mentioned, the warm, salt bottom water (t = 6—7°, s = about 35 ‰) cannot penetrate, or at any rate not in sufficient quantity to have any dominating influence on the natural conditions in the fiord. Here too, however, boreal forms occur in no small numbers, although arctic forms are undoubtedly found in much larger numbers than boreal ones. And when one finds that the fiord contains such forms as *Potamilla neglecta, Neaera arctica, N. subtorta, Siphonodentalium vitreum, Philine finmarchica, Campespe major, Sclerocrangon boreas, Polycarpa libera* etc., there is reason to conclude that the fauna of the Skjerstad Fiord is predominantly arctic.

The same must also be said of Skjomen, the Kanstad Fiord (cf. Hydrography, p. 20).

I will not give any detailed list of the forms noticed in these latter fiords, but only mention that in the Ogs Fiord were found, amongst others, *Ctenodiscus crispatus, Pectinaria hyperborea, Acanthozone cuspidata,* in the Kanstad Fiord *Asterias lincki* was found and in the Kirk Fiord, *Clymenia praetermissa, Eteone depressa, Defrancia lucernaria* etc.

On the other hand, it has been proved that in those fiords, or parts of fiords, where the ocean water has free access (t = 6—7° C., s = about 35 ‰) the fauna in the deep water is predominantly boreal. (Cf. Hydrography, p. 19). With respect to the Vest Fiord, Professor G. O. SARS[1]) many years ago called attention to the fact that in the littoral and sublittoral zones some characteristic arctic animal forms certainly do occur, while the fauna in the deep water is southern in its character, and corresponds in most respects to the fauna on the west coast of Norway.

By the aid of the material which has been obtained by hydrographical research in recent years, we are now able to explain the reason for this state of things. On the surface, the warm current, which flows northwards, makes itself most felt on the outer coast, but its influence decreases the further one goes in the fiords. But,

[1]) *Asterias rubens* occurred in monstrous size. One of those we took had thrown its arms around a *Cyprina islandica,* which was half sucked out.

[1]) Nogle Bemerkninger om den Marine Faunas Karakter ved Norges nordlige Kyster. Tromsø Museums Aarshefter, II. Tromsø, 1879.

on the contrary with regard to the warm bottom water, which is almost independent of continental factors, and which, therefore, can retain its properties almost unchanged during its course in the fiords.

And the observations made have shown that the temperature and salinity of the bottom water in the Vest Fiord differs only very slightly from that of the fiords on the west coast of Norway.[1] The similarity in fauna which the zoological examinations have brought to light are thus quite natural. As the Vest Fiord is the last of the large fiords which has bottom water with a temperature of 6—7° C. and a salinity of about 35 pro mille, it is also natural that it forms the northern limit for many boreal and lusitanic forms. Many southern forms are also found in Malangen, but the arctic species are doubtless in the majority there, and this is still more certainly the case in the Bals Fiord, the Ulfs Fiord, Lyngen and Kvænangen. As Malangen, hydrographically speaking, takes the position of a kind of transition fiord, I will mention some of the animal forms we dredged there.

Polychæta: — *Harmothoë rarispina, H. nodosa, H. asperrima, Lepidonotus amondseni, Lætmonice filicornis, Leanira tetragona, Nephtys incisa, N. ciliata, Leodice norvegica, Brada granulosa, B. granulata, Euphrosyne borealis, Nicomache lumbricalis, Pectinaria koreni, Terebellides strömi, Sabella paronia.*

Of *Bryozoa*, there are two very characteristic boreal species which have their northern limit in Malangen, namely, *Kinetoskias smitti* and *Domopora stellata.*

Amphipoda:[2] — *Hyale nilsoni, Socarnes vahli, Hippomedon propinquus, Orchomenella minuta, O. pinguis, Tryphosa höringi, Anonyx nugax, Lepidepecreum umbo, Leptophoxus falcatus, Harpinia neglecta, H. serrata, Ampelisca macrocephala, A. eschrichti, A. æquicornis, A. amblyops, Byblis gaimardi, Haploops tubicola, Stegocephalus inflatus, S. similis, Andania abyssi, Amphilochus tenuimanus, Stenothoë brevicornis, Metopa borealis, M. bruzeli, Leucothoë spinicarpa, Paroediceros lynceus, P. propinquus, Monoculodes borealis, M. tessellatus, M. latimanus, M. longirostris, M. packardi, Halimedon megalops, H. brevicalcar, Bathymedon obtusifrons, Aceros phyllonyx, Pleustes panoplus, Paramphitoë assimilis, Ephimeria tuberculata, E. loricata, Acanthonotosoma serratum, Iphimedia obesa, Syrrhoë crenulata, Tiron acanthurus, Eusirus minutus, Rhacotropis helleri, Haliragcs fulvocinctus, Apherusa bispinosa, A. tridentata, Calliopius laeviusculus, Dexamine spinosa, D. thea, Melphidipha borealis, Gammarus locusta, Melita dentata, Lilljeborgia pallida, L. fissicornis, Protomedeia fasciata, Gammaropsis melanops, Amphitoë rubricata, Ischyrocerus anguipes, Corophium crassicorne, Unciola planipes, Dulichia sp., Phtisica marina, Ægina spinosa, Caprella linearis.*

Sparre Schneider had no opportunity to examine the greatest depth of Malangen, so our dredgings form a suitable supplement to Schneider's investigations. We brought to light 18 species of amphipods, which were new to the Malangen fauna, and most of these were from the great depth where, as above mentioned, Schneider did not make any dredgings. There are several boreal forms among the amphipods mentioned, but the arctic ones are however, in a small majority. *Epimeria tuberculata*, which is a boreal form, has its northern limit in Malangen and *Epimeria loricata*, which is an arctic one, has here its southern limit. Of *Cumacea*, I found for instance *Diastylis goodsiri*, which is a decided arctic form. It was new to Malangen, which is the southern limit for the species on our coast.

[1] Cf. Nordgaard. Studier over naturforholdene i vestlandske fjorde, I, Hydrografi. Berg. Mus. Aarb. 1903, nr. 8, p. 32.

[2] Here I have also included the amphipods which were found in Malangen by Sparre Schneider. Cf. Malangenfjordens fauna. Tromsø Mus. Aarsh. 14, 1891.

Schizopoda: — *Boreophausia inermis, Boreomysis arctica, B. tridens, Pseudomma roseum, Mysideis insignis, Mysis mixta.*

Boreomysis tridens has not been found north of Malangen.

Decapoda: — *Pasiphæa tarda, Pandalus annulicornis, P. propinquus, P. brevirostris, Crangon almani, Pontophilus norvegicus, Sabinea septemcarinata, S. septemcarinata* var. *sarsi, Hippolyte spinus, H. lilljeborgi, H. polaris, Bythocaris simplicirostris, Eupagurus pubescens, Lithodes maja, Munida rugosa, Hyas coarctatus.* Of those mentioned, both *Pandalus propinquus* and *brevirostris* have here their northern limit. Respecting the fauna of Malangen, I refer to the mentioned paper by Sparre Schneider. With the exception of the amphipods, I have here only mentioned the forms which I personally observed in the fiord.

Brachiopods and molluscs have long been considered to be useful in forming a precise picture of the zoogeographical character of a given district. I will therefore arrange these animals in a table, based upon the examinations which have been made by Sparre Schneider[1], the Norwegian North Atlantic Expedition[2], C. W. S. Aurivillius[3], Johan Hjort[4], A. M. Norman[5], G. O. Sars[6]) and myself.

[1] Kvænangens Molluskfauna. Malangenfjordens fauna. Tromsö Mus. Aarsh. 14, 1891.

[2] Herman Friele & James A. Grieg. Mollusca III.

[3] Hafsevertebrater från nordligaste Tromsö amt och Vestfinmarken. Bihang til Kgl. Sv. Vet. Akad. Handl. 11, No. 4.

[4] Herman Friele, Mollusken der ersten Nordmeerfahrt des Fischereidampfers „Michael Sars" 1900 unter Leitung von Herrn Dr. Johan Hjort. Berg. Mus. Aarb. 1902, Nr. 3.

[5] Notes on the Natural History of East Finmark.

[6] Mollusca regionis arcticae Norvegiae.

Brachiopoda and Mollusca	Malangen	Kvænangen	East Finmark Fiords
Brachiopoda.			
Rhynchonella psittacea, Chemn.	+	+	..
Terebratulina caput serpentis, Lin.	+	+	..
T. septentrionalis, Couth	..	..	+
Waldheimia cranium, O. F. Müll.	+	+	+
Pelecypoda.			
Anomia ephippium, Lin.	+	+	—
A. aculeata, Müll.	+	+	—
Pecten islandicus, O. F. Müll.	+	+	..
P. septemradiatus, O. F. Müll.	+	..	..
P. tigrinus, O. F. Müll.	..	+	—
P. striatus, O. F. Müll.	+	+	..
P. vitreus, Chemn.	+	+	..
P. abyssorum, Lov.	+	+	..
P. imbrifer, Lov.	+	+	+
P. groenlandicus, Sow.	..	+	+
Mytilus edulis, Lin.	+	+	—
Modiola modiolus, Lin.	+	+	—
M. phaseolina, Phil.	+	+	—

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Pelecypoda.			
Modiolaria discors, LIN.	..		
M. laevigata, GRAY			
M. corrugata, STIMPS.			
M. nigra, GRAY			
Dacrydium vitreum, MOLL			
Crenella decussata, MONT.			
Nucula tenuis, MONT.			
N. delphinodonta, MIGH.	..		
Leda pernula, MULL.			
L. minuta, O. F. MULL.	.		
Portlandia lucida, LOV.			
P. intermedia, M. SARS	..		
P. lenticula, FABR.			
P. frigida, TORELL	..		
Yoldia limatula, SAY.			
Arca pectunculoides, SCHACCHI			
A. p. var. septentrionalis, G. O. SARS			
A. glacialis, GRAY	..	..	
Limopsis minuta, PHIL.	..	..	
Cardium echinatum, LIN.			.
C. edule, LIN.			
C. ciliatum, FABR.	..	..	
C. fasciatum, MONT.			
C. minimum, PHIL.			
Serripes groenlandica, LIN.	..		
Cyprina islandica, LIN.			
Astarte borealis, CHEMN.			
A. banksi, LEACH.			
A. sulcata, da COSTA		..	-
A. compressa, LIN.		.	
A. crenata, GRAY			
Venus gallina, LIN.			
V. ovata, PENN.			
Lucina borealis, LIN.		..	
Axinus flexuosa, MONT.			
A. sarsi, PHIL.			
A. gouldi, PHIL.			
A. obesus, VERR.	..		
Axinopsis orbiculata, G. O. SARS		..	
Cyamium minutum, FABR.			
Kellia suborbicularis, MONT.		--	.
Montacuta bidentata, MONT.			
M. maltzani, VERK.	..	.	
Mactra elliptica, BROWN		.	
M. subtruncata, da COSTA		..	
Syndosmya nitida, MULL.		..	
Tellina calcarea, CHEMN.			
T. balthica, LIN.		--	
T. fabula, GRONOV.		..	..
Solen pellucidus, PENN.		..	..
Thracia truncata, BROWN			
Neaera arctica, M. SARS	..	..	
N. obesa, LOV.			
N. obesa, var. *glacialis*, G. O. SARS	..	..	
N. subtorta, G. O. SARS			
Poromya granulata, NYST.		..	
Corbula gibba, OLIVI		..	
Mya arenaria, LIN.		--	
M. truncata, LIN.			-
Panopea norvegica, SPENGL.			
Saxicava arctica, LIN.			

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Scaphopoda.			
Dentalium entalis, LIN.			
D. occidentale, STIMPS.			
Siphonodentalium vitreum, M. SARS			
Placophora.			
Hanleyia hanleyi, BEAN.			
Leptochiton cancellatus, SOW.	.		
L. arcticus, G. O. SARS	..		
L. cinereus, LIN.			
Trachydermon albus, LIN.			
T. ruber, LOWE			
Tonicella marmorea, FABR.			
Gastropoda.			
Latina pellucida, LIN.			
Acmaea testudinalis, MULL.			
Tectura rubella, FABR.			
T. virginea, MULL.			
T. fulva, O. F. MULL.			
Lepeta coeca, O. F. MULL.			
Puncturella noachina, LIN.			
Scissurella crispata, FLEM.	..	..	
Mölleria costulata, MOLL.	..	..	
Cyclostrema petterseni, FRIELE	..	..	
Margarita helicina, FABR.	+	+	-
M. groenlandica, CHEMN.	+	+	
M. cinerea, COUTH.	-	+	—
M. olivacea, BROWN			
Machaeroplax obscura, COUTH.	+	+	
M. varicosa, MIGH.	..	..	
Gibbula cineraria, LIN.		+	-
G. tumida, MONT.			
Trochus occidentalis, MIGH.			
Velutina laevigata, PENN.			
V. lanigera, MOLL	..	..	
V. zonata, GOULD.	..	.	
V. flexilis, MONT.	..		
V. cryptospira, MIDD.	.		
Lamellaria latens, O. F. MULL.	..		
Marsenia prodita, LOV.	..		+
M. micromphala, BERGH.	..	..	
M. groenlandica, MOLL.	..		
Onchidiopsis glacialis, M. SARS	..		
Ampullina smithi, BROWN	..		
Amauropsis islandica, GMEL.	-		
Natica (Lunatia) groenlandica, BECK			
N. (Lunatia) montagui, FORB.	-	..	
N. (Lunatia) nana, MOLL.	..	..	
N. affinis, GMEL.	+	+	
Trichotropis borealis, BROD. & SOW.		+	
T. conica, MOLL.	..		--
Littorina littorea, LIN.	+		
L. rudis var. *groenlandica*, MOLL.			
L. palliata, SAY.	--	-	
L. obtusata, LIN.	..	..	-
Lacuna pallidula, da COSTA	..		
L. divaricata, FABR.		+	-
Hydrobia minuta, TOTTEN	..	-	--
H. ulvae, PENN.	--	..	+
Onoba striata, *Mont.*	..		--

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Gastropoda.			
Onoba aculeus, GOULD		..	
Cingula castanea, MOLL	..	..	
C. tumidula, G. O. SARS	..	..	+
Alvania jeffreysi, WALLER	..	..	
A. jan mayeni, FRIELE	..	..	
Rissoa parva, da COSTA		..	..
R. parva, var. *interrupta*, ADAMS	..	..	+
R. inconspicua, ALD	+	..	..
Skenea planorbis, FABR	..	..	+
Jeffreysia globularis, JEFF	..	..	+
Turritellopsis acicula, STIMPS	..	..	+
Lovenella metula, LOV	..	..	+
Cerithiopsis costulata, MOLL	..	..	+
Laeocochlis granosa, WOOD	..	..	+
Scalaria groenlandica, CHEMN	+	+	+
S. obtusicostata, S. WOOD	..	..	+
Parthenia eximia, JEFF	..	..	+
P. spiralis, MONT	..	..	+
Odostomia unidentata, MONT	..	+	+
O. turrita, HANLEY	..	..	+ (s)
Auriculina insculpta, MONT	+	+	..
Liostomia eburnea, STIMPS	..	..	+
Eulima bilineata, ALDER	..	..	+
E. stenostoma, JEFF	..	..	+
Homalogyra atomus, PHIL	..	..	+
Admete viridula, FABR	+	+	+
Taranis cirrata, BRUG	..	+	+
Mangilia (Teretia) amoena, G. O. SARS	..	..	+
M. (Thesbia) nana, LOV	+	..	+
Bela pyramidalis, STROM	+	+	
B. pingeli, BECK	+	..	+
B. cancellata, MIGH	+	+	+
B. obliqua, MOLL	+	+	+
B. cinerea, MOLL	..	+	+
B. nobilis, MOLL	..	+	+
B. scalaris, MOLL	+	+	+
B. rugulata, TROSCH	+	+	+
B. exarata, MOLL			+
B. harpularia, COUTH	+	+	+
B. trevelyana, TURT	+	+	+
B. decussata, COUTH		+	+
B. tenuicostata, M. SARS	..	..	+
B. bicarinata, var. *violacea*, MIGH	+	+	+
B. kobelti, VERK	..	..	+
B. simplex, MIDD	..	..	+
B. sarsi, VERK	..	..	+
Typhlomangelia nivalis, LOV	+	+	+
Spirotropis carinata, PHIL	+	..	+
Metzgeria alba, JEFF	+	..	..
Trophon truncatus, STROM	..	+	+
T. clathratus, LIN	+	+	+
T. barvicensis, JOHNST	+ (s)	..	+
Purpura lapillus, LIN		+	+
Astyris rosacea, GOULD	+	+	+
Nassa incrassata, STROM	..	..	+
Buccinum undatum, LIN	+	+	+
B. groenlandicum, CHEMN	..	+	+
B. undulatum, MOLL	..	+	+
B. finmarchianum, VERK	..	+	+
B. hydrophanum, HANCOCK	..	..	+
B. humphreysianum, BEN	..	..	+
Neptunea despecta, LIN	+	+	+

Mollusca	Malangen	Kvænangen	East Finmark Fiords
Gastropoda.			
Volutopsis norvegica, CHEMN	..	+	
Ukko turtoni, BEAN	..	+	+
Sipho islandicus, CHEMN	..	+	+
S. gracilis, da COSTA, var. *glaber*, VERKR	..	..	+
S. turritus, M. SARS	..	+	+
S. lachesis, MORCH	..	..	+
S. verkrüzeni, KOBELT	..	..	+
S. latericeus, MOLL	..	+ (s)	+
S. ebur, MORCH	+	..	+
S. fusiformis, BROD	..	..	+
Boreofusus berniciensis, KING	..	..	+
Acera bullata, MULL	+	+	+
Cylichna alba, BROWN	+	+	+
C. propinqua, M. SARS	+	+	+
Tornatina nitidula, LOV	+	..	..
Utriculus truncatulus, BRUG	+	..	..
U. pertenuis, MIGH	..	..	+
Amphisphyra hyalina, TURT	+	..	+
A. hiemalis, COUTH	..	+	+
Scaphander puncto-striatus, MIGH	+	+	+
Philine scabra, MULL	..	+	..
P. finmarchica, M. SARS	..	+	+
P. fragilis, G. O. SARS	..	..	+
P. quadrata, S. WOOD	..	..	+
P. lima, BROWN	+	+	+
Nudibranchiata.			
Doris obvelata, O. F. MULL	..	+	+
Lamellidoris bilamellata, LIN	..	..	+
L. muricata, O. F. MULL	..	..	+
Acanthodoris pilosa, O. F. MULL	..	..	+
Triopa lacer, O. F. MULL	..	..	+
Dendronotus frondosus, ASC	..	..	+
D. robustus, VERR	..	..	+
Aeolidia papillosa, LIN	..	..	+
Ae. pusilla, FRIELE	..	+	..
Coryphella rufibranchialis, JOHNST	..	+	..
C. sarsi, FRIELE	..	..	+
Limapontia capitata, O. F. MULL	..	..	+

From these tables, it will be seen that Malangen, Kvænangen and the fiords of East Finmark for the most part have the same molluscs. It is probable that further investigation would show a still greater similarity than that found in the tables. It may, however, with certainty be affirmed, that there are more boreal forms in Malangen and Kvænangen than in the East Finmark fiords, in the latter there are, on the other hand, more arctic species. The warm current which flows northwards also exerts some influence in East Finmark. On 28/4 1899, at the mouth of the Porsanger Fiord, at a depth of 250 mtrs., I registered $2^{\circ}.75$ C. (p. 8), which proved that a comparatively warm current was seeking to penetrate at the bottom. The temperature at a depth of 200 mtrs. was 1.3 and salinity 34.51.

According to GRAN, on Aug. 28th 1900, at the mouth of the Porsanger Fiord, the following conditions were registered from „Michael Sars":

Depth: —	0	20	60	100	200	m.
Temp.: —	6.6	6.2	6.2	5.8	3.8	„
Sal.: —	33.56	34.23	34.36	34.44	34.89	„

A little farther in the fiord, *Limopsis minuta*, PHIL., which is a boreal form, was taken, according to FRIELE.

In the Tana and Varanger Fiords, such comparatively high temperatures at the bottom as 2.8 and 3.1 (p. 20) have also been registered. So that one must not expect to find an altogether unmixed arctic fauna in East Finmark either, although the arctic forms are greatly in the majority. Such species as *Pecten tigrinus*, *Venus ovata* and *gallina*, *Dentalium entalis*, *Patina pellucida*, *Gibbula cineraria* and *tumida*, *Natica montagui* etc. must be considered to be decided boreal forms, and yet they have pushed their way up to East Finmark.

Professor G. O. SARS has found several boreal forms at Hasvik in Sorø. This place has not been hydrographically investigated, but I am inclined to think that the deep channel, which penetrates in from the ocean along the island, has comparatively warm water at the bottom. Another stopping place for boreal forms is the Malangen, where the bottom temperature at the greatest depths varies between 4 and 5°.5 C., but the Vest Fiord is the most definite limit for marine fauna on the Norwegian coast, a very large number of boreal animal forms being found here, but not further north. It is interesting to be able to connect this fact with the one that the Vest Fiord is the most northerly of the large Norwegian fiords in which ocean water dominates the natural conditions at the depths (t = 6—7°, s = ca. 35 ‰). As a general zoogeographical result, it may be stated that, with respect to the large important fiords, which are open to the ocean, the lusitanic and boreal forms occur as far up as the Vest Fiord in larger numbers than the arctic ones. It is first in the Malangen that the arctic forms are in the majority, and this even more noticeable in the Kvænangen and Porsanger Fiords, the latter having almost unmixed arctic fauna. The inner parts of the fiords and the branch fiords have retained more of the arctic species. For instance, while in the Salten Fiord, the southern forms are in the majority, we find that in the Skjerstad Fiord, which lies further inland, and in the Beier Fiord which is a little farther south, the arctic animals are more profuse than the southern ones. The Ranen Fiord has not yet been investigated, but it is probable that also there arctic forms will be predominant.

Generally speaking, these facts coincide with the opinion expressed long ago by Prof. G. O. SARS.[1] What I have tried to adduce is the connection between zoogeographical and hydrographical limits.

The northernmost *Lophohelia* reef, hitherto known.

In his description of *Ophiacantha spectabilis*, G. O. SARS[2]) says: — „I have found this important species at one place only, namely near Bodo, where it is not so very scarce between the corals (*Lophohelia prolifera*), which are abundant at a depth of from 80—100 fathoms. It is generally so firmly attached to the tangled branches of the corals, by means of its spiked arms, that it is exceedingly difficult to get it loose." On June 19th 1878, the Norw. North Atl. Exp. took two specimens of this echinoderm at st. 255 in the Vest Fiord (68° 12′ N., 15° 40′ E.). The depth is given as being 624 mtrs., temperature 6.5 and the bottom material, clay.

About the same time, *O. spectabilis* was found by V. STORM in the outer part of the Trondhjem Fiord. In a paper written in recent years STORM[1] says that this species occurs in large quantities on *Lophohelia prolifera* in the outer part of the Trondhjem Fiord. According to GRIEG,[2] also HOYLE has mentioned the species from the Faeroe Channel (433 fathoms). I do not know if *Lophohelia prolifera* is found at the latter place, but it is very probable, for M. SARS[3] mentions that it is found off the Shetland Isles. VERRILL[4] too mentions *spectabilis* as found off Nova Scotia, 1883, 131 fathoms, one specimen. Nothing is said about *O. spectabilis* having been found together with *Lophohelia prolifera*, but in another place, VERRILL writes (l. c. p. 536): „*L. prolifera* B. range, 100 to 300 fathoms, off Nova Scotia; 1060 fathoms, dead, 1884, rare." There is thus probably nothing which makes it unlikely that the ophiurid in question may have been attached to the coral here mentioned.

When working out my material of echinoderms, GRIEG[5] mentions that KOEHLER has given *O. spectabilis* as being found in the Bay of Biscay, but as KOEHLER's specimens appear to be somewhat different to SARS's species, GRIEG raises doubt as to their identity. The following table gives some important data concerning the places where I have found *spectabilis*.

O. spectabilis, G. O. SARS.

Date	Place	Lat. & Long.	Dredged between m.	Depth of water sample m.	Temp. C.	Salin. cont.	Bottom.
16/3 1899	Tranodybet	68° 15′.5 N. 15° 49′.0 E.	450—530	500	6°.3	35.06	*Lophohelia*
28/3 1899	The Tys Fiord I	68° 12′.5 N. 16° 12′.5 E.	500—600	500	6°.3	35.11	*Lophohelia*
30/3 1900	Arno	67° 11′ N. 14° 0′ E.	300—400	400	6°.55	35.18	*Lophohelia*

Arno is situated outside the mouth of the Salten Fiord near Bodo, and Tranodybet is a little farther in than st. 255 of the Norw. North Atl. Exp. in the Vest Fiord, the bottom here is given as being of clay, but there has probably been a hard spot which is accounted for by the presence of *Lophohelia*, which was the case in Tranodybet.

There is thus reason to conclude that *O. spectabilis* is so closely connected with *Lophohelia prolifera* as to make the latter almost a necessity for the former. This does not, however, at all imply that where ever *Lophohelia* occurs, *O. spectabilis* is also found. This is an interesting instance of one animal's dependence upon another.

[1]) Nogle bemerkninger om den marine faunas karakter ved Norges nordlige kyster. Tromsø Mus. Aarsh., II, 1879.

[2]) Nye Echinodermer fra den norske Kyst. Sep., p. 12. Kristiania Vid. Selsk. Forh. 1871.

[1]) Oversigt over Trondhjemsfjordens fauna. Beretning fra arbeidskomitéen for Trondhjems biologiske station 1900.

[2]) Ophiuroidea, p. 24. The Norw. North Atl. Exp.

[3]) Fossile dyrelevninger fra Quartærperioden, p. 92.

[4]) Results of the Explorations made by the steamer Albatross. Ann. Rep. of the Comm. of Fish and Fishery for 1883.

[5]) Oversigt over det nordlige Norges echinodermer. Berg. Mus. Aarb. 1902, no. 1, p. 14.

and it will be interesting to see what other animals exist together with *Lophohelia*. But first I will mention a few facts about the coral itself. This easily recognized species has been found in several of the fiords on the west coast of Norway up to the Vest Fiord, in rather deep water (about 150—500 m.). As far as I know, my specimens have been taken at the most northerly place for this species (Tranodybet, the Tys Fiord I). And I am inclined to think that no living specimens will be found farther north, as the colonies live on our coast under unusually uniform and settled natural conditions, with a temperature of 6—7° C. and a salinity of about 35 ‰. There is reason for supposing that at VERRILL's locality „off Nova Scotia" the conditions are similar. At any rate, VERRILL (l. c. p. 506) mentions that off Cape Sable the temperature, at a depth of 65—131 fathoms, varies between 42° and 46° Fhr. (5°.5—8° C.). Cf. stations nr. 2065—2071. The bottom at a couple of these stations is given as being of coral. It is, therefore, probable that the temperature here too is near 6—7° C. at those places where *Lophohelia prolifera* occurs alive. According to VERRILL, only dead specimens were taken at 1060 fathoms, and if it be remembered that in the Norwegian waters the coral in question does not extend beyond the boundary of the ocean water, it tempts me to conclude that the species cannot live at a depth of 1060 fathoms off Nova Scotia, notwithstanding that the fall in temperature is not particularly great. VERRILL (l. c. p. 503) says „The bottom temperatures between 1000 and 2000 fathoms were usually between 37° F. and 39° F., and rarely 40°." If *Lophohelia* from 1060 fathoms had existed at this place under present natural conditions, it ought therefore also now to be able to thrive in a temperature of 3—4° C. But the investigations hitherto made in Norway seem to contradict this possibility. A couple of suggestions may be made to account for the occurrence of *Lophohelia* at such a great depth. The colonies may have been transported from some other locality, so that when the dredgings were made from the „Albatross" they were in a secondary layer, or a f a l l in the bottom level may have taken place. There are instances of a r i s e of the bottom in a couple of places in Norway where *Lophohelia* has been brought several meters higher than the present water level.

Prof. MICHAEL SARS[1]) was the first who discovered *Lophohelia prolifera* at a height of 30 meters above sea level, this was at Drobak in the Kristiania Fiord, he paid great attention to this occurrence and gave a good description of it. Later on, more light has been thrown upon the subject by Prof. W. C. BRØGGER,[2]) who writes in part as follows: — „From the time of the deepest submergence of the Kristiania region, an epiglacial fauna is known, which has lived at a great depth, at least 150 meters. This is the famous dead coralreef at Drobak, south of Kristiania, where the shore, from 60 meters below the sea-level to about 30 meters above it, is covered with the remnants of a great reef of *Lophohelia prolifera*." BRØGGER also shows the height of the reef above the sea-level (30 m.) + the minimum depth of the coral in the present fiords (150 m.) answers to the upper marine boundary at Drobak (180 m.) — „a proof, that the *Lophohelia*-reef was formed, partly at any rate, during the deepest submergence of the land at Drobak." A similar argument holds good with regard to the other occurrence at Stenkjær at the end of the Trondhjem Fiord.

[1]) Fossile dyrelevninger fra quartærperioden, p. 76—77.

[2]) Om de senglaciale og postglaciale niveauforandringer i Kristianiafeltet. N. G. U. No. 31, p. 182—187, p. 689 (English Summary).

Natural conditions at the time when *Lophohelia* lived at Drobak and Stenkjær cannot have been very different to what they are now in the deep western fiords, and it may from this be concluded that the Gulf Stream, at least from the epiglacial time, filled the channels and basins in the Norwegian fiords with its warm water.

Together with *Lophohelia*, M. SARS found various other characteristic forms, e. g. *Pecten vitreus*, *P. aratus*, *Lima excavata*, *Arca nodulosa* etc.

These animals very frequently follow *Lophohelia* in our fiords at the present day, but in no definite state of dependence. Further, the presence of these animals proves that the natural conditions in the depths of the fiords during the epiglacial time could not have been so very dissimilar to the present conditions. But, on the other hand, the deposits in the shallow waters plainly show that in the upper layers of water, quite a different state of things was prevalent to that of the present day.

It is interesting to give a list of the most important animals which have been observed together with *Lophohelia* at the most northern localities where this species has been found.

$^{30}/_{3}$ 1900. Arno. 300—400 m.

Lophohelia prolifera, PALL., *Paramuricea placomus*, LIN., *Ophiacantha spectabilis*, G. O. SARS, *Flustra barleei*, BUSK, *Lima excavata*, FABR., *Lamellaria latens*, O. F. MÜLL., *Pandalus propinqvus*, G. O. SARS, *Pontophilus norvegicus*, M. SARS.

$^{16}/_{3}$ 1899. Tranodybet. 450—530 m.

Lophohelia prolifera, PALL., *Ophiacantha spectabilis*, G. O. SARS, *Pteraster militaris*, O. F. MÜLL., *Pandalus propinqvus*, G. O. SARS, *Hippolyte polaris*, SAB., *Galathodes tridentatus*, ESMARK.

$^{25}/_{3}$ 1899. The Tys Fiord I, about 500 m.

A sounding at the beginning of our dredging stated a depth of 725 m. and at the end 500 m. We drove along very quickly, however, and our line was hardly long enough, so that we got nothing from the clay at 725 m. It was first at the edge that the trawl began to take in anything, and when we drew it up from a depth of about 500 meters, the net was half full of living and dead branches of *Lophohelia*, on which was found: —

Pulvinulina punctulata, D'ORB.

There were also: —

Lophohelia prolifera, PALL., *Protanthea simplex*, CARLG., *Ophiacantha spectabilis*, G. O. SARS, *Ophioscolex glacialis*, MÜLL. and TROSCH., *O. purpureus*, DÜB. and KOR., *Pteraster militaris*, O. F. MÜLL., *Echinus elegans*, DÜB. and KOR., *Lineus cinereus*, PUNNETT, *Leodice norvegica*, LIN., *L. gunneri*, STORM, *Terebratulina caputserpentis*, LIN., *Waldheimia cranium*, MÜLL., *Lima excavata*, FABR., *Pecten vitreus*, CHEMN., *Pleurobranchus plumula*, MONT., *Metopa alderi*, BATE, *Janira maculosa*, LEACH., *Pandalus propinqvus*, G. O. SARS, *Hippolyte polaris*, SAB., *Galathodes tridentatus*, ESMARK, *Munida rugosa*, G. O. SARS, *M. tenuimana*, G. O. SARS, *Ciona intestinalis*, LIN.

Some of the species mentioned have here their northern limit, e. g. *Protanthea simplex*, *Echinus elegans*, *Lima excavata*, *Galathodes tridentatus*. A wide distribution southwards has for instance *Galathodes tridentatus*, which, according to MILNE-EDWARDS and BOUVIER, extends right down to the west coast of Marocco, and *Lima excavata*, of which FRIELE and GRIEG write in their account of the Mollusca of the Norw. North Atlantic Exp.: — „It is also known in the deep water between the Hebrides and the Faeroe Isles, in Portugal, the Azores and Senegambia."

From the investigations made by M. and G. O. SARS, as well as V. STORM, we have a tolerably complete knowledge of the fauna of the coral regions in our fiords. STORM has given a concise account of the conditions in the Trondhjem Fiord, with a map showing the position of the corals, and to this I would beg reference. I will here also emphasize the fact that the characteristic forms on the epiglacial *Lophohelia*-reef at Drøbak (*Pecten vitreus*, *P. aratus*, *Lima excavata*, *Arca nodulosa* etc.) also at the present time show themselves to be faithful companions. However, I do not think practical boundaries can be drawn between the fauna which are connected with *Lophohelia* and those which are connected with other corals, such as, *Paragorgia arborea*, *Paramuricea placomus* or *Primnoa lepadifera*.

It may, on the other hand, be said that the region of the deep water corals has its definite, decided fauna, which is particularly uniform in all the large Norwegian fiords to which the ocean water has free access, from the Bokn to the Vest Fiord. There is a coral facies of animals, just as there is a clay facies.

A few words on the fauna in clay.

The deep channels and basins in the fiords (150—200 m. and more), of which clay forms the bottom and into which the ocean water has access, have also their characteristic animal life.

And since the investigations made by G. O. SARS, in the sixties, at the fishing place Skroven and at other places in the Vest Fiord, we know that there are especially interesting forms on the clay-bottom of the depths. Such as, for instance, *Isidella hippuris*, *Ulocyathus arcticus*, *Rhizocrinus lofotensis*, *Brisinga coronata*, *Flustra abyssicola* etc. The fauna at Skroven, where I have made a very successful haul with a trawl at a depth of 350—410 m., is very rich. In addition to the forms just mentioned, it was quite usual to find such species as the following, on the clay depths in the Vest Fiord and those of its arms into which ocean water penetrates at the bottom: —

Foraminifera: — *Astrorhiza arenaria*, *Saccammina sphaerica*, *Storthosphaera albida*, *Bathysifon filiformis*, *Rhabdammina abyssorum*.

Echinodermata: — *Amphilepis norvegica*, *Ophioscolex glacialis*, *Psilaster andromeda*, *Stichopus tremulus*, *Bathyplotes natans*, *Mesothuria intestinalis*, *Cucumaria hispida*, *Myriotrochus vitreus*.

Polychaeta: — *Laetmonice filicornis*, *Leanira tetragona*, *Terrebellides strömi*.

Mollusca: — *Nucula tumidula*, *Portlandia lucida*, *Malletia obtusa*, *Arca pectunculoides*, *Limopsis minuta*, *Cardium minimum*, *Kelliella milliaris*, *Syndosmya*-species, *Neaera obesa*, *N. rostrata*, *Dentalium occidentale*, *D. agile*, *Siphonodentalium quinquangulare*, *Scaphander lignarius*.

Ostracoda: — *Cypridina norvegica*.

Isopoda: — *Munnopsis typica*, *Eurycope cornuta*.

Schizopoda: — *Boreomysis tridens*, *Pseudomma roseum*.

Decapoda: — *Pontophilus norvegicus*, *Munida rugosa*, *M. tenuimana*.

Ascidia: — *Ascidia gelatinosa*.

The above list gives some of the species which are constantly found on the clay at the bottom of rather deep water. Many of these forms are undoubtedly mud-eaters, more especially is this the case with regard to the above mentioned Holothurioidea. Some of them appear to be dependent upon ocean water (t = 6—7° C., s = about 35 ‰). According to ÖSTERGREN,[1] *Bathyplotes natans*, *Mesothuria intestinalis*, *Cucumaria hispida* and *Myriotrochus vitreus* are not found in Norwegian fiords further north than the Vest Fiord. It is characteristic that I took several specimens of *Bathyplotes natans* and *Mesothuria intestinalis* in the Salten Fiord where the temperature was 6°,65 C. and the salinity 35,13 ‰, while in the Skjerstad Fiord, which is only a little further in, where t = 3°, 2 and s = 34 ‰, not a single specimen was to be seen in all the dredgings made. *Bathyplotes* occurs in rather large numbers at its northern limit; at the station at the mouth of the Folden Fiord at a depth of 530 m., 20 individuals of this species were taken, but only 1 *Mesothuria*. Of clay-bottom molluscs, which have not hitherto been found north of Lofoten, the following may be mentioned: —

Malletia obtusa, *Kelliella milliaris*, *Dentalium agile*, *Scaphander lignarius* etc. The deepwater fauna on the mud-bottom is remarkably uniform in the large fiords which are filled with ocean water, from the Bokn Fiord to the Vest Fiord, nothwithstanding that the Vest Fiord and its adjacent fiords contain some forms which are wanting in the Bokn Fiord. Further investigations will probably equalize this apparent difference to some extent, for instance, I have latterly found *Rhizocrinus lofotensis* also in the Bokn Fiord. But it will probably be found that such a species as *Ulocyathus arcticus* cannot be included among the fauna of the Bokn Fiord, this species must, judging from what is up to the present known with regard to its distribution, be considered to be an arctic species, which has been able to exist under the natural conditions determined by the ocean water which penetrates into the fiords. On the whole, one may say that, zoogeographically speaking, the deep water fauna on the clay-bottom of the fiords in question are specially remarkable on account of the large number of forms in them which have a wide distribution southwards. But, north of Lofoten, the fauna on the clay have quite another character. The southern forms disappear, and the northern ones take their place. At my stations in the Lyngen Fiord (Lyngen II and III) at the respective depths of 250 and 320 m. on clay-bottom such forms as the following occurred in large quantities: — *Ctenodiscus crispatus*, *Myriotrochus rinki*, *Pecten groenlandicus* and *Astarte crenata*. Here too were found *Siphonodentalium vitreum*, *Scalaria groenlandica*, *Bela excavata* etc. The peculiar arctic Bryozo, *Alcyonidium disciforme*, was also taken here. *Diastylis goodsiri*, *Pseudomma truncatum* and many other arctic forms also occurred. At the station Lyngen II, d = 250 m., t = 2°,85 C., s = 34,47 ‰, and at Lyngen III, d = 320 m., t = 3°,65 C. and s = 34,84 ‰. At both stations in the Lyngen Fiord, several specimens of two actinia species were taken, but none were conserved. If I remember rightly, they were *Actinostola callosa* and *Bolocera tuediae*.

Edwardsia andresi and *Epizoanthus erdmanni* were also found. As I have previously mentioned, there is another character over the fauna in the deep waters of the Malangen Fiord, and if we go as far as to Lyngen and Kvænangen, the difference is even more striking. In the deep waters of Kvænangen where d = 343 m., t = 2°,3 C., and s = 34,19 ‰, were found, for instance, *Myriotrochus rinki*, *Polychaeta*, e. g. *Harmothoë rarispina*, *Nephthys malmgreni*, *N. ciliata*, *Nicomache lumbricalis*, *Terebellides strömi*.

Mollusca: — *Pecten groenlandicus*, *Arca pectunculoides*, var. *septentrionalis*, *Astarte crenata*, *Siphonodentalium vitreum* etc.

[1] The *Holothurioidea* of Northern Norway. Berg. Mus. Aarb. 1902. No. 9.

Amphipoda. *Halirages fulvocinctus*, *Idunella aequicornis*. The latter has, hitherto, only been taken in the Varanger Fiord.

Notwithstanding that the clay depths both north and south of Lofoten have some forms in common, the Vest Fiord, however, forms a very decided limit for fauna, as has been explained in the foregoing pages. One may also in the fauna of the Norwegian deep waters make a distinction between an arctic and a subarctic (boreal) clay-facies.

Remarks on the fauna of the ocean banks.

I was not able to make many dredgings on the ocean banks in 1899, but I succeeded, however, in getting an idea of their fauna. The station, Rost II, is not far from the ocean banks, at a depth of 150 mtrs. here *Capulus hungaricus*, which is a southern form, was dredged, here this form has its northern limit on our coast. On the banks themselves, it extends, perhaps, a little farther northwards. And at the station at Gankvaero, 250 m., t = 7°.1 C., s = 34.38 ‰, *Harmothoë oculinarum* was taken, this form must be characterized as a boreal one, judging from the places where it has hitherto been found. In the sea off Ingo (71° 10′ N., 23° 10′ E.), d = 315 m., t = 3°.45 C., s = 35.24 ‰, an amphipod, *Erichtonius abditus*, occurred, among other things: this form, according to G. O. Sars has a distribution as far south as The Azores, and was previously only known from „the south and west coasts of Norway". Taking into consideration the hydrographical conditions on the banks outside Lofoten, Vesteraalen, Tromsø and Finmark, one would expect to find that at any rate some boreal forms would be able to exist there. To get light on this subject, reference can be made to the material collected by the Norwegian North Atlantic Expedition. First I will give a table showing the temperatures at some of the stations in the southern bankdistrict of the Norwegian Sea (Stadt—Shetland—Lofoten). Cf. map of the district of the Norwegian North Atlantic Expedition.

Bottom temperatures on the southern banks in the Norwegian Sea.

Station Nr.	Situation.	Depth.	Temp.	Bottom.
9.	61° 30′ N. 3° 37′ E.	377 m.	5°,9 C.	Clay.
10.	61° 41′ N. 3° 19′ E.	402 m.	6,0	Ooze, Clay.
92.	64° 0′ N. 6° 42′ E.	326 m.	7,2	Sabulous Clay.
79.	64° 48′ N. 6° 32′ E.	283 m.	6,9	Sabulous Clay.
101.	65° 36′ N. 8° 32′ E.	408 m.	6,0	Sabulous Clay.
147.	66° 49′ N. 12° 8′ E.	260 m.	6,2	Grey Clay.

On these banks, one would expect to find an animal life which differs only slightly from that of the Norwegian fiords (The Bokn Fiord — the Vest Fiord), where there are corresponding temperatures. The investigations hitherto made appear to confirm this expectation. I will now give a table showing the bottom temperatures on the northern banks from Lofoten to Beeren Island.

Bottom temperatures on the northern banks in the Norwegian Sea.

Station Nr.	Situation.	Depth.	Temp.	Bottom.
195.	70° 55′ N. 18° 38′ E.	196 m.	5°.1 C.	Stones, Clay.
290.	72° 27′ N. 20° 51′ E.	349 m.	3,5	Sabulous Clay.
323	72° 53′ N. 21° 51′ E.	408 m.	1,5	Clay.
280.	74° 10′ N. 18° 51′ E.	64 m.	1,1	Stones.
315.	74° 53′ N. 15° 55′ E.	329 m.	2,5	Clay, Sand.
326.	75° 31′ N. 17° 50′ E.	225 m.	1,6	Clay.

According to Friele and Grieg, 13 species of Mollusca were taken at station 195, several of which are widely distributed southwards. Among these may be mentioned: —

Calalus subfusiformis, *Cyclostrema petterseni*, *Capulus hungaricus* (shells), *Menia cimicoides*, *A. jeffreysi*, *A. subsoluta*, *A. punctura*, *Aclis walleri*, *Parthenia spiralis*, *Odostomia unidentata*, *O. acuta*, *Eulimella scillae*, *E. ventricosa*, *Eulima bilineata*, *Adeorbis fragilis*, *Metzgeria alba*, *Buccinum humphreysianum* (shell), *Sipho fusiformis*.

At the stations previously mentioned in the northern bank district, forms also occurred which have a wide southern distribution. At station 315 (74° 53′ N.) a boreal Bryozo, *Bicellaria alderi*[1]) was taken. I have not on any other occasion noticed this species north of Lofoten. Undoubtedly there are several species which on the banks go further north than in the fiords, so that it is important to state clearly, when mentioning distribution, whether the species in question occurs in the fiords and the belt of skerries (skjaergaard) or on the banks.

Zoologically speaking, there remains much to be done with respect to the Norwegian ocean-banks, and a thorough investigation of the edge towards the deep basin of the Norwegian Sea would be highly interesting. For here the transition from boreal to arctic fauna occurs, and that too not spread over several geographical degrees of latitude, but in the space of a few hundred meters.

Shallow-water shells found at great depths.

Of late years, there has been a good deal of discussion among Danish and Norwegian authors as to the cause of the occurrence of littoral shells at great depths, especially in the Norwegian Sea. I do not intend to go into the matter, as I do not possess the necessary material to take part in the discussion of it. I would refer those who wish to have a clear account of the various opinions advanced to Dr. A. C. Johanssen's[2]) paper, in which references will also be found to other works dealing with the same subject.

[1]) Cf. Nordgaard. *Polyzoa* of the Norw. N. Atl. Exp. p. 6, 26.

[2]) On the hypothesis on the sinking of sea-beds based on the occurrence of dead shallow-water shells at great depths in the sea. Medd. fra den naturh. Foren. i Kjøbenhavn 1902.

Those who have considered this question seem to have forgotten that also A. E. VERRILL has expressed an opinion with reference to transportation by ice.

In 1883, dredgings were made from S S „Albatross" in the region of the Gulf Stream from off Cape Hatteras to Nova Scotia. In the „Results of the Explorations" (p. 507) VERRILL writes: — „In many instances we have also dredged pebbles and small, rounded bowlders of granite and other crystalline rocks from beneath the Gulf Stream in deep water. These, I suppose, have been carried to that region by shore-ice floating off in great quantities from our northern coasts in winter and spring, and melting where the warm Gulf Stream water is encountered." From this, it will be seen that VERRILL inclined to the opinion that the pebbles found in the deep water were brought thither by floating ice, and if the ice takes along pebbles, there is nothing to hinder for its also taking along shells from the coast.

In the Norwegian fiords, it is highly probable that drift-ice causes a transportation of littoral shells out into the deep basins. For instance, *Littorina rudis* and *obtussata* found at a depth of 150—180 m. on Risværflaket, and *Gibbula cineraria* at a depth of 600 meters in the Oxsund, (in each case the shells were empty) were neither of them in their primary locality. HANS KLÆR,[1] too, has given a very plausible explanation of the storing of gravel and shells in the snow and ice on the shore, and their conveyance to places farther off when the ice melts in the spring; his explanation is based upon personal observations at Tromsø.

Fauna and Hydrography.

In the foregoing pages, I have tried to prove that there is a close connection between fauna and hydrography. It would from this again appear, that a majority of species of animals have an organisation which can only bear a very slight variation in hydrographical conditions. The number of socalled cosmopolitan species is very small, and it seems to me that the number of those which are mentioned as being widely distributed is also on the decrease. The more exact morphological investigation which is demanded now-a-days often results in the dividing of a species into two or more.

And this is the case, not only with bottom forms, but also with reference to plankton.

I will give some instances of what I mean. We have for years heard that *Calanus finmarchicus* is found in nearly every sea. But G. O. SARS[2]) now tells us that under the name *C. finmarchicus* was hidden another species, *C. helgolandicus*, CLAUS, which is specially distributed southwards, while the former has an arctic and boreal distribution. Strictly speaking, *Calanus finmarchicus* contained three different species, for *Calanus hyperboreus* was considered to be a variety of *C. finmarchicus* previous to the publication of Dr. GIESBRECHT's well-known monograph on Copepods. Instead, therefore, of one species distributed over nearly every sea, we now get three species with comparatively limited distribution, *C. hyperboreus* being arctic, *C. finmarchicus* boreal and arctic and *C. helgolandicus* lusitanic.

Similarly with respect to *Euchæta*. Instead of the widely distributed *Euchæta norvegica*, we now have, *norvegica*, *glacialis* and *barbata*. Examples might easily be multiplied from the Copepods. On the other hand, it is beyond doubt that there are also deep-water forms of Copepods which have an exceedingly wide distribution. Natural conditions are only subject to very slight changes at the great depths, and this too for extensive stretches. It is also very probable that there are shallow-water forms which are so organized as to be able easily to adapt themselves to changes in natural conditions, and are thus able to exist under very diverse physical conditions, but their number has undoubtedly been over rated. In his excellent monograph on northern *Annulata*, G. M. R. LEVINSEN[1]) says: —

„I must say that I doubt whether the northern seas really have so many species in common with the Mediterranean as would appear from the lists given in the literature available." On account of this doubt, LEVINSEN carefully compared the northern forms and those from the Mediterranean, and come to the conclusion that *Arenicola marina* and *Pectinaria koreni* from the latter sea were different from the northern species bearing the same name. They were given the names *A. claparèdi* and *P. robusta*.

Similarly with respect to *Pectinaria auricoma*, *Potamilla reniformis* etc.

I could give a number of examples from the Bryozoa too, to show how the extent of the distribution of a species diminishes, as the claim for greater exactness in the determination of a species increases. The change which has taken place in the use of the word „species" with regard to the Bryozoa, has had a similar effect. F. A. SMITT, for instance in his work on boreal and arctic Bryozoa, which in other respects is excellent, has used the word „species" in a very extended sense. He has entered as „forms" a large number of specimens which are given the rank of „species" by recent systematical investigators.

As a result, SMITT's species were attributed with a much too extensive geographical distribution.

The distribution of a species is undoubtedly dependent on many other things than the temperature and salinity of the water in which it exists. Currents especially have both a direct and indirect influence. If one considers the conditions on the Norwegian coast, where arctic and boreal fauna meet, the question naturally suggests itself: — Is it the arctic or the boreal animals which on our coasts are gaining ground?

To settle whether the movements of a given element of fauna or flora are progressive or retrograde, one can examine the currents in the adjoining sea. On the Norwegian coast, the current which flows in a northerly direction is predominant, and the southern animal forms are carried along with it. On the east coast of North America, the reverse is the case. The duration of the pelagic state is also important with regard to the penetration of the species into new districts. It would therefore seem likely that such species as *Mytilus edulis* and *Modiola modiolus*, in which the pelagic state hardly lasts much more than a week, would find it difficult to get over the space between two coasts which are separated by a wide expanse of ocean. Along a length of coast line, however, these and similar species are widely distributed, for, in the course of thousands of years, the many small steps forward amount to a considerable distance.

I do not know very much about the plankton in the more southerly seas, but I have the impression that there is not so much difference there in its quantity and quality at the different times

[1]) Niveauforandring eller transport. Naturen, 1902, p. 364.

[2]) Crustacea of Norway, Vol. IV.

[1]) Systematisk geografisk Oversigt over de nordiske *Annulata, Gephyrea, Chætognathi* og *Balanoglossi*. Aftryk af Videnskab. Medd. fra den naturhist. Foren. i Kjøbenhavn 1882 og 1883 (p. 287).

of year, as is the case in the northern latitudes.[1] And if this be a fact, its influence will be seen on the plankton-eating animal world. It is possible that the suitability of the molluscs as zoographical character-forms, depends upon the fact that a great many of them are plankton eaters. The mud-eating worms, for instance, are much less suitable in giving a characteristic of the fauna. Besides, there are species of mudeaters with a small geographical distribution. A star-fish, *Ctenodiscus crispatus*, whose stomach is almost always full of mud, is very little found beyond the arctic district. In such cases, one is compelled to conclude that the animal has very little power of adaptation.

Further Remarks on Plankton.

In the fiords near Bergen, February is the month in which the plankton is poorest, and there is reason to think that the minimum for the year, for the northern fiords of Norway, also falls in this month. The great change in plankton life occurs at the spring inflow of the diatoms.

In the fiords near Bergen, March is the month when the diatoms begin to show themselves en masse, but at different times, within the limit of this month, from year to year. It is not yet possible definitely to fix the time when the winter state gives way to the spring one in the northern fiords, but it is probable that the spring-diatoms appear in very large quantities somewhat later here than in the south west fiords. Below I give some data concerning the occurrence of diatoms on the northern coasts.

In the Tys Fiord on 29/3 1899 only a few diatoms were found, but on 1/4 they were numerous near Lille Molla, and this was also the case on 4/4 in the same year at Hola near Svolvær.

10/4 1899. In the harbour at Stene in Bo (Vesteraalen) many diatoms, 0—3 m.

12/4 1899. The Malangen Fiord, many diatoms. Whilst there in Malangen, from 12th—14th of April 1899, was a rich development of diatoms, in Kvænangen on 19th of the same month, winter conditions prevailed. But on 21/4 the spring diatoms also had shown themselves in Kvænangen.

23/4 1899. Trold Fiord harbour, many diatoms.
24/4 1899. Ingohavet, many diatoms.
26/4 1899. Repvaag harbour, diatoms.
27/4 1899. The Porsanger Fiord, many diatoms.
28/4 1899. Mehavn, diatoms.
1/5 1899. Vardo, some chains of diatoms.
5/5 1899. Hola near Svolvær, few diatoms.

At the place last mentioned (in Lofoten) the first rush of diatoms was over. In place of them, there were multitudes of forms in different stages of development belonging to *Copepoda*, *Cirripedia*, *Annelida* etc.

22/3 1900. The Ostnes Fiord, 0—25 m., development of the spring diatoms.
30/3 1900. The Vest Fiord, 0—25 m., many diatoms.
2/4 1900. The Skjerstad Fiord, still winter conditions.
5/4 1900. The Salten Fiord, many diatoms.
6/4 1900. The Folden Fiord, still winter conditions.

Previously in this treatise, it has been shown that the Vest Fiord is the most important terminus for a great number of southern bottom forms. It is probably also the case, if one substitutes plankton forms for bottom animals. North of the Vest Fiord such species as *Pleuromamma robusta*, DAHL, and *Candacia armata*, BOECK, will hardly be found. In the Norwegian series of fiords, *Euchæta norvegica*, for instance, is not found north of the Vest Fiord, but I took specimens of *Chiridius armatus* in Malangen.

The very large quantities of such *Siphonophora* as *Cupulita sarsi* and *Physophora borealis* along the northern coast and in the northern fiords during the winter of 1899, was an occurrence which merits further mention. Of the forms mentioned, *Cupulita sarsi* was exceedingly common. On 20/4 I saw in the Jokel Fiord (arm of Kvænangen) a fisherman whose gloves on the inside were striped red by the remains of this siphonophor which had fastened itself to the fishing lines. The inhabitants looked upon this as being something unusual, which points to the fact that the phenomenon is not of annual occurrence. As the plankton species in question are oceanic, their occurrence in large quantities in the fiords can hardly be explained in any other way than by supposing that there had that year been an unusually strong flow of the current in the upper layers of water in the sea towards the coast and into the fiords. It occured to me to connect this with the prevailing winds. To be able to form an opinion of the relation between the sea and land winds, we will look at the downfall for the period in question.[1]

Downfall from October 1898—March 1899.

	Bodo		Tromsø		Gjesvær		Vadsø	
	Downf.	Normal	Downf.	Normal	Downf.	Normal	Downf.	Normal
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1898.								
October	108	106	86	98	77	79	53	80
November ...	148	109	184	86	113	66	61	69
December ...	153	87	75	103	100	63	121	60
1899.								
January	70	77	58	108	78	55	79	50
February	129	61	174	110	78	57	55	45
March	96	61	80	95	69	61	114	41
Average	117.3	83.5	109.5	100	85.8	63.5	80.5	57.5

As it is more especially the ocean winds which cause downfall, one must be justified in concluding that, from October 1898 to March 1899, their influence on the coast line in question must have been greater than usual. But this would again result in more than the ordinary quantity of water being driven in from the sea coast, which must be evident in the kind of plankton which occurs.

In this connection, it is also interesting to recall that, on the south west coast of Norway (in the spring-herring district), the fishermen call some *Salpæ* „silderæk",[2] and they look upon their appearance as a sure sign that the herrings will come in shoals to the coast. It is not altogether impossible that scientific investigations will verify this prognostication. At any rate, it appears to be quite reasonable, that the prevailing ocean winds stir up surface currents which drive both herrings and their food towards the coasts.

[1] Both large and small animals, from the Spitzbergen reindeer to the plankton-crustaceans, find that winter in the arctic zone is a time when food is scarce.

[1] Cf. Nedboriagttagelser i Norge. Aarg. IV (1898) og V (1899).
[2] From sild (herring) and reka (to drift with the stream).
Cf. M. SARS, Fauna littoralis Norvegiae, Part I, p. 63.

B. The Investigations considered from a practical Point of View.

The Vest Fiord is one of the most thoroughly investigated of our fiords, speaking in a biological and hydrographical sense. And the reason for this is not difficult to understand. The government has found it necessary to send naturalists to the district in which a cod fishery is carried on, upon the results of which the income of the country shows an important rise or fall, in proportion to the success or failure of the catch. The statistics taken have shown that the catch varies quite considerably from one season to another, and it has been the aim of the investigating naturalists to discover the factors which have an influence on the fate of the fishing. The most important marine animals for us are undeniably cod and herrings, but in addition to these, there are many other fish which are caught in large quantities on the coasts of the counties of Nordland, Tromso and Finmark.[1] I will first mention some invertebrates, which are of economic importance. Then I will deal with the cod fisheries in Lofoten and Finmark.

a. Some Invertebrates of economic Importance.

The animals may be divided into the following groups: — injurious, indifferent, indirectly useful, directly useful, if account only be taken of their useful or baneful relation to mankind.

A decidedly injurious animal is *Myxine glutinosa*, which sucks out the fish caught in nets and on lines. Such forms as *Calanus finmarchicus*, *Boreophausia inermis*, *Nyctiphanes norvegica*, many worms, molluscs etc., may be said to be indirectly useful, as they serve as food for edible fish.

To the directly useful animals, belong first of all those which are eaten by man, then those from which useful products are obtained, and lastly those which are used as bait for the edible fish. Only some of those which are directly useful to man shall be mentioned here.

Arenicola marina, Lin.

This polychaet occurs rather numerously and at many places in muddy beaches, it is dug up by the fishermen and used by them as bait. Similarly too, a fish *(Ammodytes tobianus)* is taken and also serves as bait.

Pecten islandicus, Müll.

The Trondhjem Fiord is the most southerly place, on our coast, where this mussel occurs of sufficient size and in such quantities as to give it any economic importance. According to V. Storm, it is particularly plentiful on the banks north of Tautra, where it has been dredged for a very long time and has been used as bait. Of late years it has also been taken to Trondhjem and used as food. In the north of Norway, too, this species is a much prized bait, and S. Schneider says that it is eaten by many better-class families at Tromso. The southern limit on our coast for the occurrence of this species, is the Lyse Fiord, not far from Stavanger (59° 3′ N.).

Mytilus edulis, Lin.

On our northern coasts, this species is as a rule so small that it is not of much use as bait.

Modiola modiolus, Lin.

At the present time, this is our most important bait-mussel, it is found in large quantities at some places on our northern coasts. It is used as bait on the day fishing lines in Lofoten. The greatest part of the shell-bait which is used in Lofoten is, however, taken from the fiords in the neighbourhood of Bergen and Stavanger. This mussel attains to a considerable size in the western fiords. A specimen from Lonevaag (Ostero) was, for instance, 17.3 cm. long and 9.5 cm. wide. The shells held about $^1/_2$ liter

I have measured unusually large specimens from the Sogne Fiord, from 17 to 18.4 cm. In the Oster Fiord, where shells to the value of several thousand kroner have been dredged, I took 100 from a heap at Raknes. The most usual measurement of the shells which were sorted out here to be used as articles of commerce, was 10—15 cm. In the arctic district of our country, *M. modiolus* does not attain the size of those in the western fiords. A specimen from Vardo was, however, found to be 11.2 cm. long and 5.3 cm. wide.

It is quite usual to find the tubes of *Pomatoceras triqueter* and various forms of Bryozoa and Hydroida on the shells. On one single occasion, I saw in an aquarium *Cancer pagurus* crush these shells to eat them.

In the aquariums of the Bergen Biological Station, we have had *M. modiolus* for many years, and their mortality has been low. Spawning in these aquariums has been observed on $^{20}/_5$ 1899, $^2/_5$

[1] Cf. Helland, Lofoten og Vesteraalen, p. 119.

1901 and $^{12}/_{7}$ 1901. From what I have been told by those engaged in dredging shells, I conclude that spawning also takes place in the months of March and April. Spawning time may therefore be supposed to be from March to August. The spawning process itself was seen quite plainly on $^{2}/_{5}$ 1901. Both eggs and sperm emerged through the anal sipho. The eggs were ejected in the form of narrow, short ribbons which were, for the most part, broken up in the water and immediately sank to the bottom. A single female shell expelled so many that a large reddish-yellow elevation was formed. Some of the eggs were whirled about in the water and were greedily devoured by shrimps and barnacles; some settled down in empty mussel shells and in the openings of the lumps of *Pomatoceros triqueter*, which covered the living and dead specimens of *M. modiolus*. On closer investigation, it was found that only a small number were fecundated. This was especially so with regard to the reddish-yellow mass above mentioned, these eggs soon began to decompose.

I also succeeded in seeing fecundated eggs at several stages of development. The eggs, which were 0.078—0.09 mm. in diameter, had no special colour. Division was, as in other mussels, complete and inequal. There is reason to suppose that fecundation took place outside the female's body.

While spawning goes on, the eggs (and the sperm) are pressed out through the genital openings, one on either side, then the spawn passes through the innermost branchial passage, close up to the hindermost constrictor and finally enters the cloacal room to be expelled thence into the water through the anal sipho. The reason for the eggs assuming the form of narrow, short ribbons is probably that the genital opening is a column and not a pore. The eggs rushed quite quickly out of the anal sipho, and it is most probable that fecundation did not take place until they were protruded here.

On $^{12}/_{7}$ 1901, spawning of specimens which had been in the aquarium about a year, was observed. Sperm was so plentiful as to give the tank the appearance of being filled with milk and water. There was at the same time a strong stream of water flowing into the tank and this caused the eggs, for the most part, to whirl about in the water. But as soon as the stream of inflowing water was turned off, the eggs sank to the bottom. The process of division took place rapidly. Already in the evening of the same day ($^{12}/_{7}$) the eggs were divided into a large number of small balls, and the next morning at 9 o'clock ($^{13}/_{7}$) they had become larvae, which were wheeling around by the help of cilia and describing tiny circles. They had formed themselves into irregular small lumps, which moved about at the bottom, their movements being quite regular. Three days later ($^{15}/_{7}$) the specimens were seen to have larval shells and velum. These shells were 0.1 mm. long, their ventral side being curved and the dorsal forming a straight line. The velum could be drawn entirely inside the shells. At this stage, the young *Modiola* possess a considerable power of motion, for they swim quickly about by means of their velum. Instead of being confined to a rotatory motion with very little change of centre, they now moved more in a straight line. When they were six days old, the specimens at the „velum" stage were seen to have acquired circle shaped shells, the straight edge which represented the dorsal side having become more curved. The length of the shells was 0.156 mm., width 0.130 mm. The development of these particular specimens was not followed further, but, from analogy with other mussels, we know that the next important stage is the disappearance or alterations of the velum, while the foot now performs the motion, until the little animal finally attaches itself to some object or other. To catch these animals, a shell dredge of a special construction is used, and also a „stikkert", which is a kind of pinchers with three or four claws.

Sometimes too they are taken by divers. They are taken out of their shells after being brought to land. In addition to the shells, the bundles of byssus and the gills are also removed. The remainder is salted in kegs containing 28 liters. If the shells are large, about 400 are enough to fill a keg, but as a rule from 700—800 are necessary. The price is about 9 kroner (10/—) per. keg at first hand, and as the expense of catching them is very slight, mussel fishing may be very profitable.

I have referred somewhat at length to *Modiola modiolus*, as this particular mussel plays an important part as bait in the cod fisheries at Lofoten.

Cyprina islandica, Lin.

This animal is used as bait in ordinary fishing, but sometimes too in fishing ocean cod.

As for instance in 1896, about the middle of March, at Balstad fishing station, where it was asserted that there were good results when using this bait.

Besides *Cyprina*, which was dredged somewhere in Napstrommen, *Arenicola marina* was also used, which was found near the Balstad station.

Zirphaea crispata, Lin.

This peculiar mussel was noticed by me in 1899, alive, in the sand on the beach at the farm Sund, in Gildeskaal; several specimens were dug out and used as bait.

Ommatostrephes todarus, Raf.

„Sprut" and „akker" are common names in the north of Norway for this Cephalopod species, which, in the autumn come in to the coast in large quantities and thence into the fiords, where they are taken in thousands to be used as bait during the cod fishing in Lofoten. In the Kvæ Fiord in the north of Hinno a considerable catch of cuttle-fish has of late years been made. In many instances, a single family has made an income of kr. 600—800 in the course of a few weeks.

Pandalus borealis, Kroyer.

During the investigations in the Skjerstad Fiord in April 1900, several specimens of this species were met with, and 1903, Niels Haagensen, who was my assistant at the earlier date, made some trial catches with a shrimp trawl, and he succeeded in taking from 10—30 liters each time. So that it was thus proved that *P. borealis* occurs in large quantities in this fiord.

This species is now sent to Bergen and Kristiania to be used as food in no small quantities, but in the north of Norway it is more difficult to sell them, so that there is not much prospect of making much profit on them.

Haagensen, has, nevertheless, suggested that a trial should be made to salt them, prepared as bait, for the fisheries in the north. His suggestion might, at any rate, be found useful for such times as there is a scanty supply of other bait.

H. Kiær at Tromso in 1903 made investigations* with respect to the occurrence of *P. borealis* in the Bals Fiord, the Tromso-sund, the Kvalsund and the Kal Fiord.

In the inner part of the Bals Fiord, he fished, on an average, 3 liters pr. hour with a little shrimp trawl, but at the other places mentioned, *P. borealis* only occurred singly.[1]) The author mentioned is not sure that it would pay to carry on this kind of fishing, even in the Bals Fiord, under present conditions. The day will, however, doubtless come when it will be found profitable to do so, also in the northern districts where this species is found.

Cancer pagurus, Lin.

The species is of no importance in the economy of the northern districts, as it occurs very sparsely. Concerning its distribution, it should be noticed that M. Sars[2]) mentions having found it at Lofoten. Sparre Schneider has informed me that it does not go so far north as Tromso. Schneider has also told me that the common crab, *Carcinus maenas*, has its northern limit at Dyro and the outer coast of Senjen. For the present, Lofoten ought, therefore, to be considered to be the northern limit for *C. pagurus*.

Homarus gammarus, Lin.

M. Sars says (l. c. p. 124) that lobster is only rarely found in Lofoten and the Folden Fiord (67½° N.).

Later on, it was proved that lobster is found in the Tys Fiord. In 1896 „Nordlands fiskeriforening", on the suggestion of inspector Dahl, decided to use a sum of money on trial fishery. About one hundred lobsters, large and of a good flavour, were caught, but no actual lobster fishery has resulted from this trial. It would indeed be quite unique, if an animal should be found in such large quantities near the boundary limits for its distribution as to make it possible to carry on a profitable catch.

It is, of course, a necessary condition that, to be of any economical importance, a marine animal must occur in comparatively large numbers within a limited area. *Buccinum undatum*, for instance, would no doubt be excellent bait, but as it does not occur so close together as *Pecten islandicus* or *Cyprina islandica* it is of little practical importance.

A form, which has recently been taken into use, is *Nyctiphanes norvegica*, M. Sars. At one place in the Trondhjem Fiord (near Verdalsoren) a large number of this Schizopod is washed ashore, and in recent years they have been salted and used, with excellent results, as bait for haddock (*Gadus aeglefinus*).[1]) On our northern coasts, *Boreophausia inermis* occurs in large numbers, and it is probable that also this form, as well as *Nyctiphanes*, may be used as bait for haddock.

b. The „Skrei" Fishery in Lofoten.

The Lofoten fishery is very old. In the latter half of the 9th century Torolv Kveldulvson lived at Sandnes in Alsteno, and it is said of him, in Egil's historical tales, that he had sent men out fishing „skrei" at Vaagan (Lofoten) and some were also gone to fish herrings.[3]) In the same tale too, it is related that Torolv sent his trusty man Torgils Gjallande to England with a vessel laden with dried „skrei", furs, etc. And wheat, honey, wine and clothes made up the return cargo from England. There are many historical references, in the following centuries, to the fisheries in Lofoten, but I will only here refer to some of them.

The tackle used in the old times took the form of hand-lines, about A. D. 1600 longlines came into use, and about the year 1700 nets appeared upon the scene. At the present day all three are used.

For several centuries the „skrei" was exclusively prepared as „dried fish", the head was cut off and entrails taken out and then the fish was hung up to dry. Towards the end of the 16th century some trials were made to prepare „klip" fish (tor-fisk = dried fish = stockfish [commercial], klipfisk = salted, dried cod).

In a description of Lofoten in 1591,[4]) we read that the fish was first salted and then dried on the rocks so that it became „as hard as a piece of wood". In the same account, it is also mentioned that in the summer when the fish were dried and the oil was pressed out of their livers, traders came to Lofoten to barter barley, rye, salt, iron, clothes, linen etc. in exchange for the fish and cod liver oil. The primitive preparation of the latter consisted in the collecting of the liver in large cisterns, which were exposed to the direct heat of the sun, the oil was thus melted out and drawn off little by little. About the middle of the 17th century, cod-roe began to be considered as an article of commerce.

Preben von Ahnen, the last of the feudal lords of Nordland, made strenuous efforts to effect the sale of cod-roe, and in 1658 he obtained a license from Fredrik III to trade in this article.[2])

About the year 1600, Peder Claussøn Friis relates that it was forbidden, under severe penalty, to throw single cod heads into the sea, for fear that fish should eat them to their harm. If one, at that time, wished to be quit the heads of cod one had to string them together and sink them. However, the same writer mentions, some heads were dried to be used as fodder. Now-a-days, the heads and back bones, which are removed when cod is prepared as „klip"fish, are made into guano in factories erected for the purpose. So that not only the flesh of the cod, but also its head, backbone, liver and roe are now made use of. The sperm bags are also sometimes used as fodder, but the rest of the entrails are still thrown into the sea.

The honour of founding the present cod-liver oil industry belongs to a Norwegian pharmaceutical chemist, Peter Møller, he having started the first factory for the preparation of medicinal cod liver oil in 1853.

His son, Dr. F. P. Møller studied the subject also, and he has, in a comprehensive work,[3]) explained the scientific basis of the method adopted by his father.

[1]) Cf. H. Kiær, Om forekomsten af dybvandsræker ved Tromsø. Norsk Fiskeritidende, 1903, p. 624.

[2]) Kristiania Vid. Selsk. Forh. 1858, p. 123.

[3]) Cf. Egils saga Skallagrimsonar. Reykjavik, 1892, p. 39.
„*Han hafði þá menn i skreidfiski i Vágum, enn suma i sildfiski.*"

[4]) Beskrivelse over Lofoten o. s. v. Det kgl. norske Vid. Selsk. Skr. i det 19de aarh., B. 1, p. 473.

[1]) Cf. Nordgaard, Et nyt agn for hysen. Norsk Fiskeritidende, 1903, p. 618.

[2]) Cf. O. Nicolaissen, Fra Nordlands fortid. Kristiania, 1889, p. 80.

[3]) Cod-Liver Oil and Chemistry. London, 1895.

From 1859, there are statistical reports of the Lofot fisheries, including remarks on the course of the fishery etc. There is probably no instance of a completely unsuccessful fishing season, it has, however, happened that only very little has been caught and the quality has not always been equally good. The exact statistics show that the variations in quantity have been very considerable. As the prosperity of thousands depends upon the fishing, the inhabitants have tried, in the course of the centuries, to discover different signs upon which to build prognostications, and resource was even had to divination. For instance, AXEL HAGEMANN[1]) relates that the fishermen, in Saltdalen, made use of the following device, to be able to foretell the prospects for the Lofot fishing season. On Christmas Eve an outline of the Lofot islands was made on a deep dish, which was then filled with water and put aside to freeze during the night. If there were, the next morning, found to be a good number of air-bubbles formed in the dish, it was said that the coming fishing-season would be a good one. And according to the position of the bubbles, one tried to decide at which places there would be most fish. According to Prof. H. STRØM,[2]) the fisherfolk in Søndmør adopted a similar method to discover what the cod-fishery, which began directly after Christmas, would be like.

As time went on, scientists began to concern themselves with problems connected with the fisheries. The wonderful progress made in natural history, which is due to CARL LINNÉ, was also seen in an increased interest in the study of the natural causes which are the necessary conditions for the carrying on of various industries. MARTIN VAHL was a Norwegian who had studied under LINNÉS guidance, and he in his turn had a pupil, JENS RATHKE, who was sent, in 1801, to Northern Norway on account of the fishing which was being carried on there. RATHKE's report of this journey has not been printed, as far as I know, but various extracts from it may be found in a topographical-statistical work by A. HELLAND on the county (amt) of Tromsø. It is G. O. SARS who, in our country, actually laid the foundation for fishery investigations, in the years 1864—70, when he made his wellknown investigations in Lofoten. In 1874, he also visited Finmark to examine into certain questions concerning cod fisheries. The Norwegian North Atlantic Expedition 1876—78, also had matters of a practical scientific nature with regard to the fisheries on its programme. From this period, there are a series of valuable „reports" written by SARS, in which a great many fishery phenomena are discussed.

I have previously given an account of the hydrographical investigations which have been made in the Lofotfishery district.[3]) In the years 1900—01, Dr. HJORT, on S.S „Michael Sars" made extensive investigations along the northern coast of Norway. In his preliminary account, Dr. HJORT gives many important results, among which may be mentioned the exceedingly interesting fact that the young of the cod is found far out in the Norwegian Sea in the summer, while spawning chiefly takes place on the coast banks, and in a less degree in the fiords. HJORT has given a very instructive chart (l. c. p. 43) showing the distribution of the eggs and young of the „skrei" in the summer of 1900 and 1901. From this it would appear that the movement from land is not the same every year.[4])

[1]) Blandt lapper og bumænd, p. 101. Kristiania, 1889.

[2]) Søndmørs beskrivelse, I, p. 536. Sorøe, 1762.

[3]) Cf. NORDGAARD, Contribution to the Study of Hydrography and Biology on the Coast of Norway, p. 5—7. Bergen, 1899.

[4]) HJORT, Fiskeri og hvalfangst i det nordlige Norge. Bergen, 1902.

During the last twenty years, when the Lofot-fishery season has not been a good one, the usual explanation for this fact has been offered in the circumstance that the temperature of the water has been too low. In the course of time, however, so many measurements of temperature have been made that it must be possible to form a decided opinion on the actual relation between the quantity of fish and the temperature of the water. I have previously dealt with this subject, and will now repeat that at the depths where fish is generally found the temperature is approximately the same year after year; consequently the thermometer cannot, as a rule, be taken as a guide. Capt. GADE, too, arrived at a similar conclusion, as a result of measurements of temperature made in the Lofoten fishing waters in the years 1891—92.[1]) On a former occasion, I mentioned, among other things, that the fluctuations in the quantity of fish might possibly be accounted for by the variations in the number of sexually fully developed „skrei". I must, however, confess that a more careful consideration of the question makes this supposition much less likely. The investigations made by HJORT and DAHL in recent years have made it clear that quantities of cod are found in the summer on the Finmark banks and in the sea between Norway and Spitzbergen. Of these, the sexually fully-developed individuals in the winter go westwards and southwards to spawn, while the younger ones (loddetorsken) stay near the coast of Finmark. As there is every reason to suppose that, even in the most successful seasons, only a small fraction of the whole number of spawning cod is fished up, it must be concluded that quite extraordinary variations in their number would have to occur if there were to be any noticeable effect on the catch. The natural instinct, whether it be intense or slight in degree, which impels to a change of environment, must be taken to be the same year after year for the same species, and finally, the conclusion is reached that the fluctuations in the quantity of fish must depend upon certain conditions in the medium in which they move. The investigations made up to the present appear entirely to confirm the opinion that it is not the differences in temperature and salinity which determine the yield of fish. The properties of *Gadus callarias*, which determine this in Lofoten, must certainly be taken to be the same, year in and year out; on the other hand, such things as the number of fishermen, of days when it is possible to put out to sea etc. are subject to variation. But I am convinced that such variations alone are not a sufficient explanation of the fluctuations in the yield of fish. With respect to the number of fishermen, this decreases on account of the fall in the yield, while a prospect of better yield increases the number of fishers. There must, therefore, be conditions in the sea itself, which contribute in various degrees to increase, or diminish, the effect of the positively active factors, which, in spite of everything, have exerted so much influence as to prevent the Lofot fishery from having at any time been altogether a failure. By the yield of the Lofot fishery is meant, in the Norwegian fishery statistics, the „skrei" (ocean cod) which is caught from the middle of January to the end of April, during which period an official control is exercised, in the district from Guldviken to Lofotodden. During the decennium 1886—95, the average yield was 26.53 millions. The maximum was reached in 1895 with 38.6 millions. For the years 1896—1902, the average yield was 16 millions, the greatest catch was in 1897 (25.8 millions) and the least in 1900 (8.4 millions). The year 1895 forms the turning point, and it is tolerably natural to set the limit here. If

[1]) Temperaturmaalinger i Lofoten 1891—92. Kristiania, 1894.

comparison be made with statistics for 1859—85, it will be seen that the years 1886—95 were particularly favourable ones, while from 1896 up to the present time, there have been unusually bad seasons. In this clearly defined state of things, there lies an increased possibility of getting at the causes thereof, and I have tried, in various ways, to connect facts, but it was a long time before I succeeded in finding anything which seemed to point to a law. During my work, however, the opinion has gained upon me that the movements in the sea itself have a great effect upon the direction taken by the fish. A. Boeck, to whom much is due for his study of the spring-herring fishery, was of the opinion that the herrings went against the stream, but later observers do not agree with him in this matter, and I believe that both herrings and cod most probably, as a general rule, move with the stream. So that a very careful study of the currents in the sea is of great practical import. In recent years, V. Bjerknes, Sandstrom and Helland-Hansen have developed the analytic apparatus to be used in calculating the movements of the sea, but it would seem that these scientists have taken no account of the wind. In his well known work on the Norwegian Sea, Mohn, has, on the contrary, very strongly emphasized the importance of the wind as a cause of currents, and this opinion is shared by many foreign hydrographers. With regard to the mutual dependence of winds and currents upon each other, it may, generally speaking, be said that a constant off-land wind causes a corresponding current from land, while during a constant sea-wind, the water is forced in towards the coasts. In the spring (March and April) the water on the west coast of Norway is particularly low, the supply of fresh water being slight, but more especially does the continual land-wind blow a quantity of water away from the coasts. At the end of March this year (1904), there was in Bergen continually easterly winds, which were so strong that they kept the tide waves so much at bay as to make the difference between ebb and flow very slight indeed. Similarly, a strong sea-wind in the late autumn is able to keep the water for days at an unusually high level. It is, however, clear, that, during the movements to or from the coast of the surface water, a compensating current must be set in motion in the deep water; it has long been a recognized phenomenon in the fiords, that the surface and under-currents go in contrary directions. If we now take it for granted that both herrings and cod are to a certain extent drawn along by the currents, it naturally follows that one must try to find out whether it be the motions in the surface-layers or the deeper situated compensation-currents which exert a special influence on the direction taken by the fish. Keeping this question to the fore, I have gone through a large number of fishery reports, and it seems from these to be fairly certain that the herrings move coastwards especially in the surface layers, while the „skrei" travels along in the deeper layers. This would imply that herrings are most influenced by the surface-currents, cod by the compensation-currents. In reports on spring-herring fishery, it is, for instance, mentioned that small lots of herring (the so-called „Aater") are often seen drifting along with the stream, and there are many remarks made by skippers about the sea being of a peculiar colour just beyond the spring fishery district, and that this is caused by the large number of herrings which are there present, and this fact denotes that the fish cannot be at any great depth. There is, however, no reason why the herrings should not lower themselves deeper in the water, but as a general rule, I think one may conclude that they move principally in the upper layers. On the other hand, no one has observed shoals of „skrei" off the coast, and the first „skrei" of the year is, in fact, usually taken from a depth of 100—150 meters. It must, therefore, be supposed that as cod and herrings, to a certain extent, depend upon contrary current phases, a particularly good spring-herring fishery would prevent a correspondingly good cod fishery in the same district; for a strong tendency of the upper layers towards the coast certainly takes herrings along in the current, but this at the same time causes a compensation current in the deep water, and this current hinders the cod in its passage to the spawning places. It is indeed specially mentioned in reports on spring-herring fishery, that, in really good herring years, cod does not, as a rule, occur in any quantity.

The „skrei" fishery takes place in Lofoten in the months January—April.

Let us have a look at Mohn's Climate tables (Vol. IV), so as to get an idea of the winds prevalent at this time of year. We find that at Skomvaer, from October—April, the prevailing wind is from S. At Andenes station, there is prevalent southerly wind from September—April, and at Fruholmen station from SE in the months of October—March. From this, it would follow that, as a rule, the wind and the surface current go in a contrary direction to that taken by the cod from the northern banks, while the under-currents probably go in the same course as that which the cod has to follow. On looking through the remarks on the weather which are found in the annual reports of the Lofot fishery, I have got the impression that the cold-bringing easterly winds by no means retard the fishing, as has been stated, but that they, on the contrary, assist it. For instance, the following paragraph is found in the chief controller's report on the excellent season 1895:—

„Easterly and north-easterly winds were prevalent, with clear skies and frost, north-westerly and westerly winds and snow were not unusual either, but southerly winds and rain were rare." When easterly winds prevail, it is found that the surface temperature on the Lofoten banks falls considerably, and the principal reason for this fact is that the wind sweeps along the cold surface water from the fiords, while the under-currents undoubtedly go in a contrary direction and carry along the cod.

As a result of the foregoing, it is quite natural to conclude that the fluctuations in the Lofot fishery really are due to the distribution of atmospheric pressure, or, in other words, the direction and strength of the winds. As, however, there are many difficulties to be surmounted in studying the changes in the influence of winds, I have chosen another thing, which is greatly affected by them, namely downpour. I take it for granted that the annual downpour must, taken generally, give a measure of the influence of the winds. By noting the changes in downpour from year to year, one must be able to form an opinion of the relation of the sea and land winds to each other; for upon this, according to the theory stated above, depends the success of the fisheries. In the „Observations of the Downpour in Norway" published by the Norwegian meteorological institute, we have an excellent aid in studying the fluctuations in downpour. From this work, I have taken the necessary data to enable me to give the following table, which shows the annual average height of downpour in millimeters, at a series of coast stations, during the years 1886—95 and 1896—1902, as well as the calculated normal height.

Station	1886—95	1896—1902	Normal
	mm.	mm.	mm.
Fredrikshald	725	682	718
Kragerø	1027	925	1019
Tvedestrand	1181	1118	1157
Oxø	1073	810	1000
Mandal	1491	1348	1339
Skudenes	1181	1151	1158
Ullensvang	1375	1355	1297
Bergen	2096	2250	1916
Florø	2233	2348	2050
Aalesund	1234	1396	1170
Kristiansund	1148	1158	1097
Trondhjem	1013	1033	1001
Nordøerne	..	765	817
Brønnø	960	884	897
Sandnessjøen	1104	1008	1080
Bodø	923	1248	905
Svolvær	..	1301	1284
Tromsø	981	1120	1017
Gjesvær	665	729	669
Vardø	..	731	625

For the sake of clearness, I have, in the following table only put a + to represent those average values which are greater than the normal ones, and a — for those below the normal ones.

Station	1886—95	1896—1902
Fredrikshald .	+	—
Kragerø	+	—
Tvedestrand..	+	—
Oxø	+	—
Mandal	+	+
Skudenes	+	—
Ullensvang ..	+	+
Bergen......	+	+
Florø	+	+
Aalesund	+	+
Kristiansund .	+	+
Trondhjem ...	+	+
Nordøerne ...		--
Brønnø......	+	—
Sandnessjøen .	+	—
Bodø	+	+
Svolvær		+
Tromsø......	—	+
Gjesvær	—	+
Vardø		+

On comparing the values at the stations from Fredrikshald to Skudenes, it will at once be seen that the downpour was generally above the normal in the years 1886—95, below, in 1896—1902. The exception which is found at Mandal is of no consequence, as the surplus above the normal in 1896—1902 is exceedingly small, in comparison to the difference between the average height of downpour in the series of years mentioned.

If we next investigate the results of the herring fishery in the Skagerack, we find that the Swedish Bohus fishery shows considerable increase in the years 1886—95, with a succeeding decrease up to the present time. In 1886—95 the catch of fish in Eastern Norway was, as a rule, good, and at times very plentiful. In 1893, the culminating point was reached with a catch of 337000 Hl. But from 1896—1902 the herring fishery in the same district was poor.

It will be found that the winter herring fishery, both in the North Sea and Norwegian Sea off the coast of Norway, had a different result. As will be seen, on reference to the tables, there was a surplus downpour both in 1886—95 and 1896—1902 from Skudenes to Kristiansand and Trondhjem, but it was very slight at the two last mentioned places, so that no decided effect can be expected there. On the other hand, on the coast southwards from Aalesund, a considerable surplus during both periods, greatest during the years 1896—1902, will be noticed. These facts harmonize well with the particularly successful spring-herring fisheries from 1896 onwards, the catches in the previous period, 1886—95, being unimportant in comparison. And, as it is well known, it is also from 1895 onwards that there has been herring fishery in the Romsdal district.

During the years 1896—1902 then, the downpour on the Skagerack coast was on an average below the normal, and in the spring-herring district considerably above the usual average; at the same time, the springherring fishery flourished, and that in the Bohus and East Norwegian districts decreased.

It has long been affirmed that there is an alternation between the winter-herring fishery in the Skagerack and the Norwegian springherring fishery, so that when the curve for the latter reaches its maximum, the other is at a minimum, the highest point for the one corresponding to the lowest for the other. As far as can be seen from the historical notices of the fisheries, this interchange would appear to be almost an unbroken rule, which does not, however, prevent the possibility of there being some catch of fish at one and the same time both on the Bohus and the West Norwegian coasts. In the light of my hypothesis, of the definite influence of the pressure of the atmosphere on the fisheries, an explanation may be sought in the fact that the barometrical minima which compel winds and currents to send the herrings into the west coast of Norway, cannot at the same time act similarly on the south Norwegian and Bohus coasts.

From what has now been advanced, it follows that the influences which are favourable to an inflow of herrings along a given stretch of coast will obstruct the passage of the cod landwards.

Let us, therefore, have a look at the results of the cod fishery. That which is carried on in the springherring district (Stavanger and the Bergenhus counties) yielded, during the years 1886—95, about 3 million fish, calculated from the official statistics; for the years 1896—1902, the average was about 1 million.

In the Romsdal district, where big herring fishery has been flourishing since 1895, I have calculated the average yield of cod to be 7.9 millions during the years 1886—95, and about 6.5 millions for the years 1896—1902. Thus, in both these districts, an increase in herrings and a decrease in cod have gone together. On reference to the tables, it will be seen that the stations at Kristiansund and Trondhjem show, for the years 1896—1902, as compared with 1886—95, an average downpour which is not very unlike or much above the normal height. During the years 1896—1902 the downpour was below the average at Nordoerne, Bronno and Sandnessjoen. So that we should expect to find an improvement in the cod fishery in the Trondhjem district and on the coast of Nordland south of the Vest Fiord, and statistics prove that this was actually the case; for I have calculated, from the official statistics, that the average yield in 1886—95 was about 2 millions, from 1896—1902 about 3. In the district where the largest cod fishery is carried on, it is interesting to notice that there was an usually high average downpour in the „bad" years 1896—1902, while the „good" fishing seasons are characterized by very little downpour. And, as already mentioned, the average yield of the Lofot fishery in the years 1886—95 was 26,5 millions, but from 1896—1902 only about 16 millions. Thus, there does appear to be a connection between the downpour, on the one hand, and the cod and herring fisheries, on the other.

In judging the various fisheries, a much too important part has hitherto been given to the natural animal instinct, while, on the other hand, it would be incorrect to attribute all the chief phenomena connected with the fisheries to purely hydrodynamic conditions. Especially with regard to the cod, it should be mentioned that if everything depended upon the mechanics of the water layers, one would also expect to find younger individuals than fully sexually developed ones at the spawning places. Dr. Hjort has shown that spawning principally takes place on the banks, less in the clay channels, so that *Gadus callarias* must, undoubtedly, possess some degree of initiative. But it can hardly be denied that the currents in the sea exert a very modifying influence on the movements of the fish. From this point of view, it becomes of considerable interest to have a clear knowledge of the causes of these currents. But on this matter, there is no little disagreement. Some scientists assert that the rotatory motion of the earth is alone necessary to cause the system of currents taken as a whole. But even if this be so, it can be said that the influence of the rotatory motion of the earth, whether it be great or small, must at any rate, be constant, and when one is trying to discover the causes of fluctuations in the fishery-yield, one must especially examine the variable factors which may be supposed to exert some influence. And then, I think, the winds must first of all be considered. As variations in atmospheric pressure cause winds, winds cause currents and currents, with great probability, exert an influence on the course of herrings and cod, it must certainly be practical to turn one's attention to the barometrical minima. In the foregoing pages, I have considered that the downpour will generally be influenced both by the situation and the degree of prominence by which they are characterized. In the meantime, it is interesting to consider these minima direct.

It may now be taken for granted that the great atmospheric depression, which is called the winter minimum, in the Norwegian Sea is subject to considerable variations, both with respect to place and degree. In „The Book on Norway", Einar Haffner describes the variations in atmospheric pressure in the years 1884 and 1890. Haffner also gives charts showing the distribution of atmospheric pressure, respectively in January 1884 and December 1890. The former shows a low pressure north of Norway, and the result was that January 1884 was unusually mild. In the chart for December 1890, this northern minimum has disappeared, the lowpressure centre near Iceland determined the direction of the winds, and in the month in question the temperature was very low over the whole of the Scandinavian peninsula. In „Ymer" for 1898 (Nr. 2), Otto Pettersson has described how the great development of the Gulf Stream, in the northern part of the Norwegian Sea in the summer of 1897, caused a winter minimum to the N.W. or N. of Norway. In consequence of this, there was a higher average temperature in Sweden in January and February 1898, on account of the prevailing westerly winds. As a whole, several winters from 1896 onwards have been unusually mild, while the summers have, to some extent, been cold, at any rate, in the north. There have also been „green" years in the same period. Another peculiar feature in connection with these years, is that some arctic mammals have come far south during the spring and summer (*Phoca groenlandica* and *Delphinapterus leucas*). But of greatest interest is the fact that there was a much smaller yield of cod than usual, in these years. If the theory, advanced in the foregoing, be adhered to, with respect to the dependence of this fishery upon winds and currents, a natural explanation of the decrease in the Lofot yield will be found in the fact of the atmospheric winter depression in the Norwegian Sea having been so marked and so situated as to make the system of currents, set in motion by the wind, act as an obstacle to the progress of the fish.

It is possible, too, that this way of looking at things, may throw new light upon the subject of the changes in the height of our coast water.

According to Dr. Andreas Hansen, the variations in the height of coast water have been above and below a settled medium, and the result, in historical times, has been that the relation between land and sea on the coasts of the North Sea and the Norwegian Sea has remained unaltered. It might perhaps be practical to introduce the idea of a medium normal height of water, which would correspond to the normal height of downpour for a given stretch of coast. The medium annual height of water, according to Andreas Hansen falls into groups of years in which it is above, and years in which it is below the normal height. In Rost 1891—94 he mentions a lesser height than usual, but in 1890 at Skagerack a greater.[1] This answers particularly well to the circumstance that on the Skagerack coast in the period 1886—95 there was a surplus downpour, while on the northern coasts the average was not attained. For, as both downpour and water-level depend upon the direction and force of winds, they must have a corresponding course, and the measure of the one may, therefore, serve to judge of the other. It is also probable that just as the water on the Skagerack coast and the west coast of Norway may be in different phases, as proved by Hansen, so may there also be places, on the long stretch of coast from Skudenes to Vardo, where the water is higher than the normal height, while at others, it is lower. There is reason to suppose that, in the years 1896—1902, the medium water-level was lower than usual on the coast of Helgeland, and probably also on the coasts of the Trondhjem district, for the table shows that the downpour was below average.

If events should prove that my opinion, concerning the influence of atmospheric pressure upon the yield from the fisheries,

[1] Cf. Skandinaviens Stigning, p. 52. Norges geol. Unders. Aarb. f. 1896—99.

is well founded, it is at the same time settled that an increased interest will be attached to the question of the causes of, and laws governing, atmospheric pressure. But this is an exceedingly difficult problem, for, as an English scientist, F. W. HARMER[1], says: — „It seems impossible in these questions to distinguish between cause and effect. Temperature, pressure, winds and ocean currents act and react upon each other as links in an endless chain."

It is evident that, if the connection referred to really does exist, an important advance in weather prognostications will also be of some weight with regard to the prediction of the fisheries. And it would then be a reasonable supposition that an investigation of the distribution and degree of heat of the Gulf Stream in the Norwegian Sea, in December, for instance, would provide material which would make it possible to get an idea of the prospects for the subsequent Lofot fishery. Similarly, it may be supposed that, if the fluctuations in the fisheries were given a place in the group of phenomena, which vary during the so-called „Brückner Periods", a helpful plan of the rise and fall which occur in the fisheries might be obtained, by means of the historical-statistical method.

One is then tempted to conclude with regard to the Lofot fisheries that as the years 1886—95 were unusually favourable, it is not likely that the present marked poor yield of cod can last much longer, a change for the better must soon occur. It is, however, a fact that the changes in climate hardly occur with the regularity which the word „period" demands. In the last edition of his Meteorology, MOHN writes (p. 302): — „Beyond the daily and the yearly period in the course of the meteorological elements, we know no other period in the weather changes. One day, the one year, is not like the same day, another year, one month, the one year, is not like the same month another year; there is, indeed, a variation from one year to another in the weather, which seems quite irregular."

But on the other hand, the circumstance that bad years, — as well as good years, — both on land and at sea are inclined to follow each other, would seem to modify the supposition that there is an interchangeable tightening and slackening in the play of forces. At any rate it will be exceedingly interesting to follow the working out of the problem: — Are there periods of years which are characterized by great downfall, high medium water-level, good winter herring fishery, less good cod fishery, cold summers, with sometimes „green" years for the farmer; and are there periods of years when there is little downfall, low medium water-level, good cod fishery, less good herring fishery, dry and warm summers, with sometimes „dry" years for the farmer?

With regard to the special problem here being dealt with, what has already been said will, I hope, make it clear that there seems to be an agreement between the yield of the cod and herring fisheries and the winds, for whose influence the downfall has been used as a measure. To this method may be objected that the cod and herring fisheries are carried on in certain months, while the calculations of the downfall are made for the whole year. But it should be noticed that those months, in which these fisheries are carried on, are the richest in the year in downfall. Consequently, there will hardly be any real difference in results on account of the method here adopted. It might, however, perhaps be found that the agreement between the winds and the yield would be greater, even in details, if the downfall for the months September—December were taken in conjunction with the downfall in the months of January—April in the succeeding year. Any very detailed agreement must not, however, be expected, as the catch for a single year is only an unreliable measure of the actual quantity of fish present.[1]

The observations of downfall are of comparatively recent date in our country, consequently they can only be used as a measure of the effect of the winds, during recent years. But there are other things which give hints as to the conditions previously. During the last period of years in which there was a surplus downfall, a storm flood occurred in Lofoten and caused much damage. RICHARD HANSEN writes about this, as follows: — „During the week, 19th—26th January (1901) a violent storm of wind from southwest to northeast raged; and on the 22nd, there was such high water that it was unparallelled in the memory of the oldest inhabitants, and much damage was done by this unusually high flood all along the Lofoten district."[2] This kind of damaging flood will probably only occur in years with great downfall and high average water-level, so that the mention of such a flood makes it possible to draw conclusions with regard to the weather and matters connected with it. When, for instance, ABSALON PEDERSSÖN, in his diary[3]) mentions that on November 1st 1570 „a very great and high flood occurred, whose equal no one in Bergen remembered and which did great damage to flour, malt and fish," one might from this circumstance conclude that herring catch was made during these years. From Christmas 1570 to February 1571 there was according to the same writer, severe frost, and the herring fishery that year was a failure, but the next year (1572) herrings were caught in the beginning of February, and in the years preceeding 1570 in February herrings were regularly to be had in the Bergen market. From several sources, we find that the years 1740—42 were „bad" ones or „green" years. Professor HANS STRØM, in his well-known description of Søndmør, mentions that spring-herring fishery was started there about 1740, „that is to say about the same time as the general failure of crops occurred in Norway." And at another place, in the same work, he says that the summer is generally short and warm, but „from 1740 the summer here has generally been cold and damp with thick fogs, which have continually come in from the sea and brought a cold northerly, or westerly, wind in its wake." Here we have a clear combination of bad weather and inflow of spring-herrings, and this is not the only example of its kind. The first „green years" mentioned in our history occurred during the reign of HARALD GRAAFELD (961—970), and were exceedingly bad. SNORRE relates that „the country people were almost entirely without grain and fish". At Helgeland, there was great hunger and want. OIVIND SKALDE-

[1]) Influence of winds upon climate during the pleistocene epoch. Quart. Journ. Geol. Soc., vol LVII, 1901, p. 457.

[1]) After this was written, J. REKSTAD's interesting treatise on the changes in Norwegian glaciers was published („Om Justedalsbræen" Berg. Mus. Aarb. 1904). REKSTAD comes to the conclusion that temperature exerts a greater influence than downfall on the changes in the glaciers, and in the course of his investigations, he has compared the downfall curves for the period 1st May—1st September, and from September—May. He says (l. c. p. 70): „On considering the anual curves and those for the 8 winter months, it was found that they (downfall curves) pretty closely corresponded. When the annual downfall was great, the same was the case in the winter months; and when the annual downfall, on the contrary, was small, the corresponding was found to be true, with regard to the winter months."

[2]) Norges Fiskerier 1901, Nr. 2, p. 109.

[3]) Cf. NICOLAYSEN's edition (1860), p. 203.

SPILDER, who lived at Tjøtta, wrote about the common misery, and he too was a great sufferer during the bad years. One spring, there was an inflow of herrings to some outlying places, and OIVIND rowed thither to buy some. SNORRE further writes that „the first winter (970—971) that HAAKON JARL ruled in Norway, herrings came around the whole country.“ We see, that, at this time too, bad years and inflow of herrings were coincident, and I am, moreover, inclined to conclude that, as there was such hunger and want at Helgeland, the cod fishery had not been successful. SNORRE indeed says that there was a want of fish. We know that, about a hundred years previously, the Lofot fishery had been so good that a man at Helgeland had been able to export stock fish to England.

Right back in the olden days, there are sources of information which hint at considerable variations in the yield of the Lofot fishery. And at the present day, we have certain proofs that rather great fluctuations do indeed occur.

To confirm which, I will, finally, give a few features of the history of the Lofot fishery in the 19th century. At the commencement of the century in question, there were many bad years for the farmer, 1812 being one of the worst. From an account written at the time[1], it will be seen that the Lofot fishery had so fallen off that it was feared that it would altogether fail, and the reason for this was not sought in natural circumstances, but in the increasing use of nets during the fishing season.

About ten years later, there appears to be an improvement in the fishery. The clergyman in Saltdalen, S. C. SOMMERFELDT[2]) writes that, in the year 1823, there was a particularly good Lofot fishing season, and the yield was calculated to be 15.923000 fish, divided among 2788 boats. For the succeeding years the following figures are given by JENS KRAFT[3]) for Lofoten and Vesteraalen.

	Nr. of boats.	Nr. of fish
1825	— 2589 —	11509180.
1826	— 2790 —	12821760.
1827	— 2916 —	15864620.
1828[1])	— 2731 —	13919380.
1829	— 3027 —	11676200.

These figures, according to A. M. SCHWEIGAARD[2]) are too low, as the fishers were supposed to have given too low numbers, on account of tithes to be paid. As, however, the yield from Vesteraalen[3]) is also included in these figures, the yield for Lofoten alone can hardly be said to be more than 15 millions.

From 1859, there are complete reports of the Lofot yield.

A graphic illustration of the millions caught from 1859—1903 gives a particularly irregular picture, suggesting a panorama of Jotunheim, with a Galdhopig for the maximum year.

It is evident that the catch of a single year may, to some extent, be affected by more or less accidental factors, whose influence must be supposed to be disregarded when an average for a period of years is to be given, e. g. a decennium.

The result would then be: —

1861— 75	.... 18.4	million fish
1876— 85	.... 21.5	— „
1886— 95	.... 26.5	— „
1896—1903	.... 15.4	— „

These figures are supposed to be comparable.

It is interesting to note that during the years 1861—71, there was a big-herring period in Nordland. At the same time, the average water-level is mentioned as being higher than normal, and the yield of cod must be reckoned as not very good. The next period shows an improvement in the yield, and the best seasons are reached in the years 1886—95. This agrees beautifully with a low average water-level in Nordland in the years 1891—94, and a downfall less than usual in the same decennium. On the contrary, as already mentioned, the Lofot fishery has of late years not been very good, while there has been a surplus downfall.

c. Some Remarks on the Cod-fishery in Finmark.

The catch of spawning cod (skrei) in Finmark is not very important, at any rate at the present time. Spawning takes place, however, every year and Brevik and Hasvik in Søroen are important stations during the winterfishery in Finmark. A. F. BREMER[4]) mentions that, about 1830, there was a very good catch of „skrei“ in the fiords of West Finmark, in particular in the Alten Fiord. But in 1838 a change occurred, and from that year the fishery in the fiords was poor, and the reason BREMER thought, was that the considerable inflow of *Ommatostrephes todarus* (akker) and herrings began just that year. BREMER, and others, also mention that from 1830—40 the „loddefishery“[5]) was very poor. It is mentioned as a general rule that the winter cod fishery in Finmark is always better in those years when the „lodde“ (capelan) occurs only in small numbers. The spring cod-fishery, which depends upon the capelans being followed on its spawning travels by young individuals of *Gadus callarias*, is very much more important than the winter fishery (skrei-fishery), therefore the absence of capelan is a serious matter for the Finmark fishers economically speaking. It would therefore be of great economical importance to get a thorough knowledge of the capelan's life. In one of his latest works, Prof. COLLETT[4]) has collected what is up to the present known about this fish. I beg to refer to this account, from which it will be seen that „during the inflow, the capelan often travels in compact shoals in the surface layers“. Sometimes, spawning occurs at a depth of a few meters, but generally deeper down (70—90 m.).

[1]) E. A. COLBAN, Forsøg til en Beskrivelse over Lofotens og Vesteraalens Fogderi (1814). Det Kgl. norske Vid. Selsk. Skrifter i 19de Aarh., Bd. 2, Trondhjem. 1824—27.

[2]) Physisk-økonomisk Beskrivelse over Saltdalen, p. 139. Det Kgl. norske Vid. Selsk. Skr. 19 Aarh. Bd. 2, Trondhjem 1824—27.

[3]) Beskrivelse over Kongeriget Norge, 6 Del, p. 373, Kristiania, 1835.

[4]) En gammel Finmarkings Betragtninger o. s. v. Hammerfest. 1881.

[5]) By this expression is meant the cod fishery which is carried on at the time when *Mallotus villosus*, MÜLL. (lodde) spawns.

[1]) Lofoten alone.

[2]) Norges Statistik, p. 96. Kristiania, 1840.

[3]) According to SOMMERFELDT (l. c. p. 139), the yield from Vesteraalen in 1823 was 581700 fish.

[4]) Meddelelser om Norges Fiske i Aarene 1884—1901. II. Kristiania Vid. Selsk. Forh. f. 1903, nr. 9, p. 147—163.

A glance at a curve depicting the yield of this fish (cf. Hjort, Hvalfangst og fiskeri, p. 81) gives the impression of great irregularity, without any sign of any rhythmical law. It must, however, be remembered that there are many things which affect the yield of a fishery. It cannot be denied that there are immense variations in the occurrence of capelan, and this cannot be supposed to be a whim on the part of the fish, but must depend upon variations in the natural conditions in the sea itself. When I visited Finmark, in 1899, M. Ingebrigtsen, the whale-catcher, told me that old fishermen took two things as signs of a good number of capelan, and these were (1) a plentiful supply of driftwood, and (2) a good ptarmigan year.

Carefully considered, it will be found that these two „signs" point to the fact that sea winds have been prevailing: for the drift wood is driven by wind and storm landwards, and prevailing winds from the ocean means a good deal of moisture which here falls as snow, and a good deal of snow in the mountains sends the ptarmigan down into the low lands. If it be taken for granted that the capelan, as well as the herring, is dependent upon the movements of the surface layers, my hypothesis would mean that in the years when there is a plentiful downfall, there would be large shoals of capelan. This does not, however, seem very likely from the statistics given for the years 1896—1902, during which period there was a surplus downfall, but only a poor yield of fish. But *Phoca groenlandica* occurred in large numbers in the years mentioned, and the presence of this animal was said to have a particularly bad influence on the fishery.

According to Bremer there was, from 1830—38, good skrei-fishing in the fiords of Finmark, but then *Ommatostrephes* and herrings showed themselves and the skrei diminished in numbers. The same writer says that the capelan, about the year 1840, again came in large numbers to the coasts of Finmark.

I have already shown that the „skrei"-fishery and the winter herring-fishery appear to depend upon contrary current-phases, and as the capelan's habits are, as far as is at present known, similar to those of the herring at the time of inflow, we must expect that the surface currents, which drive the capelan landwards, cause compensation currents further down, and these latter obstruct the inflow of „skrei". What I have just said must only be taken as an attempt at an explanation. It is, meanwhile, interesting that this attempt harmonizes with the prognostications made by old fishers in Finmark.

At any rate it would seem to be worth while to pay attention to those mechanical factors which may be supposed to exert an influence on the yield from the fisheries.

It is possible that it will be found that the large catches of herrings on the coast in the months of October—December, and to some extent also January, may be accounted for by the fact that meteorological conditions in these months cause a strong flow of water to the coasts, which is also evident from there being a maximum height of water in the autumn. And with regard to the spawning herring (vaarsild) and the spawning cod (skrei), I think I have found as a result of historical and statistical investigations, that, as a rule, a good herring fishery and a good „skrei"-fishery will not occur on the same stretch of coast, simultaneously. At the period these fisheries are carried on (January—April), there is a sinking tendency in the water towards the spring minimum, and it seems reasonable, that just as the relation between ocean and land winds at this time exerts an influence on the medium water-level, by regulating the currents in the coast water, so will its effect on the currents also, to some extent, further or hinder the inflow of cod and herrings. There can be no doubt that biological and physical factors play an important part in the fisheries. The former may be taken to be constant, while, at any rate, some, of the physical ones are variable.

If one takes it for granted that the ocean-currents have an important influence on the course of the fish towards land, the difficulty meets one that scientists are not agreed as to which of the causes of currents one should give most weight. Can it, however, be proved that there is a connection between the periodical changes in the yield of the fisheries and the fields, one will be compelled to suppose that there is a common cause at the bottom, and we have thus come to the conclusion that this must be the variations in atmospheric pressure. But we get no farther, and will hardly be able to do so, until meteorologists have solved the problem of the laws governing the rise and changes in barometrical minima.

As far as practical marine investigations are concerned, the following famous words of Laplace may well be used:—

„Ce que nous savons est peu de chose, ce que nous ignorons est immense."

PLATE I.

PLATE I.

Map showing the northern part of Norway. The curves are isohyets and represent downfall in mm. for the year 1899 (blue) and 1900 (green).

Pl. I.

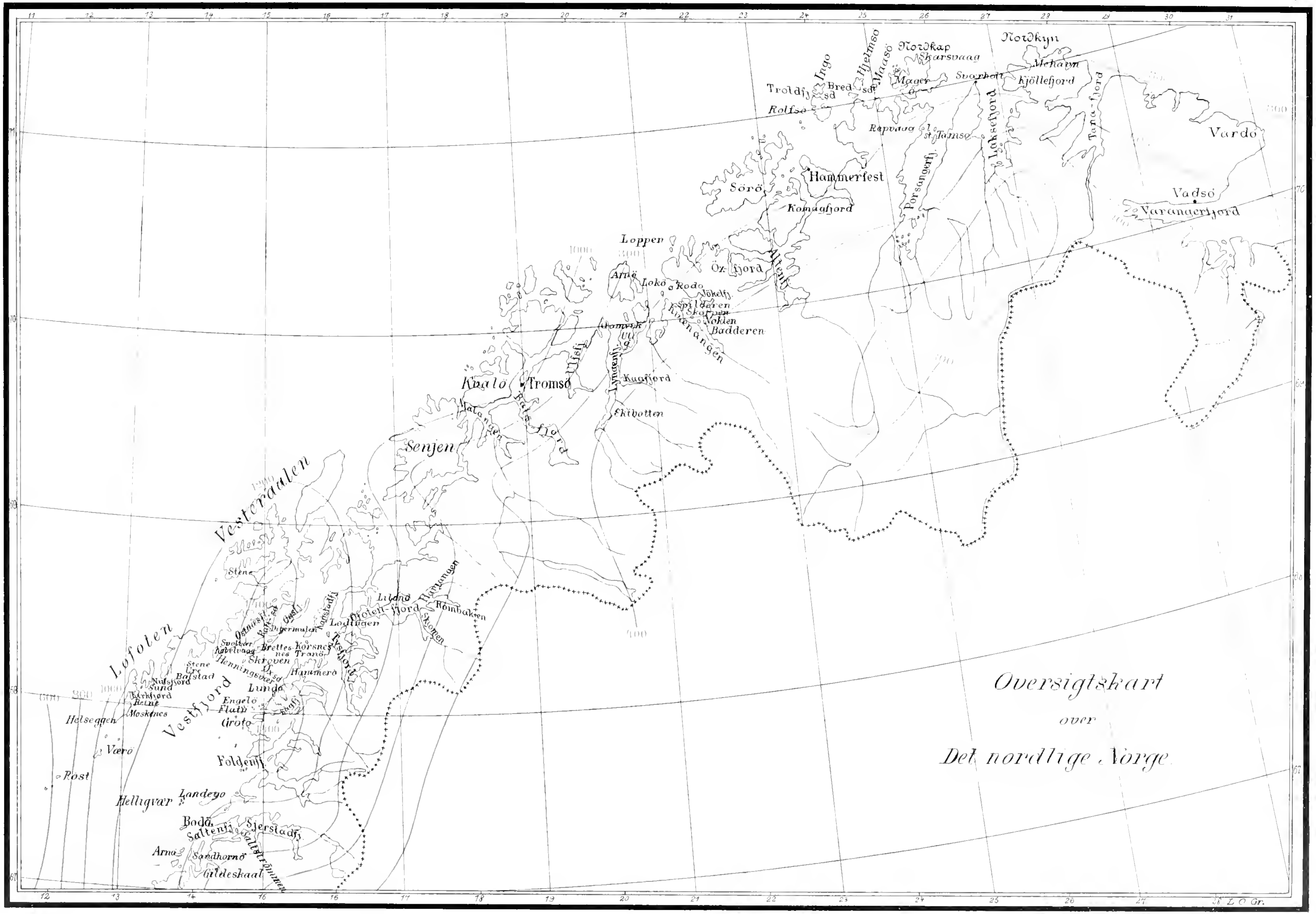
Oversigtskart
over
Det nordlige Norge
Nordkap
Nordkyn
Skarsvaag
Mehavn
Kjöllefjord
Hjelmsö
Maasö
Ingo
Troldfj
Rolfsö
Mager ö
Svarholt
Repvaag
Tamsö
Laksefjord
Tana-fjord
Vardö
Vadsö
Varangerfjord
Porsangerfj
Hammerfest
Komagfjord
Sörö
Loppen
Arnö
Lokö
Rodo
Öz-fjord
Altenfj
Jökelfj
Badderen
Kvænangen
Tromsö
Kvalö
Ulfsfj
Lyngenfj
Kaafjord
Skibotten
Malangen
Balsfjord
Senjen
Vesteraalen
Lofoten
Vestfjord
Ofoten-fjord
Rombaken
Skjomen
Lödingen
Tysfjord
Svolvær
Kabelvaag
Henningsvær
Skrovan
Stene
Lunde
Engelö
Flatö
Grotö
Foldenfj
Balstad
Nusfjord
Reine
Moskenes
Helseggen
Værö
Röst
Helligvær
Landego
Bodö
Saltenfj
Sjerstadfj
Saltströmmen
Arna
Sandhornö
Gildeskaal
L.O Gr.

PLATE II.

PLATE II.

Fig. 1—12. *Pleuromamma robusta*, DAHL. Skroven (Vestfiord). 0—300 m., $^{4}/_{2}$ 1899.

" 1. Anterior antenna, right side. $^{83}/_{1}$.

" 2. First joints of anterior antenna, left side. $^{83}/_{1}$.

" 3. Posterior antenna. $^{83}/_{1}$.

" 4. Mandible. $^{83}/_{1}$.

" 5. Maxilla. $^{83}/_{1}$

" 6. 1. Maxilliped. $^{83}/_{1}$.

" 7. 2. Maxilliped. $^{83}/_{1}$.

" 8. 2. pair of natatory legs. $^{83}/_{1}$.

" 9. 3. pair of natatory legs. $^{83}/_{1}$.

" 10. Rostrum. $^{83}/_{1}$.

" 11. Abdomen. $^{27}/_{1}$.

" 12. 5. pair of natatory legs. $^{83}/_{1}$.

" 13. *Chiridius tenuispinus*, G. O. SARS, female. Ofotfjord. 300—350 m., $^{7}/_{2}$ 1899. Spine of the last segment of cephalothorax. $^{83}/_{1}$.

" 14. *Chiridius armatus*, BOEBK, female. The Malang Fiord. 0—380 m., $^{14}/_{4}$ 1899. Spine of the last segment of cephalothorax. $^{83}/_{1}$.

PLATE III.

PLATE III.

Fig. 1. *Flustra carbasea*, ELLIS & SOL., Mehavn, 1894, $^{1}/_{1}$.
„ 2. *Flustra securifrons*, PALLAS, Breisund (Finmarken), $^{1}/_{1}$.
„ 3. *Flustra membranaceo-truncata*, SMITT, Skjerstad Fiord, $^{1}/_{1}$.
„ 4. *Flustra membranaceo-truncata*, SMITT, Mehavn, $^{2}/_{1}$—$^{3}/_{1}$.
„ 5. *Flustra barleei*, BUSK, Arnø (Vestfjord), 300—400 m., $^{1}/_{1}$.
„ 6. *Flustra barleei*, BUSK, Røst II, 150 m., $^{25}/_{3}$ 1899, $^{1}/_{1}$.
„ 7. *Flustra abyssicola*, M. SARS, on a little stone, Balstad, 150 m., $^{1}/_{1}$.
„ 8. *Bugula murrayana*, JOHNST., the typical form, from the „skjærgaard" outside Bergen, $^{1}/_{1}$.
„ 9. *Schizoporella sinuosa*, BUSK, Svolvær, 50—70 m., aperture of the zooecium, $^{83}/_{1}$.
„ 10. *Schizoporella sinuosa*, BUSK, Digermulen, 100—150 m., operculum, $^{83}/_{1}$.
„ 11. *Membranipora minax*, BUSK, Moskenstrømmen, mandible, $^{83}/_{1}$.
„ 12—14. *Eschara sincera*, SMITT, Nordkap, 1894.
„ 12. Mandible, $^{83}/_{1}$.
„ 13. Operculum, $^{83}/_{1}$.
„ 14. Zooecium, lateral view, r. rosetplate, h. hole, $^{17}/_{1}$.
„ 15. *Porella lævis*, FLEM., The Trondhjem Fiord, $^{1}/_{1}$.
„ 16. *Porella saccata*, BUSK, Nordkap, $^{1}/_{1}$.
„ 17. *Escharopsis rosacea*, BUSK, Moskenstrømmen, $^{1}/_{1}$.
„ 18. *Escharoides coccinea*, ABILDGAARD, Solsvik in the Bergen „skjærgaard", mandible, $^{83}/_{1}$.
„ 19. *Escharoides jacksoni*, WATERS, Kvænangen II, mandible, $^{83}/_{1}$.
„ 20. *Retepora wallichiana*, BUSK, young colony, Balstad, $^{2}/_{1}$—$^{3}/_{1}$.
„ 21—24. *Cellepora nodulosa*, LORENZ.
„ 21. Colony from Mehavn (Finmarken), $^{2}/_{1}$—$^{3}/_{1}$.
„ 22. Colony from the Norwegian North Atl. Exp., St. 273, $^{1}/_{1}$.
„ 23. An operculum of a colony from the Jøkel Fiord III, 100 m., $^{83}/_{1}$.
„ 24. A mandible of a colony from the Jøkel Fiord III, 100 m., $^{83}/_{1}$.
„ 25. *Cellepora incrassata*, SMITT, Hammerfest, $^{1}/_{1}$.
„ 26—29. *Cellepora ventricosa*, LORENZ.
„ 26. Colony from Breisund (Finmarken), 30—40 m., $^{1}/_{1}$.
„ 27. An operculum of the same colony, $^{83}/_{1}$.
„ 28. Mandible of oral avicularium, $^{83}/_{1}$.
„ 29. Mandible of a spatulate avicularium, $^{83}/_{1}$.
„ 30. *Tubulipora liliacea*, PALLAS, Solsvik in the Bergen „skjærgaard", $^{2}/_{1}$—$^{3}/_{1}$.
„ 31. *Tubulipora* sp (? *penicillata*, FABR.), Mehavn (Finmarken), $^{2}/_{1}$—$^{3}/_{1}$.
„ 32. *Idmonea atlantica*, FORB., Hustadviken, outside Romsdals amt, $^{1}/_{1}$.
„ 33. *Hornera lichenoides*, PONTOP., the Porsanger Fiord, 200 m., $^{1}/_{1}$.
„ 34. *Domopora stellata*, GOLDF., the Malangen Fiord, 100—200 m., $^{2}/_{1}$—$^{3}/_{1}$.
„ 35. *Alcyonidium disciforme*, SMITT, the Lyngen Fiord III, the border a little ruptured, $^{2}/_{1}$—$^{3}/_{1}$.
„ 36. *Bowerbankia imbricata*, ADAMS, The Norw. North Atl. Exp., st. 343, $^{1}/_{1}$.
„ 37—38. *Flustrella corniculata*, SMITT, Svolvær (Lofoten), $^{27}/_{1}$.
„ 37. Zooecia, $^{27}/_{1}$.
„ 38. Spine of the same colony, $^{27}/_{1}$.

PLATE IV.

PLATE IV.

Fig. 1—2. *Physophora borealis*, M. SARS, Moskenstrommen, 0 m., 1/8 1899.
„ 1. Tentacular knob, 83/1.
„ 2. Older tentacular knob, 83/1.
„ 3—5. *Eschara moskensis*, n. sp., Moskenstrommen II, 150 m.
„ 3. Zooecium, 52/1.
„ 4. Ooecium, 52/1.
„ 5. Operculum, 83/1.
„ 6—7. *Schizoporella candida*, SMITT, The Malangen Fiord, 100—200 m.
„ 6. Zooecium, 52/1.
„ 7. Operculum, 83/1.
„ 8—11. *Porella proboscidea*, HINCKS, The North Cape.
„ 8. Zooecium, lateral view, a. a = avicular aperture, r. p = rosette-plate, h = hole, 52/1.
„ 9. Mandible, 83/1.
„ 10. Operculum, 83/1.
„ 11. Oral aperture, the condyles are seen, 83/1.
„ 12. *Palmicellaria skenei* var. *tridens*, BUSK, Radøsund, a little north of Bergen, 100 m., operculum, 83/1.
„ 13. *Palmicellaria skenei* var. *bicornis*, BUSK, Jøkel Fiord III, 100 m., operculum, 83/1.
„ 14—15. *Monoporella spinulifera*, HINCKS, Hammerfest.
„ 14. Ooecium and oral aperture, 52/1.
„ 15. Zooecium, lateral view, 52/1.
„ 16—17. *Schizoporella reticulato-punctata*, HINCKS, The Porsanger Fiord, 200 m.
„ 16. Ooecium with the upper part of the zooecium, 52/1.
„ 17. Operculum, 83/1.
„ 18—20 b. *Porella propinqua*, SMITT, Nordkap (1894).
„ 18. Zooecia, lateral view, a. u, avicularian umbo, o, ooecium, r. p, rosette-plate, 52/1.
„ 19. The back side of the zoarium, 52/1.
„ 20 a. Operculum, 83/1.
„ 20 b. Ooecium, 83/1.
„ 21—23. *Porella princeps*, NORMAN, Mehavn (1894).
„ 21. Operculum, 83/1.
„ 22. Mandible, 83/1.
„ 23. The under side of the front wall of the zooecium, showing the avicularian chamber (a. c) and the lateral channels (c h), 52/1.
„ 24. *Smittina smitti*, KIRCHENP., The Ogs Fiord I, 100 m., ooecium and the upper part of the zooecium, 52/1.
„ 25—26. *Escharella labiata*, BOECK, Svolvær, on coal.
„ 25. Zooecium, lateral view, 83/1.
„ 26. Base of the ooecium, 83/1.
„ 27. Oral denticle of *Escharella immersa*, FLEM., Moskenstrømmen, 83/1.
„ 28. —:— — *ventricosa*, HASS., Hammerfest, 83/1.
„ 29. —:— — *laqueata*, NORM., Hammerfest, 83/1.
„ 30. —:— — *abyssicola*, NORM., The Bømmel Fiord, 83/1.
„ 31. —:— — *labiata*, BOECK, Svolvær, 83/1.
„ 32—35. *Eschara nordlandica*, n. sp., The Kvænang Fiord, 90 m.
„ 32. A young zooecium and ooecium, 52/1.
„ 33. Oral aperture of the zooecium, c, condylus, r, opercular rib, 83/1.
„ 34. Ooecium, 83/1.
„ 35. Operculum, 83/1.
„ 36—38. *Smittina majuscula*, SMITT, The Porsanger Fiord, 90 m.
„ 36. Zooecium and ooecium, 52/1.
„ 37. Operculum, 83/1.
„ 38. Mandible, 83/1.

PLATE V.

PLATE V.

Fig. 1—2. *Schizoporella stormi*, n. sp., The North Cape (1894).
" 1. Zooecia, $^{52}/_1$. The avicularia are not quite correct, as the mandibles are more pointed than in the figure.
" 2. Operculum. o. r, opercular rib, $^{83}/_1$.
" 3—4. *Schizoporella levinseni*, n. sp., Kvænangen II, 90 m.
" 3. Zooecia, $^{52}/_1$.
" 4. Operculum with the proximal margin of the oral aperture, $^{83}/_1$.
" 5—7. *Porella glaciata*, Waters, Mehavn (1894).
" 5. Zooecia, $^{52}/_1$.
" 6. Operculum, $^{83}/_1$.
" 7. Mandible, $^{260}/_1$.
" 8—11. *Rhamphostomella scabra*, Fabr., The Porsanger Fiord, 70 m.
" 8. Zooecium, $^{52}/_1$.
" 9. Oooecium, $^{52}/_1$.
" 10. The back side of the zoarium, $^{52}/_1$.
" 11. Mandible, $^{83}/_1$.
" 12—13. *Schizoporella hexagona*, n. sp., Kvænangen II, 90 m.
" 12. Zooecia, $^{52}/_1$.
" 13. Operculum, $^{83}/_1$.
" 14—15. *Rhamphostomella plicata*, Smitt, Nordkyn (1894).
" 14. Ooecium with the upper part of the zooecium, $^{83}/_1$. The two small denticles, one on each side of the large one, are not illustrated.
" 15. Mandible, $^{83}/_1$.
" 16—17. *Rhamphostomella radiatula*, Hincks, The North Cape (1894).
" 16. Ooecium and oral aperture, $^{83}/_1$.
" 17. Part of the frontal wall of the zooecium, $^{83}/_1$.
" 18—20. *Rhamphostomella contigua*, Smitt, The Ostnes Fiord, 50—70 m.
" 18. Zooecium, $^{52}/_1$.
" 19. Operculum, $^{83}/_1$.
" 20. Mandible, $^{83}/_1$.
" 21—22. *Rhamphostomella costata*, Lorenz, Tromsø.
" 21. Ooecium, $^{52}/_1$.
" 22. Oral denticle, $^{83}/_1$.
" 23—25. *Schizoporella unicornis*, Johnst., Glea (Røst).
" 23. Zooecia, $^{52}/_1$.
" 24. Operculum, $^{83}/_1$.
" 25. Mandible, $^{83}/_1$.
" 26. *Schizoporella linearis*, Hass., Bognostrømmen (Bergen), 30—50 m., operculum, $^{83}/_1$.
" 27. *Schizoporella unicornis*, Johnst., The Hjelte Fiord (Bergen), operculum, $^{83}/_1$.
" 28—31. *Phylactella peristomata*, n. sp., Jøkel Fiord II, 80 m.
" 28. Zooecium with marginal pores, p. a. c, pores to the avicularian chamber, $^{52}/_1$.
" 29. Zooecia, s, shield beneath the oral aperture, $^{52}/_1$.
" 30. Mandible, $^{260}/_1$.
" 51. Oral denticle, $^{83}/_1$.
" 32. *Schizoporella porifera*, Smitt, Napstrømmen (Lofoten), operculum, $^{83}/_1$.
" 33—34. *Schizoporella lineata*, Nordg., Nordkyn (1894).
" 33. Operculum, $^{83}/_1$.
" 34. Oral aperture, $^{83}/_1$.
" 35. *Smittina trispinosa*, Johnst., Balstad (Lofoten), operculum, $^{83}/_1$.