REPORT ON THE SCIENTIFIC RESULTS OF THE "MICHAEL SARS" NORTH ATLANT. DEEP-SEA EXPED. 1910

CARRIED OUT UNDER THE AUSPICES OF THE NORWEGIAN GOVERNMENT AND THE SUPERINTENDENCE OF

SIR JOHN MURRAY, K. C. B. and DR. JOHAN HJORT

BACILLARIOPHYCEAE

FROM THE

"MICHAEL SARS" NORTH ATLANTIC DEEP-SEA EXPEDITION 1910

BY

KAREN RINGDAL GAARDER

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INTRODUCTION

During the cruise of "Michael Sars" 1910 a rich phytoplankton material was collected, net samples, pump samples and quantitative samples. The latter were centrifuged and counted on board by the botanist of the Expedition, professor Dr. H. H. GRAN who also examined the other samples, partly before fixation. The results of these investigations in regard to the composition of the phytoplankton societies in the various regions, the distribution of the most important species and the variation in the different species in different conditions of life, have been published by him in the section on pelagic plant life in: MURRAY and HJORT: The Depths of the Ocean, 1912 and in: Atlanterhavet, 1912 by the same authors.

Parts of net and pump samples were after fixation kept in small bottles with alcohol as preserving matter. This preserved material was in 1934 handed to me for closer examination and compilation of species lists. A report on the Tintinnoinea from this material has been published (GAARDER 1946) and the present paper deals with the diatoms (Bacillariophyceae).

The species lists I have gathered in the tables I—V, following GRAN's example in dividing the "Michael Sars" route in 5 parts:

Area I: The coast banks of North Europe.
- II: The coast banks of South Europe and North Africa.
- III: The Central Atlantic from the Canaries to the Azores, and from the Azores to the Newfoundland Banks.
- IV: The Newfoundland Banks.

Area V: The northern Atlantic section (now including the stations near Rockall and Shetland).

A few samples were dried up when I received the material. New alcohol was added to them and the precipitate carefully washed, but the species lists in question are rather incomplete. They are marked in the tables with an asterisk.

The diatoms were mostly examined in water. When distinct classification was based upon the fine valve structure, they were examined in Hyrax. For identification of the species HUSTEDT's monography of diatoms (1930—37) has been of great value and with a few exceptions I have followed the nomenclature of this work. In the following treatment of the different species (alphabetically arranged) references have been made to HUSTEDT's lists of synonyms, descriptions and illustrations.

As most of the diatoms in this material are well known from earlier investigations, I have only in a few cases found it necessary to give original figures and more extensive descriptions. The species in question may not be treated in the monography of HUSTEDT at all, or my view of their limitations may deviate from that of HUSTEDT. The genus *Thalassiosira* has been represented by specimens which did not closely agree with any species described in the literature at hand. I have, therefore, preliminarily set up two new species: *T. coronata* (p. 30, fig. 17) and *T. minima* (p. 31, fig. 18). In addition a new form *pentagona* of *Ditylum Brightwellii* (p. 19) and a new form *bidens* of *Rhizosolenia Bergonii* (p. 25, fig. 11a) have been set up.

List of Stations.

Number of station	Date	Position	Number of station	Date	Position	Number of station	Date	Position
AREA I.			10	19/4	45° 26′ N 9° 20′ W	19	2/5	36° 5′ N 4° 42′ W
1	9/4	49° 27′ N 8° 36′ W				20	5/5	35° 25′ N 6° 25′ W
2	10/4	49° 30′ N 9° 42′ W	AREA II.			Pump sample	5/5	*Spanish Bay.*
3	10/4	49° 32′ N 10° 49′ W	11	21/4	44° 25′ N 9° 18′ W	22	5/5	35° 42′ N 6° 51′ W
4	10/4	49° 38′ N 11° 35′ W	12	21/4	43° 11′ N 9° 26′ W	23	5/5	35° 32′ N 7° 7′ W
Pump sample	15/4	*Queenstown.*	13	22/4	41° 32′ N 9° 5′ W	25	8/5	35° 46′ N 8° 16′ W
5	16/4	51° 24′ N 9° 27′ W	Pump sample	22/4	*Coast of Portugal*	Pump sample	8/5	*Spanish Bay.*
7	17/4	49° 54′ N 12° 10′ W	—»—	25/4	*Gibraltar Strait.*	27	9/5	36° 31′ N 7° 1′ W
9	18/4	47° 49′ N 10° 52′ W	18	29/4	35° 56′ N 5° 43′ W	28	9/5	36° 0′ N 7° 19′ W

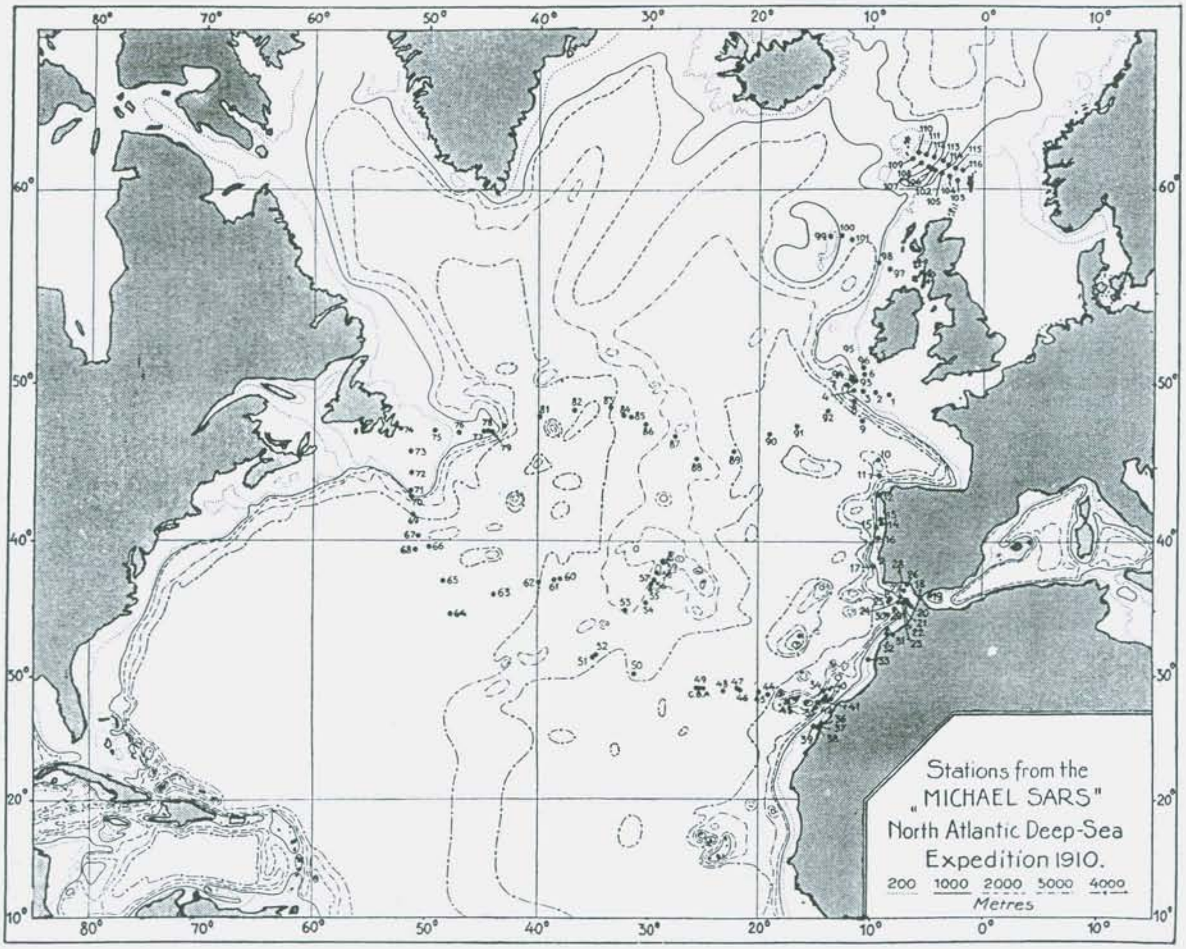

Fig. 1.

Number of station	Date	Position	Number of station	Date	Position	Number of station	Date	Position
29	9/5	35° 10′ N 7° 55′ W	50	4/6	30° 8′ N 31° 19′ W	77	10/7	47° 18′ N 44° 54′ W
30	10/5	34° 38′ N 8° 22′ W	51	6/6	31° 20′ N 35° 7′ W	80	11/7	47° 34′ N 43° 11′ W
31	10/5	33° 47′ N 8° 27′ W	53	9/6	34° 59′ N 33° 1′ W			
32	10/5	33° 27′ N 8° 32′ W	54	10/6	35° 37′ N 30° 15′ W			
Pump sample	11/5	*Coast of Marocco.*	58	12/6	37° 38′ N 29° 20′ W		AREA V.	
34	13/5	28° 52′ N 14° 16′ W	Fayal	17/6		81 a	12/7	48° 2′ N 39° 55′ W
35	18/5	27° 27′ N 14° 52′ W	59	17/6	38° 30′ N 28° 37′ W	83	14/7	48° 30′ N 33° 35′ W
36	19/5	26° 12′ N 14° 26′ W	60	20/6	37° 9′ N 38° 5′ W	84	15/7	48° 4′ N 32° 25′ W
37	20/5	26° 6′ N 14° 33′ W	63	22/6	36° 5′ N 43° 58′ W	85	15/7	47° 58′ N 31° 41′ W
38	20/5	26° 3′ N 14° 36′ W	64	24/6	34° 44′ N 47° 52′ W	86	16/7	47° 29′ N 30° 20′ W
39	20/5	26° 3′ N 15° 0′ W	65	25/6	37° 12′ N 48° 30′ W	87	17/7	46° 48′ N 27° 46′ W
40	22/5	28° 15′ N 13° 29′ W	66	26/6	39° 30′ N 49° 42′ W	88	18/7	45° 26′ N 25° 45′ W
			68	28/6	39° 20′ N 50° 50′ W	90	21/7	46° 58′ N 19° 6′ W
	AREA III.		69	29/6	41° 39′ N 51° 4′ W	92	23/7	48° 29′ N 13° 55′ W
44	28/5	28° 37′ N 19° 8′ W				97	4/8	56° 15′ N 8° 28′ W
46	29/5	28° 56′ N 21° 45′ W		AREA IV.		98	5/8	56° 33′ N 9° 30′ W
48	31/5	28° 54′ N 24° 14′ W	70	30/6	42° 59′ N 51° 15′ W	99	6/8	57° 45′ N 13° 40′ W
49 c	2/6	29° 7′ N 25° 32′ W	76	9/7	47° 11′ N 47° 6′ W	103	10/8	60° 26′ N 2° 34′ W

TAXONOMICAL AND FLORISTICAL OBSERVATIONS

GENERA AND SPECIES IN ALPHABETICAL ORDER

Actinocyclus Ehrenbergii Ralfs.

Hustedt 1930, p. 525, fig. 298.

Area I: Sts. 3,10.
- II: Sts. 22, 35, 36, 39.
- III: Sts. 50, Fayal.

At a few stations on the coastal banks of Europe and Africa, single specimens of this cosmopolitan species occurred. Otherwise it was found at the deep sea station 50 between the Canaries and the Sargasso Sea and at Fayal (Azores).

Actinocyclus subtilis (Gregory) Ralfs.

Hustedt 1930, p. 534, fig. 304.

Area III: Sts. 49c, Fayal.

One single specimen of this tropical species was observed in the 200—100 m sample from Station 49c, between the Canary Islands and the Sargasso Sea.

A few cells were also recorded from the Fayal station (Azores). It is known previously from the same area.

Diameter about 90 μ.

Actinocyclus tenuissimus Cleve.

Hustedt 1930, p. 535, fig. 305.

Area II: Sts. 19, 20, 38, 40.
- III: Sts. 46, 50—53, Fayal, 59, 63, 64, 68.

Single specimens, classified as belonging to this species, were recorded from several stations between the Mediterranean and Newfoundland.

Diameter 72—98 μ.

Actinoptychus splendens (Shadbolt) Ralfs.

Hustedt 1930, p. 478, fig. 265.

Area II: Sts. 35, 37.

On the coastal banks between the Canaries and Cape Bojador this species was observed at two stations. Both this and the following species are typical coastal forms.

Actinoptychus undulatus (Bailey) Ralfs.

Hustedt 1930, p. 475, fig. 264.

Area I: Sts. 1—3, 5, 7, 10.
- II: Sts. 11, 18, 19, 22, 32, 34, 36—38, 40.
- III: St. Fayal.

This characteristic species was rather common on the first part of the route, from Ireland to Cape Bojador, and it was also observed at Fayal (Azores). It never occurred in any abundance, often singly.

Asterionella japonica Cleve.

Hustedt 1931—37, p. 254, fig. 734.

Area I: St. 3, Pump sample 15/4, St. 10.
- II: St. 36.

This neritic species was observed in the samples from Queenstown (Ireland) and Cape Bojador and in addition it occurred at two stations between Ireland and Spain.

Asterionella notata Grunow.

Hustedt 1931—37, p. 254, fig. 733.

Area II: Sts. 34, 35.
- III: Sts. Fayal, 59.

This more southern neritic species was recorded from the Canary Islands and the Azores.

Asterolampra Grevillei (Wallich) Greville.

Hustedt 1930, p. 489, fig. 274.

Area III: St. 64.

In the 200—0 m sample from the Sargasso Sea station 64 a few specimens occurred which were classified as belonging to this species.

Asterolampra marylandica Ehrenberg.

Hustedt 1930, p. 485, figs. 270,271.

Area III: Sts. 49c—51, 64.

Single specimens were observed at 3 stations between the Canaries and the Sargasso Sea and at the Sargasso Sea station 64.

Asterolampra Van Heurckii J. Brun.

HUSTEDT 1930, p. 487, fig. 272.

Area III: Sts. 54, 64.

This species occurred in a considerable number at the Sargasso Sea station 64 together with the preceding species. Some few specimens were also observed south of the Azores.

Asteromphalus arachne (Brébisson) Ralfs.

HUSTEDT 1930, p. 493, fig. 276.

Area III: St. 64.

One single specimen was observed in the 200—0 m sample from the Sargasso Sea station 64.

Asteromphalus flabellatus (Brébisson) Greville.

HUSTEDT 1930, p. 498, fig. 279.

Area I: St. 10.
- II: Sts. 27, 39.
- III: Sts. 46, 49c, 51, 59—63.

The species was observed north of Spain, in the Spanish Bay and off Cape Bojador. It also occurred at a few stations on the southern Atlantic route, most often singly.

In the 100—0 m sample from Station 63 a specimen was observed which was nearly circular and had 10 rays. Diameter 65 μ.

Asteromphalus heptactis (Brébisson) Ralfs.

HUSTEDT 1930, p. 494, figs. 275, 277.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 22.
- III: Sts. 54, 64.
- V: Sts. 85, 87—92.

This was the most common *Asteromphalus* species, especially frequent in the northern regions, between Ireland and Spain, and on the latter 2/3 of the northern Atlantic route. Otherwise it occurred in the Spanish Bay, and single specimens were observed south of the Azores and at the Sargasso Sea station 64.

Asteromphalus robustus Castracane.

HUSTEDT 1930, p. 496, fig. 278.

Area II: St. 28.
- III: St. 54.

A few specimens were observed at one station in the Spanish Bay and one south of the Azores.

Aulacodiscus nigricans Tempère et Brun.

Fig. 2.

Aulacodiscus nigricans, BRUN et TEMPÈRE 1889, p. 20, pl. IV, fig. 1.
Aulacodiscus nigricans, A. SCHMIDT, Atlas, pl. 169, figs. 6, 7.

Area III St. Fayal.

In the surface sample from the Horta harbour, Fayal, Azores, some *Aulacodiscus* specimens occurred which most probably belong to the species *A. nigricans*, found fossil in Sendai and Yedo, Japan, described by TEMPÈRE and BRUN (1889) and illustrated in SCHMIDT's Atlas.

Diameter 95—160 μ.

The valve is more or less undulated both radially and concentrically. The primary rays lie on elevated ridges bearing processes on their outer ends near the border of the valve (see fig. 2c). The valve rises concave-convexly from the border to about 1/3 of radius, then falls convex-concavely making a shoulder between the ridges. The central part may again be somewhat elevated. The central part, the primary rays and the shoulder between them are then in focus at the same time (see fig. 2a). The angular outline of the shoulder zone is not so pronounced on all specimens. Some valves may look very much like fig. 7 of SCHMIDT.

TEMPÈRE and BRUN do not mention the number of processes. The figure given, however, and both figures in SCHMIDT's Atlas show 7 processes like all the specimens from Station Fayal.

The markings at high level look round with central dot (see fig. 2b), at low level angular. They are loosely arranged in the centre; within the compartments they are arranged in rows parallel to the middle one (see fig. 2d). Near the border a few extra rows are inserted. The markings decrease a little in size towards the border (4—5 in 10 μ in the middle of the valve, 5—6 in 10 μ at the border).

The fin-like stripes on the sides of the ridges, indicated in the figures of SCHMIDT, but not visible in the original figure, have not been observed in my specimens. (The arrangement of the markings on the sides of the ridges may give an impression of "stries pennées tournées vers l'extérieure"). The larger and more prominent markings, mentioned in the description and indicated in the original figure, I have not been able to distinguish. They are also lacking in SCHMIDT's figures. The peripheric "ligne de ponctuations serrées" shown in the figure of BRUN consists in the "Michael Sars" specimens of short close lines (12—15 in 10 μ) like those shown in fig. 6 of SCHMIDT. (See fig. 2d).

The fine granulation of the surface between the markings is clearly shown in fig. 2b. The whole cell has a brownish colour.

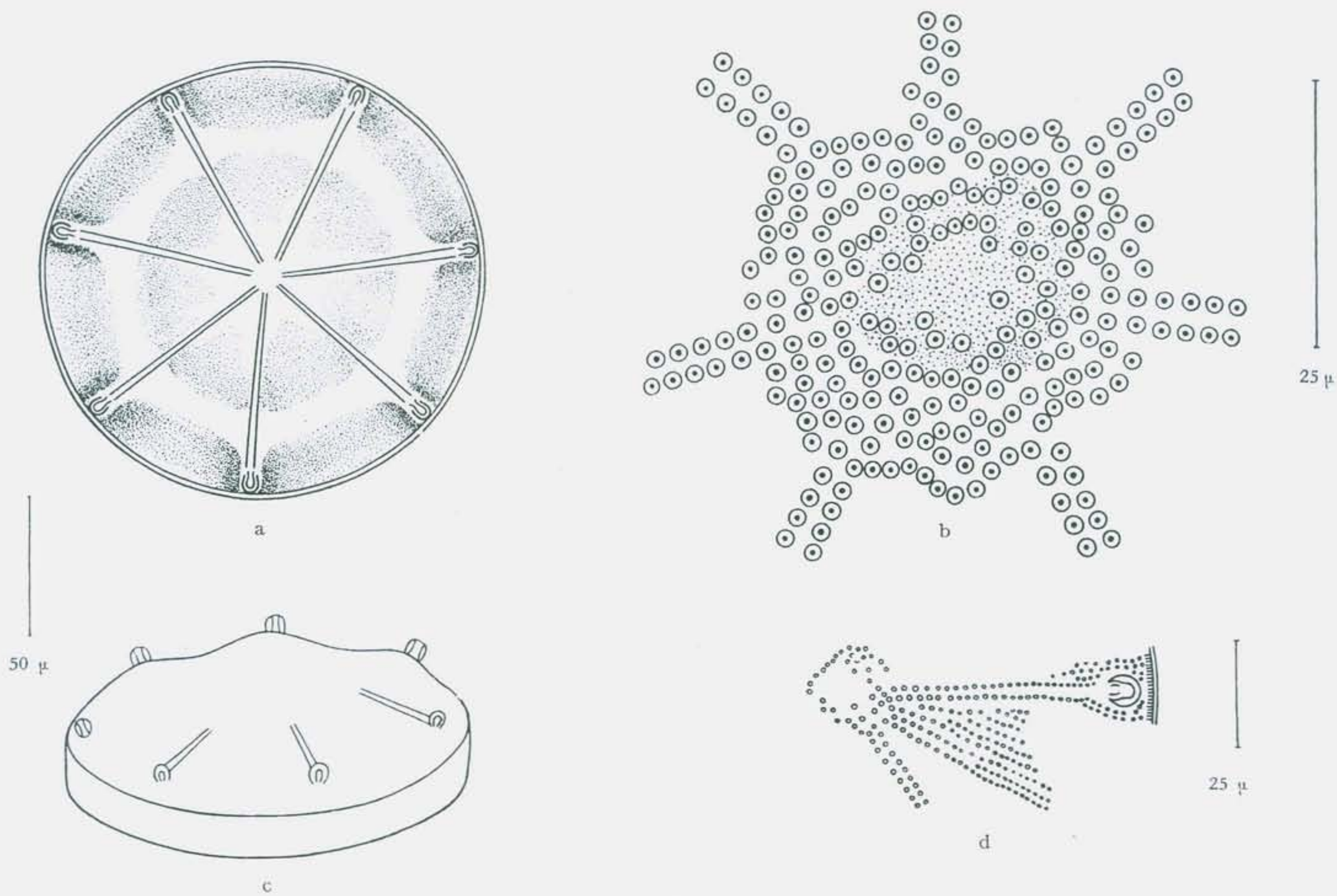

Fig. 2. *Aulacodiscus nigricans*. St. Fayal. a. and c. a little diagrammatic, showing processes, primary rays, concentrical and radial undulation. b. central part, all markings seen at high level, granulation between them indicated. d. peripheric striae, process and arrangement of markings within a sector.

Bacteriastrum comosum Pavillard.

HUSTEDT 1930, p. 622, fig. 361.

Area I: Sts. 3, 4, 7—10.
- II: St. 23.

Well developed chains of this eastern tropical species were found in the area between Ireland and Spain and also at one station in the Spanish Bay. In European waters it has previously been recorded from the Mediterranean only.

Bacteriastrum delicatulum Cleve.

HUSTEDT 1930, p. 612, fig. 353.

Area I: Sts. 3, 7, 10.

This species is widely distributed in the North Atlantic Ocean. Well developed chains were exclusively observed in material from the area between Ireland and Spain.

Bacteriastrum elegans Pavillard.

Fig. 3.

HUSTEDT 1930, p. 621, fig. 360.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 20, 22, 34.

PAVILLARD (1916, p. 28, pl. I, fig. 2) has described this species from the Mediterranean. He suggests later (1925, p. 39), however, that the majority of specimens classified as *B. varians* Lauder from the Temperate Atlantic must also be referred to this species. In the "Michael Sars" material it was recorded from the area between Ireland and Spain, from the Spanish Bay and from off the Canary Islands.

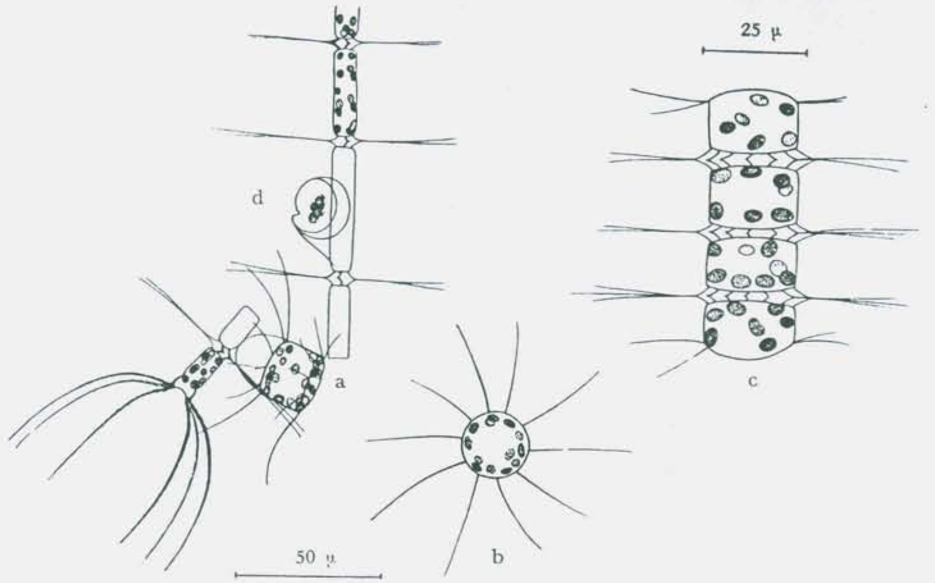

Fig. 3. *Bacteriastrum elegans*. St. 7. a. auxospore in side view (with rest of perizonium). b. the same auxospore in valve view. c. chain originating from auxospore? d. cracked spore, incomplete.

In the 50—20 m and 100—45 m samples from Station 7 and the 50—0 m sample from Station 9 south of Ireland auxospores were observed. They are formed in a manner similar to that known from the genus *Chaetoceros*. After a preceding prolongation of the mother cell the whole content of it is pushed out through a small opening in the girdle region of the cell in the form of a bladder. In this bladder the development of the new cell takes place, its pervalvar axis being perpendicular to that of the mother cell. The diameter of the new cell is about three times that of the mother cell (21—22 μ: 7,5 μ). The height of the new cell varies from 10,5 μ to 15 μ. Both valves are a little rounded and furnished with 10—16 rather thin somewhat curved marginal bristles. (See fig. 3a and b, in fig. 3a a little rest of the perizonium has been left).

Most probably the auxospore at once starts the development of a new *Bacteriastrum* chain. In the above named samples chains consisting of 4 to 8 cells were observed having about the same diameter (22—24 μ) as the auxospores. The outer valve of the terminal cells was a little more rounded than the rest, and it was most often furnished with thin marginal bristles or remnants of such bristles (see fig. 3c). Neither of these chains showed the characteristic terminal bristles of the species. These will probably develop later on.

This auxospore might possibly be identic with *Bacteriastrum solitarium* Mangin (1912, p. 37, fig. 24). However, as the cells of the latter are greater (diameter 42—48 μ), the bristles more numerous (30—40) and most often placed on one valve only, it seems more reasonable to consider *B. solitarium* as the auxospore of some other *Bacteriastrum* species. Auxospores containing resting spores, such as now and then have been found in the *B. solitarium* cells, were never observed in the "Michael Sars" samples.

While preparing the manuscript I was informed of a paper of TAFALL (1935) where auxospore formation in *Bacteriastrum hyalinum* Lauder in material from the north-west coast of Spain is described. The process was the same as in *B. elegans*, but the auxospore itself was a little different. Most often only one of the valves was furnished with bristles, the number of which being much higher (37—40) than in the *B. elegans* auxospores. And the diameter of the auxospore was only about twice that of the mother cell. Like the auxospores of *B. elegans* they seem to start the development of new chains at once.

TAFALL suggests that *B. solitarium* might be a phase in the auxospore reproduction in *B. hyalinum*. The cells have much in common, such as size, number of bristles and most often bristles on one of the valves only. (According to LEBOUR (1930) the primary valve of the fully-formed resting spore of *B. hyalinum* is covered with fine spicules Such have not as yet been seen on the resting spore formed in the *B. solitarium* cell).

Still later I discovered that SUBRAHMANYAN (1945) has found auxospores in *Bacteriastrum varians* Lauder from the Madras Coast. These auxospores are very much like those of *B. elegans*. The diameter is about two and a half times that of the mother cell, and the figures show the number of marginal bristles 16—18. (In figs. 1c and 3 it seems as if the pervalvar axis of the auxospore runs parallel to that of the mother cell, but this is probably not the case). The auxospores of *B. varians* also start developing new chains at once, without forming resting spores.

Bacteriastrum elongatum Cleve.

HUSTEDT 1930, p. 617, fig. 357.

Area I: Sts. 4, 7, 9.

This was also observed in the area between Ireland and Spain together with the 3 preceding species.

Bacteriastrum hyalinum Lauder.

HUSTEDT 1930, p. 615, fig. 354.

?*Bacteriastrum solitarium*, MANGIN 1912, p. 37, fig. 24.

Area I: St. 10.
- II: Pump samples 22/4, 25/4, Sts. 18, 20, 22, 27, 32, Pump sample 11/5, St. 36.

This species was observed as far south as off Cape Bojador. It occurred fairly frequently along the coasts of Spain, Portugal and North—West Africa. Like *B. delicatulum* it has a wide distribution in the North Atlantic.

Recently TAFALL (1935) has described auxospores of this species in material from the north—west coast of Spain. He suggests that *Bacteriastrum solitarium* Mangin might be a phase in the reproduction of these auxospores. (Cpr. *B. elegans*).

Bacteriastrum spp.

Area I: Sts. 3, 10.
- II: Sts. 11, 18, 23, 25, 28, 34, 35, 37, 39.
- III: Sts. 44, 50—58, 59—69.
- V: Sts. 81a, 85, 87, 88.

The species of *Bacteriastrum* can only be classified with certainty when both ends of the cell are well developed. In most of the samples in the "Michael Sars" material only fragments of chains were to be found, and accordingly they must remain unclassified and were listed as *Bacteriastrum* spp.

The genus *Bacteriastrum* had a wide distribution in the area. It was lacking, however, on the Newfoundland Banks and at the stations north of Ireland.

Biddulphia aurita (Lyngbye) Brébisson et Godey

Fig. 4.

HUSTEDT 1930, p. 846, fig. 501.

Area I: St. 3, Pump sample 15/4.
- III: St. Fayal.

A few specimens of this littoral species were observed in samples from the harbours of Queenstown (Ireland) and Horta (Fayal, Azores), otherwise only from one station south of Ireland.

At the latter station (3) the species was represented as var. *minima* Grunow (VAN HEURCK 1880—85, p. 205, pl. XCVIII, figs. 11-13) which HUSTEDT, however, includes in the main species. See fig. 4.

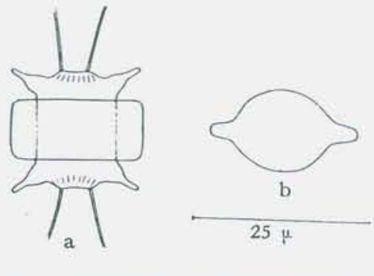

Fig. 4. *Biddulphia aurita* var. *minima*. St. 3. a. cell in girdle view. b. approximately median section of the same cell.

Biddulphia mobiliensis Bailey.

HUSTEDT 1930, p. 840, fig. 495.

Area I: St. 1.
- II: Pump samples 22/4, 25/4, Sts. 18—20, 22, 32, Pump sample 11/5, Sts. 35—39.

This was the most common *Biddulphia* species in the "Michael Sars" area. It occurred rather frequently along the European-African coastal banks.

Biddulphia pulchella Gray.

HUSTEDT 1930, p. 832, fig. 490.

Area II: Sts. 36, 38—40.
- III: St. Fayal.

This common littoral species occurred between the Canary Islands and Cape Bojador and in the Horta harbour (Azores).

Biddulphia regia (Schultze) Ostenfeld.

HUSTEDT 1930, p. 838, fig. 494.

Area I: St. 10.
- II: Sts. 37, 38.
- III: Sts. Fayal, 59.

It was observed together with the closely related *B. mobiliensis* off Cape Bojador. Otherwise it was found north of Spain and in the Azore area.

Biddulphia Tuomeyi (Bailey) Roper.

Hustedt 1930, p. 834, fig. 491.

Area III: St. Fayal.

This species is widely distributed in coastal regions of the warmer seas. In the "Michael Sars" area it was exclusively observed in the Horta harbour (Azores).

Cerataulina Bergonii Peragallo.

Hustedt 1930, p. 869, fig. 517.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7, 9.
- II: St. 11, Pump samples 22/4, 25/4, Sts. 20, 22, 23, 28, 32, Pump sample 11/5, Sts. 34, 36—38.
- III: Sts. 49c, 53—64, 68.
- V: Sts. 81a, 85.

This neritic species was very common in the "Michael Sars" material, especially on the first part of the route, from Ireland to Cape Bojador, and around the Azores. It was also represented at some deep-sea stations between the Canaries and the Azores, in the Sargasso Sea and on the first part of the northern Atlantic route.

Cerataulus Smithii Ralfs.

Hustedt 1930, p. 861, fig. 513.

Area II: Sts. 18, 19, 27, 38.

Single specimens occurred at Gibraltar, on the Mediterranean station, in the Spanish Bay and off Cape Bojador.

Cerataulus turgidus Ehrenberg.

Hustedt 1930, p. 860, fig. 512.

Area III: Sts. Fayal, 59.

This purely littoral species was exclusively observed in the Azore area.

Chaetoceros affinis Lauder.

Hustedt 1930, p. 695, fig. 396.

Area I: Sts. 1, 3, 4, 7—10.
- II: Sts. 11, 18, 20, 22—25, 27, 32, 36, 39.

This widely distributed species occurred regularly between Ireland and Spain and on the route from Gibraltar to Cape Bojador.

Chaetoceros affinis var. **Willei** (Gran) Hustedt.

Hustedt 1930, p. 697, fig. 398.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 18, 20, 22, 23, 28, 31, 32, 35, 38, 39.
- III: Sts. 50, 59.

The variety was found in the same area and most often in company with the main species. In addition it was represented at two stations between the Canaries and the Azores.

Chaetoceros anastomosans Grunow.

Hustedt 1930, p. 743, fig. 429.

Area II: Sts. 20, 23, 28, 35.

This neritic species was recorded from the Spanish Bay, and one single chain was observed at Station 35 near the Canaries.

Chaetoceros atlanticus Cleve.

Hustedt 1930, p. 641, figs. 363, 364a, b.

Area I: Sts. 3, 4, 7.
- IV: Sts. 70—80.
- V: Sts. 81a, 87, 90.

This cold water species was represented in the northern part of the "Michael Sars" area only: south of Ireland, on the Newfoundland Banks and at three stations between these areas.

Chaetoceros atlanticus var. **neapolitana** (Schröder) Hustedt.

Hustedt 1930, p. 645, fig. 366.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 20, 22, 27, 34.
- III: Sts. 44, 49c, 51—54, 59, 63—65.
- V: Sts. 81a, 87, 90, 92.

This variety was observed together with the main species at all stations except on the Newfoundland Banks. In addition it was found in the Spanish Bay, and it was common on the whole southern Atlantic route.

Chaetoceros atlanticus var. **skeleton** (Schütt) Hustedt.

Hustedt 1930, p. 643, fig. 365.

Area I: St. 3.
- III: St. 64.
- V: St. 87.

This warm water variety was very rare. Single chains were recorded from two northern and one southern station only.

Chaetoceros borealis Bailey f. **typica** Braarud.

Hustedt 1930, p. 661, fig. 375.
Braarud 1935, p. 92.

Area I: Sts. 4, 7.
- II: Sts. 18, 23, 32, Pump sample 11/5.
- III: Sts. 64, 66.
- IV: Sts. 76—80.
- V: St. 99.

On the basis of material from the Polar Current Braarud (1935) proposes to maintain three forms of the species

Chaetoceros borealis: f. *typica*, f. *concavicornis* and f. *varians*. Of these only the two first named forms were represented in the "Michael Sars" material.

The f. *typica* was rather common along the European-African coastal banks. Otherwise it was very rare. A few chains were found on the Newfoundland Banks and at two stations to the south. A single chain was recorded from off Rockall.

Chaetoceros borealis Bailey f. **concavicornis** (Mangin) Braarud.

HUSTEDT 1930, p. 665, fig. 376.
BRAARUD 1935, p. 92.

Area I: Sts. 1—4, 7, 10.
- II: Sts. 22—25, 27, 28, 31, 34, 35, 39, 40.
- III: Sts. 44, 46, 49c, 63, 65.
- V: Sts. 81a, 85, 90.

The f. *concavicornis* was much more common than f. *typica*. It was represented on the whole route from Ireland and back except on the Newfoundland Banks. Only at three stations (3 and 7 south of Ireland and 23 in the Spanish Bay) the two forms of *C. borealis* were found in the same samples, otherwise they occurred alternately.

Chaetoceros brevis Schütt.

HUSTEDT 1930, p. 707, fig. 403.

Area I: Sts. 3, 4, 7, 9.
- II: St. 23.

This neritic species was recorded from the area south of Ireland and from one station in the Spanish Bay.

Chaetoceros cinctus Gran.

HUSTEDT 1930, p. 748, fig. 432.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: Pump sample 25/4, Sts. 36—38.

This is also a neritic species, and in the "Michael Sars" material it was limited to the European-African coastal banks. From Station 3 south of Ireland resting spores were recorded.

Chaetoceros compressus Lauder.

HUSTEDT 1930, p. 684, figs. 388, 389.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: Pump sample 25/4, St. 20, Pump sample 5/5, Sts. 22, 23, 28, 32, 34—39.
- III: Sts. 63, 68.
- IV: St. 80.
- V: Sts. 81a, 85.

In accordance with its neritic character *C. compressus* occured chiefly on the coastal banks of Europe and Africa. It was also present on the Newfoundland Banks and the nearest stations to the east and south. Otherwise only a few chains were found at Station 63 on the southern and at Station 85 on the northern Atlantic route. At Station 3 south of Ireland chains containing resting spores were observed. In the Queenstown harbour it was the dominating diatom in company with *C. debilis*. At the stations 22 in the Spanish Bay and 32 off the coast of Marocco there occurred specimens giving a false impression of containing numerous minute chromatophores. By using immersion oil, however, it became apparent that the "chromatophores" were agglutinated minute "foreign particles" similar to those observed on several *Parundella* species from the same material (GAARDER 1946).

Chaetoceros constrictus Gran.

HUSTEDT 1930, p. 694, fig. 395.

Area I: Sts. 3, 4, 7—10.
- II: St. 11, Pump sample 22/4, Sts. 18, 20, 22, 23, 35—38.

It was exclusively found in European-African coastal waters. Chains containing resting spores were observed at Station 7 south of Ireland, Station 18 in the Strait of Gibraltar and Stations 36 and 38 off Cape Bojador.

Chaetoceros convolutus Castracane.

HUSTEDT 1930, p. 668, fig. 378.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 7—10.
- II: Sts. 11, 18, 19, 22, 36—39.
- III: Sts. Fayal, 59.
- IV: Sts. 77, 80.
- V: St. 87.

This is regarded as an oceanic species, but in the "Michael Sars" material it was only observed at one station in the open sea: Station 87 north of the Azores on the northern Atlantic route. It was rather common along the European-African coast, occurred also in the Azore area, and a few chains were recorded from the Newfoundland Banks.

Chaetoceros costatus Pavillard.

Fig. 5.

HUSTEDT 1930, p. 699, fig. 399.

?*Chaetoceros crinitum*, MEUNIER 1913, p. 40, pl. VI, figs. 24—30.

Area II: Pump sample 25/4, Sts. 20, 22, 23, 28, 32, 35, 36, 38.
- III: Sts. 59, 63.

This species was rather common in the Spanish Bay and along the north-western coast of Africa, never occurring in any great number. A few specimens were also recorded from 2 stations between the Azores and the Sargasso Sea. In the Pump sample 25/4 from the Strait of Gibraltar a few chains were observed, and some of these contained resting spores (fig. 5).

PAULSEN (1930, p. 25, fig. 16d) in samples from mer d'Alboran observed *Chaetoceros costatus* with initial resting spore stages. He has illustrated a chain where two neighbouring cells contain one primary valve each. They are convex, turned away from each other and densely covered with short fine spines. In the "Michael Sars" material the resting spores seem to be fully developed. They have a central position. The primary valve is in full agreement with PAULSEN's findings; the secondary valve is smooth and with a bipartite central knob. (Some of the chains showed quite clearly that the cells were held together in a manner similar to that in *C. pseudocurvisetus* Mangin).

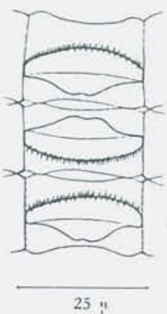

Fig. 5. *Chaetoceros costatus*. Pump sample 25/4. Resting spores. Cell a. thickenings in side contour indicating numerous copulae.

HUSTEDT (1930) includes *C. adhaerens* Mangin in *C. costatus*. MANGIN (1912, p. 39) points out that in his cells the proportion: apical axis/pervalvar axis is greater, (2,8) than in PAVILLARD's cells (1). The said proportion is, however, very variable in this species. In the "Michael Sars" material a/p was found up to 3, and according to the figures of IKARI (1926) it may reach 3,4.

MANGIN also makes the objection that *C. adhaerens* does not have the many copulae, which in PAVILLARD's material from the Mediterranean were easily observed even in living cells. The copulae are, however, not always so easily observed. IKARI had difficulties in seeing them except on using oil immersion on ignited material. PAULSEN (1930) observed them only once, and in the present material they were never distinct, slightly thicker parts in the girdle region indicating that they are present (fig. 5, cell a).

PAVILLARD (1916) and PAULSEN (1930) find it possible that a *Chaetoceros* which MEUNIER (1913) with doubt refers to *Chaetoceros crinitum* Schütt, in fact belongs here. The vegetative cells agree well with *C. costatus*. The primary valves of the resting spores conform with those of my specimens; the secondary valves, however, have an undivided central knob instead of the bipartite of my specimens. According to HUSTEDT (1930) the valves of the resting spores in *C. debilis* may also have one or more knobs. MEUNIER's species most probably belongs to *C. costatus*[1]).

[1]) While this paper was at press I discovered that fully developed resting spores of *C. costatus* have been described and illustrated by E. E. Cupp (1943, p. 127, fig. 79). In the resting spores of her fig. 79f only one of the secondary valves has a bipartite central knob while the knobs on the others are undivided.

Chaetoceros curvisetus Cleve.

HUSTEDT 1930, p. 737, fig. 426.

Area I: Pump sample 15/4, St. 10.
- II: St. 11, Pump samples 22/4, 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22, 23, 36—38.
- III: Sts. 50, Fayal, 59.

This neritic species was rather common along the European-African coast. Otherwise it was only found in the Azore area. Resting spores were observed at two stations north of Spain and at three stations near Gibraltar.

Chaetoceros Dadayi Pavillard.

HUSTEDT 1930, p. 658, fig. 372.

Area II: St. 25, Pump sample 8/5, Sts. 27, 34.
- III: Sts. 48, 51—54, 59, 60, 64.

Most often this species was found with *Tintinnus apertus* Kofoid and Campbell attached to it. It was represented in the Spanish Bay, and was also observed at several stations on the southern Atlantic route but never in any great numbers.

Chaetoceros danicus Cleve.

HUSTEDT 1930, p. 659, fig. 373.

Area I: Pump sample 15/4.

In the pump sample from Queenstown, Ireland, a few specimens of this widely distributed neritic species were observed.

Chaetoceros debilis Cleve.

HUSTEDT 1930, p. 740, fig. 428.

Area I: Pump sample 15/4, St. 10.
- II: St. 11, Pump sample 22/4.

This northern neritic species was exclusively found on the first part of the route — between Ireland and the coast of Portugal. In the pump sample from Queenstown (Ireland) it was rather abundant.

Chaetoceros decipiens Cleve.

HUSTEDT 1930, p. 675, fig. 383.

Area I: Sts. 1, 3, 4, Pump sample 15/4, Sts. 5—10.
- II: Sts. 11—13, Pump samples 22/4, 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22—25, 27, 28, 35—39.
- III: Sts. 59, 64, 66.
- IV: Sts. 70—80.
- V: Sts. 81a, 87, 90, 103.

This species was represented in the whole area. It was especially common along the European-African coast. Stages of microspore formation were observed at Station 3 south of Ireland.

49. Chaetoceros densus Cleve.

Hustedt 1930, p. 651, fig. 368.

Area I: St. 3, Pump sample 15/4, Sts. 7—10.
- II: Sts. 11, 18, 20, 23.

The species was rather common on the route between Ireland and the Canary Islands, otherwise single chains were observed at two stations between the Canaries and the Azores.

50. Chaetoceros diadema (Ehrenberg) Gran.

Fig. 6.

Chaetoceros subsecundus, Hustedt 1930, p. 709, fig. 404.

In regard to the name of this species I agree with Gran and Braarud (1935) who write: "The name *Syndendrium diadema* Ehrenberg was based upon the resting spores, the stage in its development first known, just as *Dicladia mitra* Ehr. and *Chaetoceros didymus* Ehr. We find no reason to replace these names by newer ones".

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: Pump sample 25/4, Sts. 18, 36—38.
- IV: Sts. 77, 80.
- V: Sts. 81a, 85.

This neritic species was rather common on the European African coastal banks, and in the area between Ireland and Spain the chains regularly contained resting spores. It was also represented on the Newfoundland Banks and at two stations on the first part of the northern Atlantic route.

In samples from Station 3 spores were observed which did not have the regular dichotomously branched protuberances on the primary valve; which, however, was equipped with simple threads, tapering towards the ends. They were bent backvards from the valve of the mother cell, more or less intertwining, and mostly returning to the spore (fig. 6c).

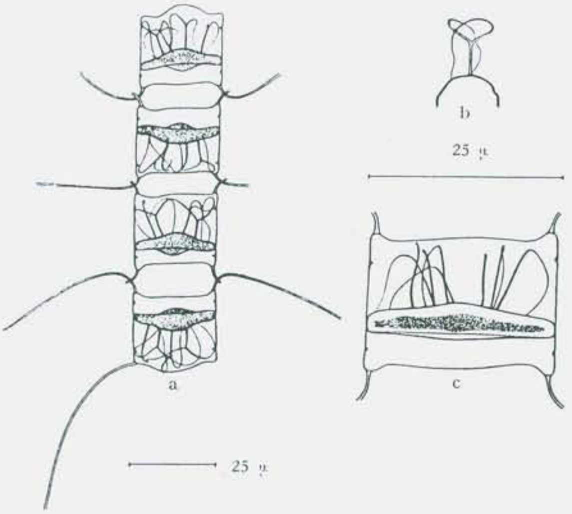

Fig. 6. *Chaetoceros diadema*. a. and c. resting spores, only a few protuberances represented. St. 3. b. primary valve furnished with one single protuberance. St. 7.

On closer examination it was found that in some spores a few or all threads were dichotomously branched, and each branch ended in a long thin thread which was bent backwards (fig. 6a). In two neighbouring cells one spore might have simple threads, the other branched threads. In a sample from Station 7 a detached primary valve was found (apical axis 8 μ) with one single dichotomously branched protuberance (fig. 6b). The thin threads which were bent backwards from each branch, could here be traced back to the valve of the spore. Another valve (apical axis 15 μ) bore 5 such simply branched protuberances which could be traced back to the valve of the spore, although some were intertwined and difficult to trace.

In protuberances with double branching it was even more difficult to distinguish the ends of the threads, and in two spores (apical axis 24 μ) with many protuberances and at least triple branching the tips of the branches were slightly bent backwards, while no long threads were distinguishable.

It seems reasonable to assume that we are here encountering different stages of the development of the protuberances on the primary valve of the resting spore.

In the samples from Station 3 a series of very short chains (apical axis 22—25 μ) containing 4, 6 or 8 cells was observed. In most of them all the cells had formed spores (fig. 6a). A few chains contained vegetative cells only, while others had cells of both types. They all had one character in common: the outer valve of the terminal cells had a hump in the middle and mostly poorly developed bristles. In some cases terminal bristles were missing and at the same time the bristles of the inner valve of the terminal cell were bent backwards, in a manner similar to that of regular terminal bristles (fig. 6a). These chains may have been formed by germination of spores, resting spores or auxospores (cpr. *Bacteriastrum elegans*, p. 7).

Many of the chains in this material had relatively large apertures, sometimes longer than the cells themselves. In a chain with apical axis 23 μ the cells were 6—8 μ long and the apertures 11—14 μ.

51. Chaetoceros didymus Ehrenberg.

Hustedt 1930, p. 688, fig. 390, 391.

Area I: Pump sample 15/4, St. 10.
- II: Sts. 11—13, Pump samples 22/4,-25/4, Sts. 18, 20, 22, 23, 28, 32, 35—39.
- III: Sts. 59, 63, 68.
- IV: St. 80.

This southern neritic species was rather common between Ireland and Cape Bojador. Single chains were also observed at a few stations on the southern Atlantic route and on the Newfoundland Banks.

At Station 18 in the Gibraltar Strait the characteristic resting spores were observed.

Chaetoceros didymus var. **anglica** (Grunow) Gran.

HUSTEDT 1930, p. 690, fig. 393.

Area I: St. 10.
- II: Sts. 20, 35.

This variety was found in company with the main species north of Spain, in the Spanish Bay and off the Canary Isles.

Chaetoceros furcellatus Bailey.

HUSTEDT 1930, p. 749, fig. 433.

Area I: St. 3.

This northern neritic species was exclusively represented at Station 3, south of Ireland.

Chaetoceros imbricatus Mangin.

HUSTEDT 1930, p. 766, fig. 448.

Area II: Sts. 23, 35, 36, 38.
- III: Sts. 63, 64.

A few chains classified as belonging to this species were found at four stations between Gibraltar and Cape Bojador. Single chains were also recorded from two stations on the border of the Sargasso Sea.

The species has previously been recorded from off the west coast of France.

Chaetoceros laciniosus Schütt.

HUSTEDT 1930, p. 701, fig. 401.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: Sts. 11, 13, Pump sample 22/4.
- IV: St. 77.
- V: Sts. 81a, 85, 87.

This widely distributed neritic species was common between Ireland and Portugal. Otherwise it was observed on the Newfoundland Banks and at 3 stations on the northern Atlantic route. Chains containing resting spores were observed at Station 81a, off the Newfoundland Banks.

Chaetoceros Lorenzianus Grunow.

HUSTEDT 1930, p. 679, fig. 385.

Area I: St. 10.
- II: Sts. 12, 18—20, 22—25, 27, 28, 31, 32, 34—36, 38, 39.
- III: Sts. 51—54, Fayal, 59, 63, 64, 68.
- V: Sts. 81a, 87.

This is a southern neritic species. It was very common along the Spanish and African coasts, but it also occurred rather frequently on the southern Atlantic route, and it was represented at 2 stations on the northern Atlantic route.

Chaetoceros messanensis Castracane.

HUSTEDT 1930, p. 718, fig. 410.

Area II: Sts. 18, 20, 22, 23, 31, 32, 34, 35.
- III: Sts. 51—59, 63—65.

This tropical species occurred frequently between Gibraltar and the Canaries, and it was rather common on the southern Atlantic route.

Chaetoceros Pavillardii Ikari.

Fig. 7.

?*Chaetoceros chinchæ*, MERESCHKOWSKY 1900, p. 483, pl. XVI, figs. 3—7.
Chaetoceros sp., PAVILLARD 1925, p. 52, fig. 88.
Chaetoceras Pavillardii, IKARI 1928, p. 255, fig. 9.

Area I: Sts. 3, 4, 7.

Pavillard (1925) has described and illustrated isolated *Chaetoceros* endocysts from the intestines of salps in material from the Bay of Biscay. These are most probably identical with those later observed by IKARI (1928) in his *Chaetoceras Pavillardii* from Japanese waters.

In the "Michael Sars" material from the area between Ireland and Spain I found fragments of *Chaetoceros* chains containing resting spores which were no doubt identical with those described by PAVILLARD from about the same area.

The vegetative cells of this *Chaetoceros* agree very well with those of *Chaetoceras Pavillardii*. The chains are straight, 12—25 μ broad. In broad girdle view the cells are rectangular with more or less projecting corners. In cells containing resting spores the pervalvar axis may be the longest one, normally the apical axis. The valves are nearly flat. The apertures are oval-oblong, sometimes very high (height/breadth: 9/18, 9/12). The thin bristles issue from the corners of the cell, cross each other leaving short basal parts and diverge at an obtuse angle. Terminal bristles are strongly divergent like those shown in IKARI's figures.

The chromatophores could not be distinguished quite clearly in this preserved material. In some cells one chromatophore could be seen attached to one valve or lying against the broad side of the girdle. In other cells there seemed to be 2 chromatophores, attached either to both valves or to the narrow sides of the girdle (fig. 7b).

The resting spores lie central or with the secondary valve near one of the valves of the mother cell. The primary valve of the spore has a central knob which most

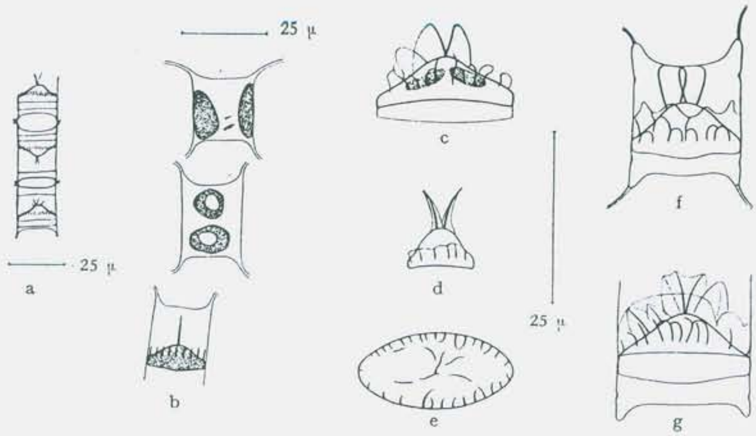

Fig. 7. *Chaetoceros Pavillardii*. a. resting spores. St. 3. b. 3 connected cells seen at individual levels. c. free spore, primary valve with peripheric and central pellicles, marginal striation indicating the concave secondary valve lying within its sheath. d. free spore in transapical view. e. primary valve seen from inside. f. and g. primary valves inside their mother cells. St. 7.

often bears 2 long spines diverging transapically (in broad girdle view they may look like one, fig. 7b). They may be surrounded by a few somewhat smaller spines (fig. 7a). On the margin of the primary valve there is a crown of small spines similar to those of the resting spore of *Chaetoceros coronatus* Gran to which species *C. Pavillardii* most probably is closely related.

MEUNIER (1913, p. 31, pl. IV, figs 33—43) and later on HUSTEDT (1930, p. 712, fig. 406) have observed resting spores in *C. coronatus* which deviate a little from the specimens originally described by GRAN (1897, p. 22, pl. II, figs. 28—31). They are formed within a special sheath overreaching the spore on both sides. On the side of the primary valve this sheath bends inwards — "en se plissant" after MEUNIER — "durch pervalvar von der Schale ausgehende Stacheln gestützt" after HUSTEDT. Higher up the sheath touches the inside wall of the mother cell in a narrow zone with a crenated upper rim. On the opposite side the sheath appears more as a uniform thickening of the mother cell wall.

Some of the resting spores of *C. Pavillardii* show very great likeness to these spores of *C. coronatus*. Besides the peripheric sheath, however, there also appears a more or less folded thin pellicle on the central knob of the primary valve, which seems quite separated from the sheath mentioned.

Fig. 7f, showing a resting spore inside the mother cell, reminds very much of the figure 406b of HUSTEDT. Here is a continuous fine pellicle with thickenings (folds, spines) in bows round the primary valve. But there is also a similar pellicle on the central part. In fig. 7d, a free spore seen in narrow girdle view, the central pellicle is only seen as small wings at the base of the two diverging central spines. The peripheric spines are all of about equal length and they seem connected by a low continuous pellicle. In fig. 7g a spore is shown which besides the peripheric crown and the two central spines is also furnished with some (3?) smaller spines scattered on the primary valve. The latter are also surrounded each by its thin pellicle. Fig. 7e shows such a valve seen from inside. This was one of the longest valves measured (23 μ).

The secondary valve of the resting spore is flat or more or less concave with or without a little central knob. Most often it seems quite smooth. On 5 specimens only a narrow marginal zone of very fine striae was observed (about 25 in 10 μ), indicated in fig. 7c which also shows the secondary part of the peripheric sheath. This feature also appears in *C. coronatus*, as shown by HUSTEDT in his fig. 406 b.

I am inclined to consider these spores, furnished with pellicles, as intermediate stages in the formation of spines on the primary valve of the resting spore in *C. Pavillardii*. This may also be the case with the resting spores of *C. coronatus*.

MERESCHKOWSKY (1900) illustrates and describes *Chaetoceros* spores from Chincha guano (Peru) reminding very much of the spores of *C. Pavillardii*. The resemblance between his drawings and my figure 7e is especially striking. On his primary valves there seem to be some more small scattered pellicles, but the valves are also longer (23—46, 6μ). The peripheric crown seems to have been formed in just the same way as in *C. Pavillardii*.

MERESCHKOWSKY names the species *C. chinchæ*. Since vegetative cells of this species are not known, it is difficult to judge its relationship to *C. Pavillardii*, although there is a possibility that they may be identical.

Chaetoceros pelagicus Cleve.

HUSTEDT 1930, p. 704, fig. 402.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 35.

Between Ireland and Spain this neritic species was rather common. Otherwise it was only recorded from Station 35 between Cape Bojador and Gran Canaria

Chaetoceros perpusillus Cleve.

HUSTEDT 1930, p. 726, fig. 415.

Area III: St. 60.
- IV: St. 80.
- V: Sts. 85, 88.

At a few stations on the western part of the "Michael Sars" area single chains of this little species were observed.

Chaetoceros peruvianus Brightwell.

HUSTEDT 1930, p. 671, figs. 379, 380.

Area II: St. 20, Pump sample 5/5.
- III: St. 53.

This widely distributed warm water species was represented in the Spanish Bay. A single chain was also recorded from Station 53 south of the Azores.

Chaetoceros peruvianus f. **gracilis** (Schröder) Hustedt.

HUSTEDT 1930, p. 672, fig. 381b.

Area I: Sts. 3, 7—10.
- III: St. 54.

This slender form was rather common in the area between Ireland and Spain. Like the main species it was also represented in the vicinity of the Azores but not at the same station.

Chaetoceros pseudocurvisetus Mangin.

HUSTEDT 1930, p. 739, fig. 427.

Area II: Pump samples 22/4, 25/4, Sts. 18—20, 22, 23, Pump sample 8/5, Sts. 27, 28, 32, Pump sample 11/5, Sts. 36—38.
- III: St. 59.

In the Spanish Bay and southwards to Cape Bojador this neritic warm water species occurred rather frequently. Otherwise it was only observed at Station 59 off the Azores. Chains containing resting spores were found in the Strait of Gibraltar.

Chaetoceros radicans Schütt.

HUSTEDT 1930, p. 746, fig. 431.

Area I: Sts. 3, 4, 7, 9.
- II: Sts. 36—38.

This species was fairly common in the area between Ireland and Spain, and it was also observed off Cape Bojador.

Chaetoceros rostratus Lauder.

HUSTEDT 1930, p. 660, fig. 374.

Area II: Pump sample 25/4, Sts. 18, 20, 22—25, 28, 31, 32, 35.

This characteristic species was rather common in the Spanish Bay and southwards to the Canaries.

Chaetoceros seiracanthus Gran.

HUSTEDT 1930, p. 711, fig. 405.

Area II: St. 18.

Chains containing resting spores were observed in the 200—100 m sample from the Gibraltar station 18.

Chaetoceros teres Cleve.

HUSTEDT 1930, p. 681, fig. 386.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: St. 11, Pump samples 22/4, 25/4, Sts. 20, 23, 35, 36, 38.
- III: Sts. Fayal, 59.

This northern neritic species was fairly common on the European-African coastal banks. A few specimens were also found in the Azore area. Chains containing resting spores occurred frequently in the area between Ireland and Spain.

Chaetoceros tetrastichon Cleve.

HUSTEDT 1930, p. 657, fig. 371.

Area II: St. 25.

In the 50—0 m sample from Station 25 in the Spanish Bay a few chains of this warm water species were observed. An empty lorica of *Tintinnus apertus* Kofoid and Campbell was attached to every one of them.

Chaetoceros Wighami Brightwell.

HUSTEDT 1930, p. 724, fig. 414.

Area III: St. 65.
- V: Sts. 81a, 103.

This was a very rare species in the "Michael Sars" area. A few chains occurred in the vicinity of the Newfoundland Banks, and one single chain was recorded from the Shetland station.

Climacodium Frauenfeldianum Grunow.

HUSTEDT 1930, p. 776, fig. 453.

Area II: St. 32.

In the 100—0 m sample from Station 32 off the coast of Marocco one single cell of this warm water species was observed.

Cocconeis sp.

Area I: Sts. 1, 3, 10.
- II: Sts. 34, 35.
- III: Sts. Fayal, 59.

A tiny little epiphytic *Cocconeis* was recorded from the area between Ireland and Spain and around the Canaries and the Azores. It was not subjected to further classification.

Corethron hystrix Hensen.

HUSTEDT 1930, p.547, fig. 311.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 7—10.
- II: Sts. 22, 36.
- III: St. 44.
- IV: Sts. 77, 80.
- V: Sts. 81a, 84, 85, 87, 88.

The species was fairly common between Ireland and Spain and likewise on the Newfoundland Banks and the northern Atlantic route. Otherwise single specimens were observed in the Spanish Bay, off Cape Bojador and due west of the Canaries.

Coscinodiscus centralis Ehrenberg.

HUSTEDT 1930, p. 444, fig. 243.

Area I: Sts. 1, 3, 4, Pump sample 15/4, Sts. 5—10.
- II: St. 11, Pump sample 22/4, Sts. 18, 20, 22—25, 28.
- III: Sts. 46, 53, 54.
- IV: Sts. 76—80.
- V: Sts. 81a, 88, 103.

This typical north Atlantic species was very common on the coastal banks from Ireland to Gibraltar. On the southern and northern Atlantic routes it was sparsely represented, but it occurred at all stations on the Newfoundland Banks and was specially numerous at Station 76.

Coscinodiscus concinnus W. Smith.

HUSTEDT 1930, p. 441, figs. 241, 242.

Area I: St. 3, Pump sample 15/4, Sts. 7—10.
- II: Pump sample 25/4, Sts. 23, 27, Pump sample 11/5.
- III: St. 68.

The species occurred at several stations along the European coast, most often singly. One single specimen was also recorded from Station 68 between the Sargasso Sea and Newfoundland.

Coscinodiscus curvatulus Grunow.

HUSTEDT 1930, p. 406, fig. 214.

Area I: Sts. 4, 7, 10.
- II: Sts. 19, 20, 22, 23, 27—30, 34—37, 40.
- III: Sts. 44, 49c—51, 59.
- IV: Sts. 70, 77, 80.
- V: Sts. 81a, 88, 103.

It had about the same occurrence as *C. centralis*, but it was never noticed in great numbers, often singly.

Coscinodiscus divisus Grunow.

HUSTEDT 1930, p. 410, fig. 218.

Area II: Sts. 31, 34, 35, 39, 40.
- III: Sts. 49c—64.

Single specimens were observed along the north-west coast of Africa. On the southern Atlantic route it occurred a little more frequently, especially around the Azores.

Coscinodiscus excentricus Ehrenberg.

HUSTEDT 1930, p. 388, fig. 201.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 5—10.
- II: Sts. 12, 18—20, 22—25, 27, 28, 30—32, 34—40.
- III: Sts. 44, 46, 49c—58, 59—64, 66, 68.
- IV: Sts. 76—80.
- V: Sts. 83, 85, 87, 88, 92, 99, 103.

This was the most common of all the *Coscinodiscus* species in the "Michael Sars" material. In area I it was observed in every one sample. Only on the northern Atlantic route it occurred a little less frequently. It is a cosmopolitan species.

Coscinodiscus excentricus var. **fasciculata** Hustedt.

HUSTEDT 1930, p. 390, fig. 202.

Area I: St. 4.
- III: St. 46.

In the 50—0 m sample from Station 4 south of Ireland and in the 200—100 m sample from Station 46 west of the Canaries there occurred a few specimens which were classified as belonging to this variety.

Coscinodiscus gigas Ehrenberg.

HUSTEDT 1930, p. 456, figs. 254, 256a.

Area II: St. 32, Pump sample 11/5.

A few specimens of this warm water species were observed off the coast of Marocco.

Coscinodiscus Granii Gough.

HUSTEDT 1930, p. 436, fig. 237.

Area I: St. 10.
- II: St. 11.

Single specimens were observed at two stations north of Spain.

Coscinodiscus lineatus Ehrenberg.

HUSTEDT 1930, p. 392, fig. 204.

Area I: Sts. 2—4, 7—10.
- II: Sts. 18—20, 23, 25, 29—31, 34, 35, 38—40.
- III: Sts. 44, 46, 49c—54, Fayal, 59, 60, 64, 65.
- V: Sts. 81a, 84, 85, 87—92.

It was one of the most common *Coscinodiscus* species in this area, but it was never recorded in any great numbers. Very often it was found singly. It is a cosmopolitan.

Coscinodiscus nodulifer A. Schmidt.

HUSTEDT 1930, p. 426, fig. 229.

Area II: Sts. 22, 27, 34.
- III: Sts. 44, 46, 49c—65, 68.
- V: Sts. 81a, 87, 88, 92.

This characteristic species was rather common on the whole southern Atlantic route. Otherwise it was observed in the Spanish Bay, and single specimens occurred at a few stations on the northern Atlantic route.

Coscinodiscus oculus iridis Ehrenberg.

HUSTEDT 1930, p. 454, fig. 252.

Area II: St. 37.
- IV: St. 80.

This species was very rare in the "Michael Sars" material. It was recorded from off Cape Bojador, and a single specimen was observed at Station 80 on the Newfoundland Banks.

Coscinodiscus oculus iridis var. **borealis** (Bailey) Cleve.

HUSTEDT 1930, p. 456, fig. 253.

Area IV: Sts. 70, 77, 80.

The variety occurred singly in samples from the Newfoundland Banks, at Station 80 together with the main species.

Coscinodiscus radiatus Ehrenberg.

HUSTEDT 1930, p. 420, fig. 225.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 5—10.
- II: Sts. 11—13, Pump samples 22/4, 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22—25, 27, 28, 30—32, Pump sample 11/5, Sts. 34—40.
- III: Sts. 44, 46, 51, 54, 58, 59, 63, 64, 68.
- IV: St. 70.
- V: Sts. 88—92, 99, 103.

With the exception of *C. excentricus* this was the most common of all the *C.* species in the area. It was specially abundant at the Rockall station. Like *C. excentricus* and *C. lineatus* it is a cosmopolitan species.

Coscinodiscus Rothii (Ehrenberg) Grunow.

HUSTEDT 1930, p. 400, fig. 211.

Area V: St. 81a.

One single specimen was found in the 200—100 m sample from the first station on the northern Atlantic route.

Coscinodiscus Thorii Pavillard.

HUSTEDT 1930, p. 433, fig. 236.

Area III: Sts. 63, 64, 68.

A few specimens recorded from three stations on the border of the Sargasso Sea were classified as belonging to this species.

Coscinosira Oestrupii Ostenfeld.

HUSTEDT 1930, p. 318, fig. 155.

Area I: Sts. 3, 4, 7—10.
- V: Sts. 81a, 84, 87.

Between Ireland and Spain this North Atlantic species was fairly common. Otherwise it occurred scattered on the first half of the northern Atlantic route.

Coscinosira polychorda Gran.

HUSTEDT 1930, p. 317, fig. 154.

Area I: Sts. 2, 3.
- II: Pump samples 25/4, 11/5, St. 36.

This northern neritic species occurred south of Ireland, in the Strait of Gibraltar and off the coast of Marocco. Even as far south as off Cape Bojador a few chains were observed.

Dactyliosolen antarcticus Castracane.

HUSTEDT 1930, p. 556, fig. 316.

Area I: Sts. 3, 4, 7, 9.

This species was exclusively observed between Ireland and Spain.

Dactyliosolen mediterraneus H. Peragallo.

HUSTEDT 1930, p. 556, fig. 317.

Area I: Sts. 3, 4, 7—10.
- II: St. 11, Pump sample 25/4, Sts. 20, 22—25, 27, 28, 32, 34, 35, 39, 40.
- III: Sts. 44, 46, 49c—58, 59—64, 66—69.
- IV: St. 80.
- V: Sts. 81a, 83, 85, 87—92.

As distinct from the previous one this species was very common in all our areas, although never occurring in any great numbers.

The chains were now and then seen with colonies of *Solenicola setigera* Pavillard attached to them.

Ditylum Brightwellii (West) Grunow.

HUSTEDT 1930, p. 784, figs. 457—459a.

Area I: St. 3, Pump sample 15/4, St. 10.
- II: Sts. 11, 12, Pump sample 25/4, St. 19.
- III: St. 59.

This neritic species was fairly common from Ireland to Gibraltar. In the 500—200 m sample from Station 10 it occurred in abundance. Otherwise it was only observed off the Azores.

Ditylum Brightwellii f. **pentagona** n. f.

Area II: St. 11.

In the 50—0 m sample from station 11 northwest of the coast of Spain some specimens were observed which had 5-cornered valves. Otherwise they could not be distinguished from the main species. They were listed under this term.

Ditylum Brightwellii f. **tetragona** (Grunow).

Hustedt 1930, p. 785, fig. 459b.

Area I: St. 10.
- II: Sts. 11, 12, Pump sample 22/4, Sts. 18—20.

It occurred regularly together with the main species along the coasts of Spain and Portugal.

Eucampia cornuta (Cleve) Grunow.

HUSTEDT 1930, p. 774, fig. 452.

Area II: St. 23.

This warm water species was exclusively observed in the 100—50 m sample from Station 23 in the Spanish Bay.

Eucampia zoodiacus Ehrenberg.

HUSTEDT 1930, p. 772, fig. 451.

Area I: Sts. 3, 4, Pump sample 15/4, St. 7, 9.
- II: Sts. 12, 13, Pump samples 22/4, 25/4, Sts. 18—20, 22, 23, 28, Pump sample 11/5, Sts. 36—38.
- III: Sts. 51, 59, 63, 68.
- V: St. 81a.

This neritic species was very common on the first part of the route from Ireland to Cape Bojador, but it was also observed, most often singly, at a few stations on the southern and at one on the northern Atlantic route.

Fragilaria oceanica Cleve.

HUSTEDT 1931—37, p. 148, fig. 662.

Area III: St. 68.
- IV: Sts. 76—80.

This northern species was observed on the Newfoundland Banks. A single chain was also noticed at Station 68 south of the Banks together with other northern diatoms such as *Coscinodiscus concinnus* and *Melosira sulcata*.

Fragilaria oceanica f. **convoluta** Gran.

HUSTEDT 1931—37, p. 148.

Area IV: St. 80.

A few chains of this form were found in the 200—50 m sample from the Newfoundland station 80.

Gossleriella tropica Schütt.

HUSTEDT 1930, p. 500, fig. 280.

Area II: St. 22.
- III: Sts. 44, 49c—58, 59, 63, 64, 68.

One single specimen was noticed in the Spanish Bay. It was common on the whole southern Atlantic route from the Canaries to the Newfoundland Banks.

Grammatophora longissima Petit.

HUSTEDT 1931—37, p. 50, fig. 578.

Area II: Sts. 36, 38.

This littoral species was exclusively observed off Cape Bojador.

Grammatophora marina (Lyngbye) Kützing.

HUSTEDT 1931—37, p. 43, fig. 569.

Area II: St. 35.

It was observed between the Canaries and Cape Bojador.

Grammatophora sp.

Area II: Sts. 12, 18, 34.
- III: Sts. Fayal, 59.

Besides *Grammatophora longissima* and *G. marina* there also occurred specimens which could not be referred to any definite species with certainty and accordingly they were listed under this term. They were observed off Cape Finisterre, Gibraltar, the Canaries and the Azores.

Guinardia flaccida (Castracane) Peragallo.

HUSTEDT 1930, p. 562, fig. 322.

Area II: Pump samples 22/4, 25/4, Sts. 28, 32, Pump sample 11/5, Sts. 36, 39.

Area III: Sts. 49c, 58, 63, 64.
- IV: St. 77.
- V: St. 88.

It occurred scattered along the coasts of Spain, Portugal and Africa as well as on the southern Atlantic route. One single specimen was observed on the Newfoundland Banks and one at Station 88 north of the Azores.

Hemiaulus Hauckii Grunow.

HUSTEDT 1930, p. 874, fig. 518.

Area II: Sts. 20,39.
- III: Sts. 44, 50—54, 59—65, 68.

This species was sparsely represented in coastal regions being observed in the Spanish Bay and off Cape Bojador. It was, however, fairly common on the whole southern Atlantic route.

Hemiaulus sinensis Greville.

HUSTEDT 1930, p. 875, fig. 519.

Area II: Pump sample 25/4, Sts. 18, 22, 23, 27, 28, 32, 35.
- III: St. 63.

As distinct from the previous one this species was almost exclusively found in the area between Gibraltar and the Canary Islands. A few specimens only were observed at Station 63 on the border of the Sargasso Sea.

Hemidiscus cuneiformis Wallich.

HUSTEDT 1930, p. 904, fig. 542c.

Area I: Sts. 3, 4, 9.
- II: Sts. 22, 25, 28, 30, 31, 34.
- III: Sts. 44, 46, 49c—54, 59—65, 68.
- V: Sts. 83—85, 87.

This southern species was fairly common on the whole route from Ireland to Newfoundland. It was also represented on the first half of the northern Atlantic route.

Hemidiscus cuneiformis var. **ventricosa** (Castracane) Hustedt.

HUSTEDT 1930, p. 906, fig. 542d.

Area I: Sts. 4, 10.
- II: Sts. 18—20, 22—25, Pump sample 8/5, Sts. 27—32, 34, 35, 39, 40.
- III: Sts. 44, 46, 49c—68.
- V: Sts. 81a, 85, 87—92.

The variety occurred still more frequently than the main species, lacking only on the Newfoundland Banks and at the stations north of Ireland and Scotland.

Lauderia borealis Gran.

HUSTEDT 1930, p. 549, fig. 313.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: St. 11, Pump samples 22/4, 25/4, Sts. 20, 22, 23, 32, Pump sample 11/5, Sts. 36—38.
- III: Sts. Fayal, 59, 63, 68.
- V: St. 81a.

It was fairly common from Ireland to Cape Bojador. Otherwise it was recorded from the Azores and a few stations on the western part of the Atlantic routes.

Leptocylindrus danicus Cleve.

HUSTEDT 1930, p. 558, figs. 318, 319.

Area I: Pump sample 15/4, St. 10.
- II: Sts. 12, 13, Pump sample 25/4, Sts. 20, 22, 28, 32, Pump sample 11/5, Sts. 36—38.
- III: Sts. Fayal, 59, 63.
- V: St. 81a.

This species occurred in the same area as the previous one but a little less frequently.

Leptocylindrus minimus Gran.

HUSTEDT 1930, p. 560, fig. 321.

Area II: Pump sample 11/5, Sts. 35, 39.

Single cells observed at three stations from off the northwest African coast were classified as belonging to this species.

Licmophora sp.

HUSTEDT 1931—37, p. 52.

Area II: Sts. 34, 35, 37—40.
- III: St. Fayal.

Specimens of this littoral genus occurred around the Canaries and at the Azores, most often singly. As they are not true plankton forms, they were not subjected to any further examination but listed under this term.

Lithodesmium undulatum Ehrenberg.

HUSTEDT 1930, p. 789, fig. 461.

Area II: Sts. 36, 38.

This was a very rare species in the "Michael Sars" material. It was exclusively observed at two stations off Cape Bojador.

Melosira moniliformis (Müller) Agardh.

HUSTEDT 1930, p. 236, fig. 98.

Area III: St. Fayal.

In accordance with its littoral character the species was exclusively observed in the Horta harbour (Azores).

Melosira sulcata (Ehrenberg) Kützing.

HUSTEDT 1930, p. 276, fig. 119.

Area I: Sts. 1—3, Pump sample 15/4, Sts. 5, 10.
- II: Sts. 12, 13, Pump samples 22/4, 25/4, Sts. 18, 20, 27, 35—38, 40.
- III: St. 68.
- V: St. 103.

Single chains of this littoral species occurred regularly along the European and African coasts. Otherwise it was only noticed south of the Newfoundland Banks and off the Shetland Islands.

Navicula sp.

Area V: Sts. 84, 86, 87.

On the western part of the northern Atlantic route single specimens of this genus were observed. They were not more closely examined, but listed under this term.

Nitzschia closterium (Ehrenberg) W. Smith.

VAN HEURCK 1880—85, p. 185, pl. LXX, figs. 5, 7, 8.

Area I: Sts. 1—4, 7, 10.
Area II: Pump sample 25/4, Sts. 23, 36, 37.
- V: St. 81a.

This littoral species was practically limited to the European-African coastal banks. Otherwise only one single specimen was recorded from Station 81a, near the Newfoundland Banks.

Nitzschia delicatissima Cleve.

CLEVE 1897, p. 24, pl. II, fig. 22.

Area I: Sts. 2—4, Pump sample 15/4, Sts. 7—10.
- II: St. 11, Pump samples 22/4, 25/4, Sts. 20, 22, 36.
- V: Sts. 85, 103.

This species was specially abundant at Station 2 south of Ireland and it was rather common between Ireland and Gibraltar. A few chains were observed as far south as off Cape Bojador. It was also noticed at one station on the northern Atlantic route and off Shetland.

Nitzschia paradoxa (Gmelin) Grunow.

GRAN 1908, pl. 131, fig. 178.

Area II: St. 35.
- III: St. Fayal.

Like *N. closterium* this species is also littoral and accordingly it was exclusively observed near land — between the Canaries and Cape Bojador and at the Azores.

Nitzschia seriata Cleve.

CLEVE 1883, p. 478, pl. 38, fig. 75.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 13, Pump samples 22/4, 25/4, Sts. 18, 20, 22, 23, 28, 32, Pump sample 11/5, Sts. 36—39.
- III: Sts. Fayal, 59, 63, 64.
- V: Sts. 81a, 83, 85, 87.

This species is closely related to *Nitzschia delicatissima*, and they occurred together in most of the samples from which the latter has been recorded. But *N. seriata* was also rather common on the western part of the southern as well as the northern Atlantic route.

Planktoniella sol (Wallich) Schütt.

HUSTEDT 1930, p. 465, fig. 259.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 13, 18, 19, 22, 23, 27—30, 32, 34, 35, 39, 40.
- III: Sts. 44, 46, 49c—68.
- IV: St. 80.
- V: Sts. 81a—85, 87, 88, 92.

This was a very common species in the whole "Michael Sars" area, especially on the southern Atlantic route. But it was only at Station 58 near the Azores that it occurred in any abundance, often it was found singly.

Pleurosigma spp.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 5, 7, 10.
- II: St. 11, Pump sample 25/4, Sts. 18, 20, 27, 32, 36—38.
- III: Sts. Fayal, 59.
- V: St. 103.

The specimens of this genus were not subjected to closer examination but recorded as *Pleurosigma* spp. They occurred fairly often in the samples from the European-African coastal banks. Otherwise they were observed around the Azores and off Shetland.

Podosira hormoides (Montagne) Kützing.

HUSTEDT 1930, p. 283, fig. 123.

Area II: St. 13.
- III: St. 59.

Single specimens of this littoral species were recorded from off the coast of Portugal and from off the Azores.

Podosira stelliger (Bailey) Mann.

HUSTEDT 1930, p. 286, fig. 128.

Area I: Sts. 1—3, Pump sample 15/4, Sts. 5, 10.
- II: Sts. 12, 18—20, 27, 28, 32, 35—40.
- III: St. 59.
- V: St. 103.

This is also a littoral species, but as distinct from the

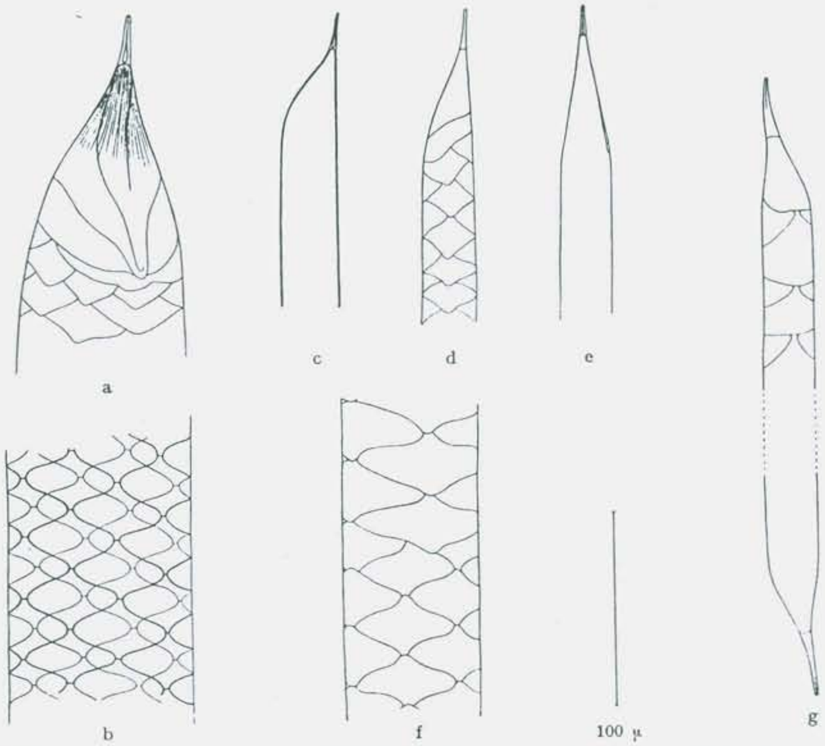

Fig. 8. *Rhizosolenia acuminata.* a. cell top slightly compressed. b. middle part of the same cell quite compressed. c. and d. slender dorsiventral tops. St. 4. e. nearly symmetrical top. St. 64. f. middle part of cell with transition from 4 to 6 rows of copulae. g. *Rhizosolenia* sp. (*calcar avis?*) St. 4.

previous one it was rather common in the net samples from the coastal banks between Ireland and Cape Bojador. It was also noticed off the Azores and the Shetland Isles.

Rhabdonema adriaticum Kützing.

HUSTEDT 1931—37, p. 23, fig. 552.

Area II: Pump sample 25/4, Sts. 18, 36, 37, 40.
- III: Sts. Fayal, 59, 60.
- V: St. 81a.

Rhabdonema is a littoral genus like the previous one. The species *adriaticum* was observed in the Strait of Gibraltar, off Cape Bojador, around the Azores and at one station to the east of the Newfoundland Banks.

Rhabdonema arcuatum (Lyngb.? AG.) Kützing.

HUSTEDT 1931—37, p. 20, fig. 549 a, b, f.

Area I: Pump sample 15/4.

A single cell was noticed in the pump sample from Queenstown, Ireland.

Rhizosolenia acuminata (Peragallo) Gran.

Fig. 8.

HUSTEDT 1930, p. 605, fig. 350.
Rhizosolenia obtusa, HENSEN 1887, p. 86, pl. V, fig. 41.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 22—25, 32.
- III: Sts. 44, 50—53, 64.

Rhizosolenia acuminata was most common at the stations between Ireland and Spain. It was also observed in samples from the Spanish Bay and from a few stations on the southern Atlantic route.

Diameter 26—70 μ.

HUSTEDT doubts the validity of this species suggesting that it may be a slender form of *R. Temperei*, the calyptra form varying with the diameter of the cell.

The species obviously is a variable one, as well in the form of the calyptra as in the shape and number of rows of copulae. Fig. 8a shows one of the broadest specimens in the material. The calyptra is rather low and distinctly excentric. Fig. 8e shows one of the most slender cells, having a long coneshaped calyptra and no pronounced excentricity. (At a first glance it reminds one of *R. Bergonii*, see p. 24). This, however, is a rare form, even the most slender forms generally being distinctly excentric (fig. 8c). They all show marks from the neighbouring cell and in Hyrax faint radiating stripes are to be seen on the upper part of the calyptra.

The imbrication lines are very difficult to observe in water, while there is a hint of them in empty cells. Even in Hyrax they are rather vague. The same variation in the copulae is to be found here as in *R. alata* f. *indica* (Hustedt 1930, p. 602, fig. 346) and in *R. calcar avis* (Hustedt l. c. p. 593, fig. 339). Most frequently there are 4 rows of copulae. In the terminal part of the cell the copulae are scale-like with the convex side away from the apex (figs. 8a and 8d). In the middle of the cell the imbrication lines are regularly undulating. This is clearly seen in fig. 8b, where the number of rows is 8 (the cell was quite compressed in the middle). Fig. 8f shows a fraction of a cell where one part has 4, the other 6 rows. In another cell (not illustrated) one part had 6, the other 8 rows. In a few cells observations in water indicated 2 dorsiventral rows of copulae, but this could not be verified, the specimens being lost when transferred to Hyrax.

The most stable character is the apical process. It is short and straight, at the basis having a small inner cavity tapering into a fine channel towards the apex, which is cut square or is a little rounded. (A couple of specimens, having 2 dorsiventral rows of copulae, from Station 4 at a first glance seemed to resemble *R. acuminata* very much. They proved, however, to have a solid apical process, possibly with a short fine channel at the point. The terminal part of the cell was slightly bent, indicating that it may have been an unusual form of *R. calcar avis*, although this species was not observed in the same area. See fig. 8g).

Rhizosolenia obtusa Hensen, described from the Atlantic Ocean in 1887 has suffered the misfortune of being confounded with *R. alata* f. *inermis* (Castracane) Hustedt and is by Hustedt (1930) recorded as synonym for this variety. In 1897 (p. 25) Cleve, without any explanation, merged this species with Gran's *R. alata* var. *truncata*. Mangin (1915, p. 73) again distinguished them: "Cette variété n'a aucune relation avec le *R. obtusa* Hensen", but did not comment on the last named species. Pavillard (1925, p. 26) confirms the reestablishment of the species and places it in the section *Inermes*.

Comparing Hensen's illustrations with my specimens of *R. acuminata* there is a definite resemblance. His fig. 41a, showing a cell in a phase of division, might as well have been an illustration of one of my specimens. In fig. 41b, showing the apical process at higher magnification, it may seem a little more straight than in my specimens, which have a slight widening at the base. If, however, the figure illustrates one of the apical processes shown in fig. 41a, it may be suggested that it gives the impression of being rather diagrammatic.

I feel justified in stating that Hensens' *R. obtusa* and my specimens are identical and according to nomenclature rules the species ought to be named *R. obtusa*. Since, however, this name has been used so extensively in connection with the *R. alata* variety, I prefer to retain the name *R. acuminata* and leave it to a future monographer to make final decision in the matter.

Rhizosolenia alata Brightwell.

Hustedt 1930, p. 600, fig. 344.

Area I: Sts. 1, 3, 4, 7—10.
- II: Sts. 11, 13, Pump sample 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22—25, 27—29, 32, Pump sample 11/5, Sts. 34—40.
- III: Sts. 44, 49c—65.
- IV: St. 77.
- V: Sts. 81a—85, 87—97, 103.

Of all the *Rhizosolenia* species in the "Michael Sars" material this was the most common one. At several stations it was the dominating species in the samples from the surface layer, especially along the south-west African coast. On the Newfoundland Banks, however, only one specimen was noticed.

Rhizosolenia alata f. curvirostris Gran.

Fig. 9.

Hustedt 1930, p. 602, fig. 347. *Rhizosolenia inermis* Castracane f. *rostrata*, Heiden und Kolbe 1928, p. 522, pl. 8, fig. 162 and pl. 9, fig. 167.

Area I: St. 7.
- V: St. 87.

Among the *Rhizosolenia alata* specimens from Station 87 on the northern Atlantic route there occurred a single one which must be classified as f. *curvirostris* Gran (1900, p. 120 pl. IX, figs. 21—22). See fig. 9a. It had a length of 165 μ.

Most probably this form is identical with the *R. inermis* f. *rostrata* described and pictured by Heiden and Kolbe (1928) from the Antarctic. Heiden and Kolbe regard *R. inermis* Castracane as a distinct spe-

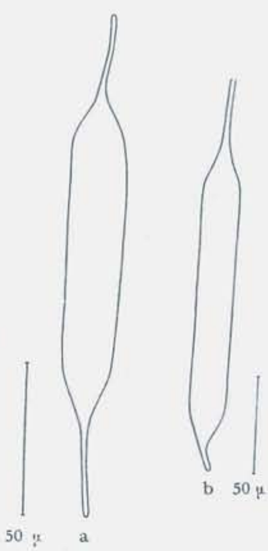

Fig. 9. *Rhizosolenia alata* f. *curvirostris*. a. St. 87. b. dimorphic cell. St. 7.

cies characterized by the linear little apical furrow. According to HUSTEDT (1930, p. 604) "kommt aber die Furche allen *Alatae* zu, nur dass sie nicht immer mit gleicher Deutlichkeit ausgeprägt ist". If this is correct, the f. *rostrata* of HEIDEN and KOLBE must be included in the species *alata*, and owing to the long curved process of the valve it must be referred to the f. *curvirostris* Gran. In fig. 162 a faint impression made by the apex of the neighbouring cell is indicated, but this may also be seen in the f. *curvirostris*.

On the "Michael Sars" specimen no such impression was to be seen nor any apical furrow, otherwise it agreed very well with the fig. 162 of HEIDEN and KOLBE.

At station 7 south of Ireland one specimen was observed which had one normal *alata* valve and one f. *curvirostris* valve (fig. 9b). The latter valve showed no mark for the neighbouring cell.

Karsten (1905a) has in Antarctic material observed similar dimorphic specimens of *R. truncata* (p. 97, pl. X, fig. 3a) and likewise from Antarctic material VAN HEURCK (1909) has illustrated a *R. inermis* cell (pl. IV, fig. 68) where one end most probably has a f. *curvirostris* valve. The figure 73 in the last mentioned table (named *R. spec.?* ou *R. truncata* Karst.?) might also be the end of a *R. alata* f. *curvirostris* cell. MANGIN (1915, p. 76, fig. 54 II) has illustrated some specimens which he records as abnormal forms of *R. truncata* Karsten. They are very similar to my specimen, and I think it most probable that *R. truncata* Karsten also must be included in the species *R. alata*.

The f. *curvirostris* Gran has previously been recorded by GRAN (1900) from off the southern and by GAARDER (1938) from off the northern Norwegian coast.[1]

Rizosolenia alata f. gracillima (Cleve) Grunow.

HUSTEDT 1930, p. 601, fig. 345.

Area I: Sts. 3, 4, 7—10.
- II: Pump sample 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22—25, Pump sample 8/5, Sts. 27—32, Pump sample 11/5, Sts. 34—37, 39—40.
- III: Sts. 44, 49c, 50, 54, Fayal, 59—65.
- IV: St. 80.
- V: Sts. 81a, 84, 87, 97, 99, 103.

This form had practically the same occurrence as the main species. On the northern Atlantic route it was less common, but in the sample from the surface layer at the Shetland station (103) it was absolutely predominant.

Cells forming auxospores were observed at Stations 7 and 9 between Ireland and Spain, 20 and 22 in the Spanish Bay, 35 between Gran Canaria and Cape Bojador, 59 off the Azores and 81a off the Newfoundland Banks.

[1] While this paper was at press I discovered that it has also been recorded by CUPP (1943, p. 93, fig. 52) from off the West coast of North America.

Rhizosolenia alata f. indica (Peragallo) Ostenfeld.

HUSTEDT 1930, p. 602, fig. 346.

Area II: Sts. 19, 20, 22, 23, 32, Pump sample 11/5, Sts. 36, 38—40.
- III: St. 68.
- V: St. 85.

Usually this form occurs in warmer seas, and in the "Michael Sars" area it was almost limited to the coastal banks of North-West Africa. It was very abundant at Station 40 between Gran Canaria and Cape Bojador in company with other forms of *R. alata*.

Only a few specimens were observed at Stations 68 on the southern and 85 on the northern Atlantic route.

Rhizosolenia Bergonii Peragallo.

Fig. 10.

HUSTEDT 1930, p. 575, fig. 327.

?*Rhizosolenia stricta*, KARSTEN 1905b, p. 162, pl. XXIX, figs. 11—11b.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 18, 22, 23, 27, 32, 34, 40.
- III: Sts. 44, 46, 49c—65, 68.
- V: Sts. 85, 87—90.

This species was fairly common within the whole region except on the Newfoundland Banks and on the first part of the northern Atlantic route.

At a first glance it may easily be mistaken for *R. acuminata*, especially for the least excentric specimens of this species (se fig. 8e). The calyptra is more or less, although never quite symmetrical. (My impression is that specimens newly formed by cell division are least symmetrical, the same possibly also being the case with *R. acuminata*). The impression made by the neighbouring cell is generally noticeable. The stripe structure from apex along the valve, distinct in Hyrax, is more pronounced than in *R. acuminata*. As in this species the imbrication lines are hardly distinguishable in water.

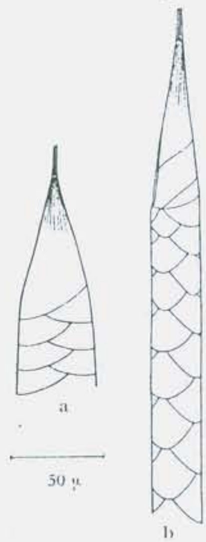

Fig. 10. *Rhizosolenia Bergonii*. a. cell top slightly compressed. St. 10. b. St. 64.

Most of the specimens had 4 rows of copulae, scale-like with the bow-shaped margins away from apex. Mostly the margin is more even in this species than in *R. acuminata*, especially noticeable in fig. 10a, while in the middle of the same cell the shape is more like that in fig. 10b, and in some cells it may be quite the same as in *R. acuminata*. In stouter specimens there seem to be 5 rows of copulae, although never so distinct that they were actually counted.

The apical process is very characteristic. It is short and straight as in *R. acuminata*, with a cave at the base and a narrow channel with a bell-shaped expansion at the top.

The difference between the two species is not very pronounced and it might be tempting to consider them as forms of the same species. Until specimens are found bearing one apical process of each kind or transition has been observed in clones, one must uphold the distinction between them.

From Atlantic material KARSTEN (1905b) has described a species, *R. stricta*, which is distinguished from *R. Bergonii* solely by having 2 rows of copulae. Since the number of rows of copulae is variable in *R. Bergonii*, increasing with the diameter of the cell, I consider it most probable that *R. Stricta* Karsten ought to be included in this species (*R. Bergonii* in the "Michael Sars" material measured 28—55 μ in diameter, while *R. Stricta* measured 20—24 μ).

Rhizosolenia Bergonii Peragallo f. **bidens** (Karsten) n. f.

Fig. 11.

Area I: St. 4.

In material from the Antarctic KARSTEN (1905a) and later VAN HEURCK (1909) and HEIDEN and KOLBE (1928) observed *Rhizosolenia* cells with bipartite apex. KARSTEN created a new species, *R. bidens*, and referred it to the *Alatae* on account of the mode of auxospore formation. Among the figures of KARSTEN (1905a, pl. IX) figs. 13a and 13b may be referred to the *alata*-group, while fig. 13 most probably belongs to a different group.

HEIDEN and KOLBE have a series of drawings (1928, pl. 8, figs. 158—161) showing that *R. hebetata* f. *semispina* may have bipartite apex. Here the identity is beyond doubt, cells occurring where one end is bipartite, the other being a regular *semispina* apex. The authors name this form: *R. hebetata* Bailey f. *bidens* (Karsten). They also create a *bidens*-form (p. 517) of *R. styliformis* Brightwell, without presenting any direct evidence of the connection with the species and without giving illustrations. (They refer to VAN HEURCK's drawing (1909, pl. IV, fig. 64), but I am not convinced that this represents a form of *R. styliformis*). Their pl. 7, fig. 156 shows another *bidens*-form, the authors not daring to decide whether it is an abnormal *R. styliformis* f. *bidens* or a typical *bidens*-form of another species. To me it does not seem improbable that it may belong to *R. hebetata* f. *hiemalis*, but this form was not recorded from the "Gauss" material.

CASTRACANE (1886, p. 73, pl. XXIV, fig. 14) in his material from the Challenger Expedition observed a *Rhizosolenia* cell (possibly *R. hebetata* f. *semispina*) with 2 apical processes, without giving further comments. PERAGALLO (1890—93, p. 109, pl. XV, fig. 3) has pictured a specimen of *R. robusta* Norman with bipartite calyptra without apical processes from the Villefranche material. PAVILLARD (1911, p. 27, fig. 2 E,F,G) describes an abnormal cell division in *R. calcar avis* M. Schultze from the Mediterranean. In the last case a kind of splitting of the apex occurred, although it did not result in the formation of two complete apices. A cell with both ends abnormal might get two normal daughter valves by division.

HEIDEN and KOLBE stress the necessity of abandoning KARSTEN's species *bidens*. The examples mentioned clearly demonstrate that bipartite forms may occur in various species of *Rhizosolenia*. Further two examples may be given:

In a sample from Station 4, south of Ireland, I found part of a *Rhizosolenia* in cell division, the two parts still being connected. The two apices were both bipartite, each being typical of *R. Bergonii* (fig. 11a). Although the imbrication lines were not observed, I have no doubt that this specimen represents a *bidens*-form of *R. Bergonii*, and I have in accordance with HEIDEN and KOLBE referred it to this taxonomical unit.

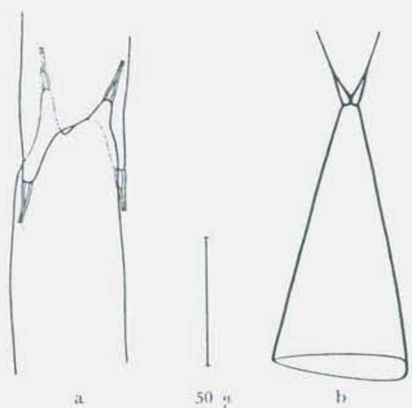

Fig. 11. a. *Rhizosolenia Bergonii* f. *bidens*. St. 4, b. *Rhizosolenia* sp. f. *bidens*. St. 3.

In fig. 11b the valve of a *Rhizosolenia* part observed in the 160—80 m sample from Station 3 has been illustrated. The cell had 2 rows of copulae and the valve was approximately symmetrical. The valve itself was not split in the same manner as in the *R. Bergonii*-form, but it was furnished with 2 separate apical processes reminding of those on *R. hebetata* f. *semispina*, although a little shorter than usual in this form. It cannot be classified with certainty, but it may be a *bidens*-form of *R. hebetata*.

Rhizosolenia calcar avis M. Schultze.

Hustedt 1930, p. 592, fig. 339.

Area II: St. 34.
- III: Sts. 44, 63, 65.

This warm water species was observed at 2 stations near the Canaries and 2 stations on the border of the Sargasso Sea, always in small numbers.

Rhizosolenia Castracanei Peragallo.

Hustedt 1930, p. 607, fig. 351.

Area II: Sts. 22—25.
- III: Sts. 44, 48, 49c—58, 64.

This is also a warm water species. It occurred in the Spanish Bay and was rather common on the southern Atlantic route between the Canary Islands and the Sargasso Sea.

Rhizosolenia cylindrus Cleve.

Hustedt 1930, p. 572, fig. 325.

Area III: Sts. 53, 54, 63, 64.

This characteristic but rare species was recorded from 4 stations near the Sargasso Sea.

Rhizosolenia delicatula Cleve.

Hustedt 1930, p. 577, fig. 328.

Area II: Pump sample 22/4, Sts. 20, 22, 23, 28, 31.
- V: St. 81a.

It was almost limited to the Spanish Bay, only a few specimens were observed at Station 81a off the Newfoundland Banks.

Rhizosolenia fragilissima Bergon.

Hustedt 1930, p. 571, fig. 324.

Area I: St. 7.
- V: St. 81a.

This northern neritic species was recorded from two stations only, one south of Ireland and one off the Newfoundland Banks.

Rhizosolenia hebetata f. hiemalis Gran.

Hustedt 1930, p. 590, fig. 337.

Area III: St. 64.

One single specimen classified as belonging to this cold water form was, strangely enough, recorded from Station 64 on the border of the Sargasso Sea.

Rhizosolenia hebetata f. semispina (Hensen) Gran.

Fig. 12

Hustedt 1930, p. 592, fig. 338.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 7—10.
- II: Sts. 11, 22, 25, 27, 28.
- III: Sts. 44, 49c—58, 59—64, 68.
- IV: Sts. 70—80.
- V: Sts. 81a, 85, 87—92, 103.

This was one of the most common of all *Rhizosolenia* and it was spread over the whole area.

In the 50—20 m sample from Station 7 south-west of Ireland a peculiar specimen obviously belonging to this species was observed. See fig. 12. Probably the spirally turned form of the cell may be due to an abnormal fixation.

A part of a cell with bipartite apical process observed at Station 3 south of Ireland may also belong to this species. See *R. Bergonii* f. *bidens*, fig. 11b, p. 25.

Fig. 12. *Rhizosolenia hebetata* f. *semispina*. Top of undulated cell. St. 7.

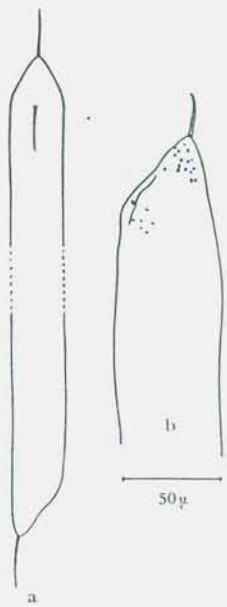

Fig. 13. *Rhizosolenia hyalina*. St. 63. a. both ends of the same cell. b. cell top quite compressed, process broken?

Rhizosolenia hyalina Ostenfeld.

Fig. 13.

Rhizosolenia hyalina, Ostenfeld og Schmidt 1901, p. 160, fig. 11.
Rhizosolenia pellucida, Cleve 1901, p. 56, pl. VIII, fig. 4.

Area III: Sts. 63, 64.

At Stations 63 and 64 on the border of the Sargasso Sea this delicate little *Rhizosolenia* species occurred in a considerable number. The whole cell was rather fragile, and the fine spine of the apical process was easily broken off (fig. 13b). The impression from the process of the neighbouring cell was always distinct (fig. 13a). Intercalaries were neither visible in water nor in Hyrax. According to Ostenfeld and Schmidt they are similar to those on *R. Bergonii*: "squamate (4—5 squamae at the same height)".

Diameter 24—38 μ. Length (incl. spines) 245—390 μ. Length of process 26—30 μ.

The species has previously been recorded from the waters around the southern and eastern parts of Asia, from the Red Sea to Japan.

Rhizosolenia imbricata Brightwell.

HUSTEDT 1930, p. 580, fig. 331.

Area III: Sts. 63, 64.
- IV: St. 80.

A few specimens were recorded from two stations on the border of the Sargasso Sea and from the most northern station on the Newfoundland Banks.

Rhizosolenia imbricata var. **Shrubsolei** (Cleve) Schröder.

HUSTEDT 1930, p. 584, fig. 332.

Area I: Sts. 3, 4, Pump sample 15/4, Sts. 7—10.
- II: Sts. 11—13, Pump samples 22/4, 25/4, Sts. 18, 20, 22—25, 27—32, Pump sample 11/5, Sts. 34—40.
- III: Sts. 49c, 53—65.
- V: Sts. 81a, 85, 87—92, 99, 103.

While the main species was very rare in this material, the var. *Shrubsolei* was very common in most of the area. It lacked on the Newfoundland Banks but was represented near Rockall and Shetland.

Rhizosolenia robusta Norman.

HUSTEDT 1930, p. 578, fig. 330

Area I: St. 10.
- II: Pump sample 25/4, Sts. 18, 20, 23, 32, Pump sample 11/5.

This species occurred now and then in samples from the European—African coastal banks, never in any great numbers.

Rhizosolenia setigera Brightwell.

Fig. 14.

HUSTEDT 1930, p. 588, fig. 336.

Area I: Pump sample 15/4.
- II: St. 20.
- III: St. 59.
- IV: Sts. 70, 80?

Single specimens of this neritic species were observed in samples from Queenstown, Gibraltar, the Azores and the Newfoundland Banks.

In the 200—50 m sample from Station 80 on the Newfoundland Banks a specimen pictured in fig. 14 was observed. It may be a *R. setigera* cell with broken spine.

25 μ

Fig. 14. *Rhizosolenia setigera* with broken process? St. 80.

In the same sample specimens of *R. hebetata* f. *semispina* with broken spines were also seen.

Rhizosolenia Stolterfothii Peragallo.

HUSTEDT 1930, p. 578, fig. 329.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 13, Pump sample 25/4, Sts. 18, 20, 22, 23, 28, 32, Pump sample 11/5, Sts. 36, 38, 39.
- III: Sts. 59, 63, 68.
- V: Sts. 81a, 103.

This characteristic species was rather common along the European—African coast. On the southern Atlantic route it was recorded from a few stations, most often as single chains. It was also observed at the first station on the northern route, and a single chain was found in a Shetland sample.

Rhizosolenia styliformis Brightwell.

HUSTEDT 1930, p. 584, fig. 333.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 7—10.
- II: St. 11, Pump sample 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22, 23, 27, 28, 31, 32, Pump sample 11/5, Sts. 34, 35, 38—40.
- III: Sts. 44, 49c—51, 54, 58, Fayal, 63.
- IV: Sts. 70—80.
- V: Sts. 81a, 83, 85, 87, 90—103.

This was one of the most common *Rhizosolenia* species in the area. On the northern Atlantic route it was most often found singly, but off Rockall it occurred in abundance.

Rhizosolenia styliformis var. **latissima** Brightwell.

HUSTEDT 1930, p. 586, fig. 335.

Area II: Sts. 20,22, 30, 32.
- III: Sts. 48, 53, 63, 64.
- IV: St. 80.

Among the *R. styliformis* there sometimes occurred specimens with very great breadth and low valve. These I have listed as var. *latissima*. This is a warm water variety, and consequently it was limited to the southern part of the area. Only one single specimen was recorded from the most northern station on the Newfoundland Banks.

Rhizosolenia styliformis var. **longispina** Hustedt.

HUSTEDT 1930, p. 586, fig. 334.

Area I: Sts. 1—4, Pump sample 15/4, Sts. 7—10.
- II: Sts. 11, 12, Pump sample 25/4, Sts. 18—20,

Pump sample 5/5, Sts. 22, 23, 27, 28, 31, 32, Pump sample 11/5, Sts. 35, 39.
- III: Sts. 50, 58, 59, 64, 65.
- V: Sts. 81a—85, 87, 90, 92, 98—103.

This variety had practically the same occurrence as the main species, it was only a little less common, and they were most often observed together in the samples.

At Station 3 south of Ireland cells forming auxospores were seen.

Roperia tessellata (Roper) Grunow.

Hustedt 1930, p. 523, fig. 297.

Area I: Sts. 3, 4, 10.
- II: Sts. 11, 19, 23, 28, 30—32, Pump sample 11/5, Sts. 34, 35, 39, 40.
- III: Sts. 44, 46, 50, 54, 58, 59—63.
- V: Sts. 87—92.

This species occurred fairly often on the coastal route from Ireland to Cape Bojador. It was also observed on the eastern half of the southern and northern Atlantic routes, but most often singly.

Sceletonema costatum (Greville) Cleve.

Hustedt 1930, p. 311, fig. 149.

Area I: Sts. 2, 3, Pump sample 15/4.
- II: Sts. 22, 35.
- III: Sts. 63, 69.

This cosmopolitan species was rare in the "Michael Sars" material. It was observed south of Ireland, in the Spanish Bay and between the Canaries and the African Coast. Otherwise only one single chain was recorded from each of two stations between the Sargasso Sea and the Newfoundland Banks.

Schroederella delicatula (Peragallo) Pavillard.

Hustedt 1930, p. 551, fig. 314.

Area II: Sts. 12, 13, Pump samples 22/4, 25/4, Sts. 18—20, Pump sample 5/5, Sts. 22, 23, 27, 28, 30, 32, Pump sample 11/5, Sts. 36—39.
- III: Sts. Fayal, 59, 63—65, 68.

The species was common along the coasts of Spain, Portugal and North Africa. Especially at the Portuguese station 13 it was rather numerous. Otherwise it occurred around the Azores and on the border of the Sargasso Sea. Auxospores were observed at the Stations 36 and 37 off Cape Bojador.

At first I was disposed to distinguish between two separate species: *S. delicatula* (Peragallo) and *S. Schroederi* (Bergon). But as intermediate forms were also seen, I have listed them all under the above mentioned name in accordance with the view of Hustedt (1930).

Stephanopyxis Palmeriana (Greville) Grunow.

Hustedt 1930, p. 308, fig. 147.

Area II: Pump sample 22/4. Sts. 18, 20, 22—25, 28, 32, Pump sample 11/5, Sts. 35, 36.
- III: Sts. 63, 68.

This warm water species, which has its main distribution in the Indian and Pacific Oceans, was observed now and then between Portugal and Cape Bojador. A few chains were also noticed on the border of the Sargasso Sea.

Stephanopyxis turris (Greville et Arnott) Ralfs.

Hustedt 1930, p. 304, fig. 140.

Area II: St. 11.

This species was exclusively observed in the 50—0 m sample from Station 11 north of Cape Finisterre (Spain).

Stephanopyxis sp.

Area III: St. 63.

In the 100—0 m sample from Station 63 on the border of the Sargasso Sea two specimens were noticed which could not be referred to any definite species but were listed under this term.

Stictodiscus parallelus var. **balearica** Grunow.

Hustedt 1930, p. 470, fig. 261.

Area II: St. 38.

One single specimen of this rare form was observed in the 80—40 m sample from Station 38 off Cape Bojador.

Streptotheca thamesis Shrubsole.

Hustedt 1930, p. 779, fig. 455.

Area II: Sts. 32, 35, 36.
- III: St. 63.

Single specimens occurred in a few samples from the African coastal banks. Otherwise it was observed in two samples from Station 63 on the border of the Sargasso Sea.

Striatella unipunctata (Lyngbye) Agardh.

Hustedt 1931—37, p. 32, fig. 560.

Area II: Sts. 34, 35, 40.
- III: St. Fayal.

This littoral species was represented around the Canary Islands and at the Azores.

Surirella gemma Ehrenberg.

A. Schmidt, Atlas, pl. 24, fig. 26.

Area I: Pump sample 15/4.

One single specimen observed at Queenstown was classified as belonging to this species.

Synedra Gaillonii (Bory) Ehrenberg.

Hustedt 1931—37, p. 195, fig. 690.

Area I: Pump sample 15/4.

Two specimens were noticed in the pump sample from Queenstown (Ireland) together with *Suriella gemma*.

Synedra sp.

Area II: St. 34.
- III: St. 63.

Some defect specimens, not subjected to any further examination, were observed near the Canaries and on the border of the Sargasso Sea. They were recorded under this term.

Terpsinoë musica Ehrenberg.

Hustedt 1930, p. 898, fig. 540.

Area II: St. 35.

Single specimens of this rare species were found in two samples from Station 35 between the Canaries and Cape Bojador.

Thalassionema nitzschioides Grunow.

Figs. 15 and 16.

Hustedt 1931—37, p. 244, fig. 725.

Area I: Sts. 1—4, 5—10.
- II: Sts. 11, 12, Pump samples 22/4, 25/4, Sts. 18, 20, 31, 32, Pump sample 11/5, Sts. 34—39.
- III: Sts. 44, 54, 58, 59, 63, 68.
- IV: St. 80.
- V: Sts. 81a, 85, 87, 88, 92.

This widely distributed species was very common along the coastal banks from Ireland to Cape Bojador. It was not rare on the southern and northern Atlantic routes, and on the Newfoundland Banks it was also represented. But it was not recorded from the stations north of Ireland and off Shetland.

The habitus of the *Thalassionema*-colonies was rather variable. The cells sometimes were short and broad in girdle view, sometimes fairly long and slender. The longest ones were supposed to originate from auxospores.

After the completion of the tables the 200—100 m sample from Station 10 between Ireland and Spain was examined more closely, and two types of valves were found. The valves of the broad and short cells (21—42 µ long) had approximately linear outlines with slightly rounded edges (3—4 µ broad) and about 9—10 marginal spines in 10 µ (fig. 15a, b). In the long and slender cells (56—175 µ long) the sides of the valves were more or less distinctly protruded in the middle (fig. 15c). At the ends these valves were mostly about 2 µ broad with 12—13 marginal spines in 10 µ, in the middle they were about 3 µ broad and with 8—9 spines in 10 µ. (Fig. 15d shows a rare form, rather short and broad, but with sides slightly protruded in the middle and about 10 spines in 10 µ).

It might be suggested that the type c, originated from auxospores and that the type a, b represented minimum forms, the result of a long progression of cell division. In fact, however, the shorter cells are broader than the longer ones, not only having a longer pervalvar axis. Such an increase in breadth combined with a decrease in length has not as yet been observed in diatoms and does not agree with common opinion (cpr. Hustedt 1930, p. 101). Nor is there any successive straightening of the valve sides, such as might be expected when the type a, b would be the final one, even the shortest valves represented in the c-type diagram being distintly protruded in the middle.

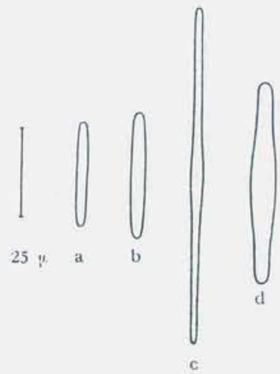

Fig. 15. *Thalassionema nitzschioides*. Outline of valves. St. 10. a. and b. short straight valves. c. long valve with sides protruding in the middle. d. rare form.

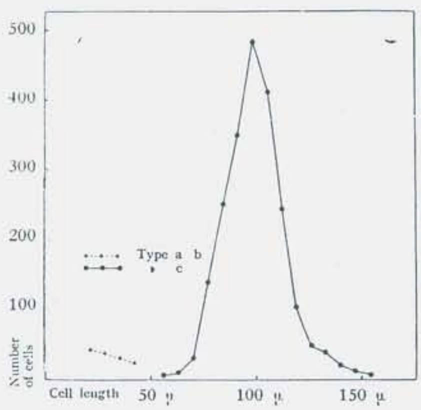

Fig. 16. Diagrams for the two valve types of *Thalassionema nitzschioides*. St. 10.

Measurements of the two forms, 2300 cells from the above mentioned sample being measured (fig. 16), do not prove that they represent taxonomical units, although they give some indications in this direction. Samples from several other stations also showed the two types of valves, but as these samples were not so well preserved, no further measurements have been carried out.

VAN HEURCK (1880—85) in pl. XXXVII, fig. 15 has illustrated a *Thalassiothrix Frauenfeldii* var. ?*tenella* Grunow from the Arctic, which HUSTEDT considers to be a *Thalassionema nitzschioides*. Possibly this type may be identical with the slender forms in the "Michael Sars" material. It is 119 μ long and recorded to have 13,5 spines in 10 μ.

Thalassiosira constricta(?) Gaarder.

Thalassiosira constricta, GAARDER 1938, p. 64, fig. 6.

Area I: Sts. 2—4, 7.

Among the chains of *Thalassiosira gravida* at four stations south of Ireland there occurred some chains which most probably belong to the species *T. constricta*. As these were never observed containing resting spores, however, they could not be classified with certainty. Auxospore-forming cells were rather common.

Diameter 21—24,5 μ.

Thalassiosira coronata n. sp.

Fig. 17.

Area I: Sts. 3, 4, 7—10.

From the region between Ireland and Spain *Thalassiosira*-chains were observed which did not agree with any descriptions of *Thalassiosira* species in the literature at hand. They are, therefore, referred to a new species, *Thalassiosira coronata*.

The chains consist of up to 14 cells connected by a thin, flaccid thread. The distance between the cells in the same chain varies between 7 and 14 μ. Maximum distance measured is 15 μ. Diameter of the cells: 9—35 μ, height: 12—26 μ. Height/diameter (h/d) varies from 3/8 to 2, for the majority of cells being close to 1.

The breadth of the girdle zone varies from 1/5 to 1/3 of the height of the cell. On each side there is a collar-like copula. The suture towards the valve is obscure, on the girdle side, however, rather evenly thickened. The valves are rounded at the edge, flat and with a distinct depression round the slime pore. At the slanting margin the valve is furnished with long (about 3 μ) spines, placed obliquely so the diameter of the outer part of the crown is about the same as or a little larger than that of the valve (fig. 17). The distance between the spines is 2—4 μ. Between the long spines a few shorter ones may occur, irregularly arranged. It is often difficult to distinguish the spines in cells with content.

In addition to the large central pore some smaller pores may be found scattered over the valve, also on the mantle

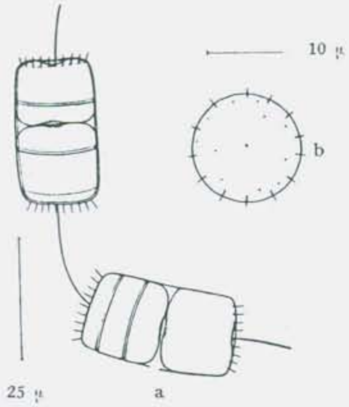

Fig. 17. *Thalassiosira coronata* n. sp. St. 7. a. girdle view of cells just divided. b. valve in Hyrax.

part. It is difficult to distinguish between pores and spines. Otherwise the valve seems quite smooth, even in Hyrax (fig. 17b).

The cromatophores are relatively large rounded discs.

The species looks a little like *T. decipiens* (Grunow) Jørgensen, but is distinguished from this species by the depression round the slime pore and in lacking the valve structure. It differs from *T. hispanica* Paulsen (1930, p. 7, fig. 1) in having 2 copulae only and a central thread, while *T. hispanica* has several copulae and is imbedded in mucilage. (Now and then chains of small cells of the present species may be packed together and imbedded in mucilage, but the central thread is then always visible). It may be distinguished from *T. constricta* Gaarder (1938, p. 64, fig. 6) by its long marginal spines and in never having the cells close together except immediately after cell division. It seems most closely related to *T. aestivalis* Gran (1931, p. 436, fig. 10), but this species has short marginal spines and a faint structure in the valve.

Thalassiosira decipiens (Grunow) Jørgensen.

HUSTEDT 1930, p. 322, fig. 158.

Area I: Sts. 3, 7—10.

This species was exclusively recorded from the area between Ireland an Spain.

Thalassiosira gravida Cleve.

Hustedt 1930, p. 325, fig. 161.

Area I: Sts. 3, 4, 7—10.
- IV: St. 76.

In the area between Ireland and Spain it was rather common. Otherwise it only occurred at one station on the Newfoundland Banks.

Thalassiosira minima n. sp.

Fig. 18.

Area I: Sts. 3, 10.

In samples from two stations in the region between Ireland and Spain a few chains of a very small *Thalassiosira* occurred, which it has been impossible to identify as one of the species described in the literature at hand. It is, therefore, like *T. coronata*, preliminarily treated as a separate species.

It has only been studied in water. The chains consist of up to 8 short cells combined by a thin flaccid central thread. The distance between the cells varies from 6 to 9 μ in the same chain. The longest distance measured is 18 μ (in cells with a diameter of 7 μ and a height of 3,5 μ). The diameter of the cells measured 7—14 μ and the height 3,5—6 μ. The proportion height/diameter (h/d) is mostly 1/2, min. 3/7, max. 3/4.

The valve is flat, rounded at the margin and with a slight depression round the slime pore. The girdle zone is low. In water neither copulae nor spines or valve structure could be distinguished. The chromatophores are relatively large irregular discs (fig. 18b).

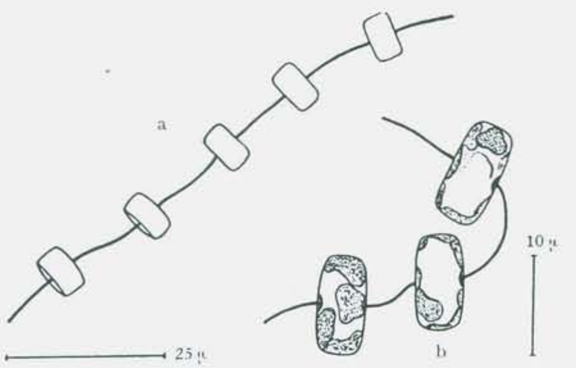

Fig. 18. *Thalassiosira minima* n. sp. St. 3. a. chain, girdle view. b. cells showing chromatophores and central valve depression.

Thalassiosira monile Cleve.

Fig. 19.

Thalassiosira monile, Cleve 1900, p. 1034, figs. 2—3.
?*Coscinodiscus moniliformis*, Pavillard 1930, p. 1, fig. 3.

Area I: St. 7.
- II: Sts. 20, 32, 36.
- IV: St. 80.
- V: Sts. 81a, 85, 87.

Scattered along the European-African coastal banks and on the western part of the northern Atlantic route there occurred colonies which have been referred to this species.

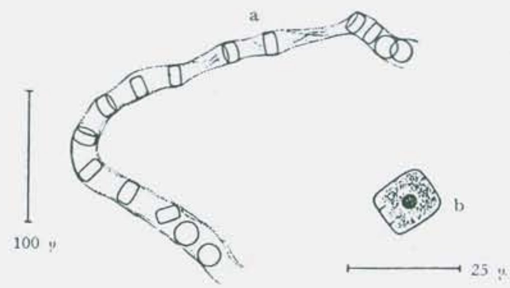

Fig. 19. *Thalassiosira monile*. St. 81a. a. cells in mucous cord. b. girdle view of cell showing nucleus.

No central thread is visible, the whole chain being imbedded in one mucous cord. This may be constricted between the cells as in Cleve's specimens from the Red Sea, but may also be of more equal breadth, as in fig. 19a.

The single cells are in agreement with Cleve's description and drawings. The valve has a structure similar to that of *Coscinodiscus excentricus*, but has a small central pore. In the "Michael Sars" specimens the marginal spines are scattered, about 2 in 10 μ. The girdle part seems smooth while on both sides one striped copula occurs, having 25 stripes in 10 μ. The nucleus is easily observed (fig. 19b).

Diameter 13—18 μ.

From the coast of Portugal Pavillard (1930) has described a *Coscinodiscus moniliformis*, which probably is identical with Cleve's species. The cells are also here imbedded in a mucous cord, more or less constricted and sometimes divided into sections with one cell in each. The structure is the same as in Cleve's cells, but Pavillard does not mention any central pore and assumes that the species belongs to *Coscinodiscus*.

Thalassiosira Nordenskioeldii Cleve.

Hustedt 1930, p. 321, fig. 157.

Area I: St. 3, Pump sample 15/4, St. 7.

This northern neritic species was sparsely represented in the area south of Ireland.

Thalassiosira rotula Meunier.

HUSTEDT 1930, p. 326, fig. 163.

Area I: St. 3.
- II: Pump sample 25/4.

A few cells of this species was recorded from Station 3 south of Ireland. Otherwise it was only observed in the pump sample from the Strait of Gibraltar.

Thalassiosira subtilis (Ostenfeld) Gran.

HUSTEDT 1930, p. 330, fig. 166.

Area I: Sts. 4, 7—10.
- II: Pump sample 25/4, Sts. 18, 22, 23, 27, 28, 31, 32, 34—36.
- III: Sts. 44, 49c—65.
- IV: St. 77.
- V: St. 81a.

This was the most common *Thalassiosira* species in the "Michael Sars" material. It was recorded from most of the stations along the European-African coast as well as on the southern Atlantic route. In addition it occurred on the Newfoundland Banks and at the first station on the northern Atlantic route.

Thalassiothrix Frauenfeldii Grunow.

HUSTEDT 1931—37, p. 247, fig. 727.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 18.
- III: Sts. 63, 64, 68.

This species was never recorded in any great numbers. It occurred frequently in the area between Ireland and Spain and more sparsely between the Azores and the Newfoundland Banks. Otherwise it was only observed in the Gibraltar Strait and at one Station on the north Atlantic route.

Thalassiothrix longissima Cleve and Grunow.

HUSTEDT 1931—37, p. 247, fig. 726.

Area I: Sts. 3, 7—10.
- II: Sts. 18, 31, 32, Pump sample 11/5.
- III: St. 63.
- IV: Sts. 76, 80.
- V: St. 83.

The species was fairly common in the area between Ireland and Spain, and it was also represented along the north-west African coast and at a few stations in the western part of the "Michael Sars" area. A considerable part of the specimens observed were totally deprived of marginal spines. Ribs 11—13 in 10 μ.

Thalassiothrix mediterranea Pavillard.

HUSTEDT 1931—37, p. 248, fig. 728.

Area I: Sts. 3, 4, 7—10.
- II: Sts. 11, 18, 20, 22, 23, 27, 28.

Specimens classified as belonging to this species were rather common in the area between Ireland and Spain and in the Spanish Bay. Transapical stripes 20—24 in 10 μ.

Triceratium alternans Bailey.

HUSTEDT 1930, p. 825, fig. 488.

Area I: St. 1.
- II: Sts. 18, 20, 27, 36—38.

One single specimen was noticed in the 40—0 m sample from Station 1 south of Ireland. Otherwise it occurred in the Spanish Bay, in the Gibraltar Strait and off Cape Bojador. But as distinct from the other *T.* species it was not represented in the Azore area.

Triceratium antediluvianum (Ehrenberg) Grunow.

Fig. 20.

HUSTEDT 1930, p. 810, fig. 472.

?*Triceratium oculatum*, GREVILLE 1864, p. 94, pl. XIII, fig. 20.
Amphitetras subrotundata, JANISCH ?, illustrated in A. SCHMIDT's Atlas, pl. 99, fig. 24.
(Non *Triceratium subrotundatum* A.S., illustrated in A. SCHMIDT's Atlas, pl. 93, fig. 1).
Triceratium atlanticum, CASTRACANE 1886, p. 111, pl. XVII, fig. 3.
?*Biddulphia parallela*, CASTRACANE 1886, p. 103, pl. XXIII, fig. 10 and pl. XXVI, fig. 7.
?*Triceratium oculatum* Greville (f. *Hillabyana*), illustrated by SLONCZEWSKI et J. BRUN in TEMPÈRE J.: Le Diatomiste, vol. II, 1893—96, pl. XXIV, fig. 19.
Biddulphia subjuncta, MANN 1907, p. 311, pl. XLVI, fig. 4.

Area III: Sts. Fayal, 59, 60.

This species exclusively occurred in the region around the Azores.

Only a few of the specimens conformed to the description given by HUSTEDT. He writes that the valves have: "stark konkaven, oft tief ausgerandeten, oft fast geraden Seiten". Fig. 20a shows the contour of one of the most concave valves in my samples, some having practically straight sides. Most of the cells had, however, slightly convex sides. In several *Triceratium* species the shape of the contour varies from concave to convex, so it does not seem unreasonable to refer also the convex specimens to *T. antediluvianum*. In general form and in valve structure there is no discordance.

The valve structure most closely conforms to the structure of *Biddulphia subjuncta* Mann (1907) from Galapagos, which according to my opinion ought to be referred to *Triceratium antediluvianum*. It has slightly concave sides. MANN writes: "My specimen is, on the whole, nearest to an unnamed figure of SCHMIDT's (Atlas pl. 99, f. 23)". He must, however, mean fig. 24 on the said plate, and this might as well have been drawn from one of my specimens, having also slightly convex sides. SCHMIDT names it *Amphitetras subrotundata* Janisch, and it originates from the Gazelle Expedition. No description of it is available. In MANN's broad list of references I find: JANISH, C. The Diatoms of the Gazelle Expedition. 22 pl. photographs, with manuscript index. Not published but distributed to several diatomists by the author. — I do not doubt that this species also ought to be referred to *Triceratium antediluvianum*.

MANN's figure gives a good impression of the protruding corners and the crater-formed protuberance in the middle of the valve, clearly noticeable in most of my specimens. The valvar pores at high level give the impression of being large and angular, at lower levels smaller and more rounded (cpr. fig. 20e). LIEBISCH (1928) was aware of this crater form (muldige Vertiefung) and has shown it clearly in his drawings.

CASTRACANE (1886) described a *Triceratium atlanticum* (b: 117 μ) observed near the Azores during the Challenger Expedition. It has slightly convex sides, blunt corners, each with its plate and a coarse structure, just like my specimens. In the illustration given the valve looks flat, but this does not seem probable. The rosette in the middle may be explained by the occurrence of a depression, so the pores are seen at high level. I have no doubt that *T. atlanticum* is identical with mine and consequently has to be referred to *T. antediluvianum*.

I find it probable that *T. oculatum* Greville (1864) (b: 18 μ) and *T. oculatum* Greville (f. *Hillabyana*) (b: 71 μ) in Le Diatomiste II (1893—96) also may be referred to this species.

The most conspicuous deviation in my specimens when compared with HUSTEDT's description was, however, that in most of them one or two of the four corners of each valve did not have the circle-round plate on the top. (I have never seen less than two plates on each valve). This deviation was only observed in specimens with convex sides, but this does not exclude the possibility that it may also occur in cells with concave sides. These were so scarce that there was less possibility of observing any deviation in them.

A few specimens (b: 65—98 μ) had 3 normal corners, the fourth lacking plate, protruding less than the others and being covered all over with the regular pore structure

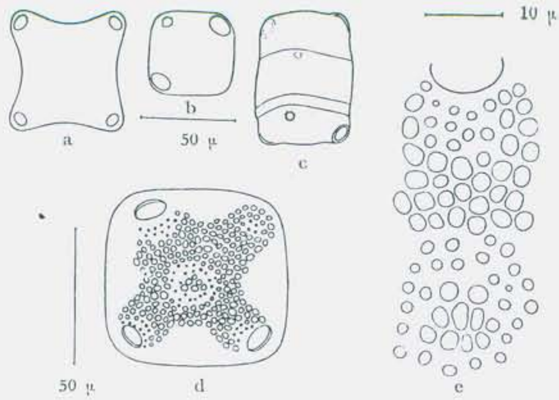

Fig. 20. *Triceratium antediluvianum*. a. valve with concave sides. St. 59. b. upper valve of c. both valves with 2 complete top plates and an initial third one. d. valve with 3 top plates. e. central part part and one corner of d. seen at low level. St. Fayal.

(fig. 20d). The two corners without plates, one on each valve, were situated above each other, but this may not be the rule.

Specimens with 3 plates on one valve and two on the other were more frequent (b: about 45 μ). In two connected cells the two valves in the middle had 3 plates, while the outer valves had 2. The third plate was often poorly developed, being represented by a circular smooth field on top of the corner (fig. 20c) or being more or less irregular (fig. 20b).

Cells with only 2 plates on each valve were, however, most common (b: 33—56 μ). On each valve the plates were placed diagonally. The two plates of each valve were sometimes located in the same plane, but more often in crossing planes.

In these specimens all the plateless corners were lower and less protruding than the others, and the rows of pores formed arcs round the peak. The crater form of the central part was clearly to be seen in all valves.

There seems to be a tendency towards increased reduction in the number of plates with decreasing diameter, but the material is too scanty for giving any conclusive proof that this is a rule.

CASTRACANE (1886) has illustrated a couple of specimens from the Sea of Japan reminding of mine. He names them *Biddulphia parallela* (b: 70—100 μ) and remarks that they may belong to the section *Amphitetras*. He has no picture showing them in valvar view and the matter does not seem settled; but I may be allowed to point out that there is a possibility that they represent specimens of *T.*

antediluvianum, having two corners on each valve reduced, perhaps a little further than in my specimens. The obliquity, mentioned in the description, may then be explained by the normal corners being placed in crossed planes in the cell.

The puncturing indicated in one of the plates of CASTRACANE's last mentioned figure, which is also mentioned by VAN HEURCK (1880—85, p. 207) in the description of *T. antediluvianum* and drawn very clearly in *T. oculatum* (f. *Hillabyana*), I have only observed in one specimen having plates on all 4 corners. The puntures were extremely fine and did not form regular rows.

(HUSTEDT records *B. parallela* as a synonym to his *B. aurita* var. *obtusa*. He also includes *B. Roperiana* Greville and *B. obtusa* (Kützing) Ralfs. My specimens, when seen in girdle view, show great similarity to VAN HEURCK's sketches of *B. Roperiana* (1880—85, pl. 99, figs. 4,5) which he says may be a form of *B. obtusa* with coarse pores. In fig. 6 of the same plate, showing a 3rd specimen in valvar view, central spines are, however, indicated while according to BOYER's monography (1900, p. 700) central spines are lacking in *B. obtusa*. It does not seem impossible to imagine a connection between highly reduced forms of *T. antediluvianum* and some of the forms included in HUSTEDT's highly variable "variety".)

Triceratium formosum Brightwell.

HUSTEDT 1930, p. 819, fig. 481.

Area II: Sts. 18, 19.
- III: Sts. Fayal, 59.

One single specimen was recorded from Gibraltar. At the Mediterranean and Azore Stations it occurred a little more frequently.

Triceratium pentacrinus f. quadrata (Shadbolt) Hustedt.

HUSTEDT 1930, p. 814, fig. 475.

Area II: St. 35.
- III: Sts. Fayal, 59.

One specimen occurred in the 500—200 m sample from Station 35 south of the Canaries, a few more at the Azore Stations.

Triceratium Shadboltianum Greville.

HUSTEDT 1930, p. 807, fig. 470.

Area II: St. 35.
- III: St. Fayal.

In the 100—0 m sample from the Canary station 35, one specimen was noticed. Otherwise it occurred together with *T. antediluvianum*, *T. formosum*, and *T. pentacrinus* f. *quadrata* at the Azore station Fayal.

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Table I.

The coast banks of North Europe. (April 9th—20th).

Date and position of the stations are given on p. 3. O singly, × present, ● abundant.

Station	1				2	3					4	15/4	5	7			9	10					
Depth in metres	140—77	140—79	80—40	40—0	*15—0	160—80	*160—110	80—40	40—0	*180—110	50—0	Pump sample	50—0	20—0	50—20	100—45	50—0	500—200	200—100	250—150	100	100—0	1000—500
Actinocyclus Ehrenbergii	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	×
Actinoptychus undulatus	—	—	×	×	O	O	—	—	—	×	—	—	×	×	—	—	—	×	×	×	×	×	×
Asterionella japonica	—	—	—	—	—	×	×	×	×	—	—	×	—	—	—	—	—	—	×	×	—	—	×
Asteromphalus flabellatus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	O	O
— *heptactis*	—	—	—	—	—	×	×	×	×	×	×	—	—	×	×	×	×	×	×	×	—	×	×
Bacteriastrum comosum	—	—	—	—	—	×	—	×	×	—	×	—	—	×	×	×	×	×	×	—	—	×	—
— *delicatulum*	—	—	—	—	—	×	—	—	—	—	—	—	—	×	×	—	—	×	—	—	×	—	—
— *elegans*	—	—	—	—	—	×	—	—	×	—	×	—	—	×	× a. sp.	× a. sp.	× a. sp.	×	×	×	—	×	—
— *elongatum*	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	×	×	—	—	—	—	—	—
— *hyalinum*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	—
— spp.	—	—	—	—	—	—	O	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×
Biddulphia aurita	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—
— — var. *minima*	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *mobiliensis*	×	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *regia*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
Cerataulina Bergonii	—	—	—	—	—	×	—	×	×	—	×	×	—	×	×	×	×	—	—	—	—	—	—
Chaetoceros affinis	—	—	O	—	—	×	×	×	×	×	×	—	—	×	×	×	×	×	×	×	×	×	×
— — var. *Willei*	—	—	—	—	—	×	×	×	×	×	×	—	—	×	×	×	×	×	×	×	×	×	×
— *atlanticus*	—	—	—	—	—	×	—	×	×	—	×	—	—	×	×	×	—	—	—	—	—	—	—
— — var. *neapolitana*	—	—	—	—	—	×	—	×	—	—	×	—	—	×	×	×	×	×	×	×	—	—	—
— — var. *skeleton*	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *borealis* f. *concavicornis*	—	×	×	×	×	×	—	—	×	—	×	—	—	—	×	—	—	×	—	—	—	—	—
— — f. *typica*	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—
— *brevis*	—	—	—	—	—	×	—	×	×	—	×	—	—	×	×	—	×	—	—	—	—	—	—
— *cinctus*	—	—	—	—	—	× sp.	× sp	×	×	—	×	×	—	×	×	×	×	O	×	×	—	×	—
— *compressus*	—	—	—	—	—	× sp.	× sp.	× sp.	×	×	×	●	—	×	×	×	×	O	×	×	×	×	×
— *constrictus*	—	—	—	—	—	×	—	×	×	×	×	—	—	× sp.	× sp.	× sp.	×	×	×	×	×	×	×
— *convolutus*	×	×	×	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×
— *curvisetus*	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	O	×	×	× sp.	× sp.	×
— *danicus*	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—
— *debilis*	—	—	—	—	—	—	—	—	—	—	—	●	—	—	—	—	—	—	×	×	×	×	—
— *decipiens*	—	—	O	O	—	× m. sp.	×	×	×	×	×	×	O	×	×	×	×	×	×	×	×	×	×
— *densus*	—	—	—	—	—	×	—	×	—	×		×	—	×	×	×	×	—	—	×	—	—	—

Table I. (Cont.)

Station	1				2	3					4	15/4	5	7			9	10					
Depth in metres	140—77	140-79	80—40	40—0	*15—0	160—80	*160—110	80—40	40—0	*180—110	50—0	Pump sample	50—0	20—0	50—20	100—45	50—0	500—200	200—100	250—150	100	100—0	1000—500
Chaetoceros didymus	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	×	×	×	×	×	×
— — var. *anglica*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	×	—
— *furcellatus*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *laciniosus*	—	—	—	—	—	×	—	—	—	—	×	×	—	×	×	—	×	×	×	×	×	×	×
— *Lorenzianus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—
— *Pavillardii*	—	—	—	—	—	× sp.	—	× sp.	× sp.	—	×	—	—	×	× sp.	—	—	—	—	—	—	—	—
— *pelagicus*	—	—	—	—	—	×	—	×	×	—	×	—	—	×	×	×	×	—	—	×	×	×	×
— *peruvianus* f. *gracilis*	—	—	—	—	—	×	—	—	—	—	—	—	—	×	×	×	×	×	×	—	—	—	—
— *radicans*	—	—	—	—	—	—	—	—	×	—	×	—	—	×	×	×	×	—	—	—	—	—	—
— *teres*	—	—	—	—	—	× sp.	× sp.	× sp.	× sp.	—	× sp.	×	—	× sp.	× sp.	×	× sp.	× sp.	×	×	×	×	×
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—
Cocconeis sp.	×	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
Corethron hystrix	—	O	×	×	O	×	—	×	×	—	×	×	—	×	×	—	×	—	×	—	—	×	—
Coscinodiscus centralis	O	—	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	×
— *concinnus*	—	—	—	—	—	—	×	O	×	×	—	×	—	—	—	×	×	—	O	—	—	—	—
— *curvatulus*	—	—	—	—	—	—	—	—	—	—	×	—	—	×	×	—	—	—	—	—	—	O	×
— *excentricus*	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
— — var. *fasciculata*	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—
— *Granii*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	O	—	O	—	—
— *lineatus*	—	—	—	—	×	O	×	—	×	×	×	—	—	×	×	×	×	×	—	×	×	—	×
— *radiatus*	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
— sp.	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coscinosira Oestrupii	—	—	—	—	—	—	—	×	—	—	×	—	—	×	×	×	×	×	×	×	—	×	—
— *polychorda*	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dactyliosolen antarcticus	—	—	—	—	—	×	×	×	×	×	×	—	—	×	×	O	×	—	—	—	—	—	—
— *mediterraneus*	—	—	—	—	—	×	—	×	×	—	×	—	—	×	×	×	×	×	×	×	×	×	×
Ditylum Brightwellii	—	—	—	—	—	×	—	×	—	—	—	×	—	—	—	—	—	●	×	×	×	×	×
— — f. *tetragona*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	×	×
Eucampia zoodiacus	—	—	—	—	—	×	—	—	—	—	×	×	—	×	×	—	×	—	—	—	—	—	—
Hemidiscus cuneiformis	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	O	—	—	—	—	—	—
— — var. *ventricosa*	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	O	×	×
Lauderia borealis	—	—	—	—	—	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×
Leptocylindrus danicus	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	O	—	×	—
Melosira sulcata	×	×	×	×	×	×	×	—	—	×	—	×	×	—	—	—	—	×	—	—	×	—	—
Nitzschia closterium	—	—	×	×	×	×	×	×	×	—	×	—	—	×	—	×	—	—	—	—	—	×	—
— *delicatissima*	—	—	—	—	●	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	—
— *seriata*	—	—	—	—	—	×	—	×	×	×	×	—	—	×	×	×	×	×	×	×	×	×	—
Planktoniella sol	—	—	—	—	—	×	×	—	×	—	O	—	—	—	× in. s.	—	×	×	×	×	×	×	×

Table I. (Cont.)

Station	1				2	3					4	15/4	5	7			9	10					
Depth in metres	140—77	140—79	80—40	40–0	*15—0	160—80	*160—110	80—40	40—0	*180–110	50—0	Pump sample	50–0	20—0	50–20	100–45	50–0	500–200	200—100	250–150	100	100—0	1000—500
Pleurosigma spp.	×	O	×	×	×	×	×	×	×	—	×	×	×	—	×	×	—	×	—	—	×	—	—
Podosira stelliger	×	●	×	×	×	×	×	O	—	×	—	×	×	—	—	—	—	—	—	—	×	—	O
Rhabdonema arcuatum	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—
Rhizosolenia acuminata	—	—	—	—	—	—	×	×	×	×	×	—	—	—	×	×	×	×	×	—	×	—	×
— *alata*	×	×	×	×	—	×	×	×	×	×	×	—	—	×	×	×	×	×	×	×	—	×	×
— — f. *curvirostris*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
— — f. *gracillima*	—	—	—	—	—	×	×	×	×	×	×	—	—	× a. sp.	× a. sp.	× a. sp.	× a. sp.	—	×	×	—	×	×
— *Bergonii*	—	—	—	—	—	×	×	×	×	×	×	—	—	×	×	×	×	×	×	×	×	×	×
— — f. *bidens*	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—
— *fragilissima*	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—
— *hebetata* f. *semispina*	×	×	×	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×
— — f. *bidens*(?)	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *imbricata* var. *Shrubsolei*	—	—	—	—	—	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×
— *robusta*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—
— *setigera*	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
— *Stolterfothii*	—	—	—	—	—	×	—	×	×	—	×	—	—	×	×	×	×	—	—	—	—	×	—
— *styliformis*	×	—	×	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×
— — var. *longispina*	×	—	×	×	×	× a. sp.	×	×	×	×	×	×	—	×	×	×	×	×	×	—	×	×	—
Roperia tessellata	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	×	O
Sceletonema costatum	—	—	—	—	×	×	—	×	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—
Surirella gemma	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—
Synedra Gaillonii	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—
Thalassionema nitzschioides	—	×	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×
Thalassiosira constricta (?)	—	—	—	—	×	× a. sp.	×	× a. sp.	× a. sp.	—	× a. sp.	—	—	× a. sp.	—	—	—	—	—	—		—	—
— *coronata*	—	—	—	—	—	—	—	×	×	×	×	—	—	×	O	—	×	—	—	—	—	—	×
— *decipiens*	—	—	—	—	—	×	×	×	×	×	—	—	—	×	O	—	×	—	—	×	—	—	—
— *gravida*	—	—	—	—	—	×	×	×	×	×	×	—	—	×	×	×	×	—	×	—	—	O	—
— *minima*	—	—	—	—	—	×	—	×	×	—	—	—	—	—	—	—	—	—	×	—	—	—	—
— *monile*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
— *Nordenskioeldii*	—	—	—	—	—	—	—	×	×	—	—	×	—	O	—	—	—	—	—	—	—	—	—
— *rotula*	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *subtilis*	—	—	—	—	—	—	—	—	—	—	×	—	—	×	×	×	×	×	×	—	—	—	—
Thalassiothrix Frauenfeldii	—	—	—	—	—	×	—	×	×	×	×	—	—	×	×	×	×	×	×	×	×	×	×
— *longissima*	—	—	—	—	—	×	—	×	×	×	—	—	—	—	×	—	×	×	×	×	—	×	—
— *mediterranea*	—	—	—	—	—	×	×	×	×	×	×	—	—	×	×	×	×	—	×	—	—	×	—
Triceratium alternans	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table II.

The coast banks of South Europe

Date and position of the stations are given

Station	11	12	13		22/4	25/4	18				19				20		5/5	22				23			25		
Depth in metres	50 – 0	50 – 0	75 – 40	40 – 0	Pump sample	Pump sample	350 – 200	200 – 100	100 – 50	*50 – 0	200 – 0	400 – 200	*100 – 50	50 – 0	130 – 80	80 – 0	Pump sample	500 – 200	200 – 100	100 – 50	50 – 0	200 – 100	100 – 50	50 – 0	100 – 50	50 – 0	200 – 100
Actinocyclus Ehrenbergii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
— *tenuissimus*	—	—	—	—	—	—	—	—	—	—	O	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—
Actinoptychus splendens	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *undulatus*	×	—	—	—	—	—	O	×	×	O	×	×	×	—	—	—	—	O	—	—	—	—	—	—	—	—	—
Asterionella japonica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *notata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Asteromphalus flabellatus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *heptactis*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
— *robustus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bacteriastrum comosum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—
— *elegans*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	×	×	—	—	—	—	—	—
— *hyalinum*	—	—	—	—	×	×	—	×	×	—	—	—	—	—	×	×	—	×	×	—	—	—	—	—	—	—	—
— spp.	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	×	—
Biddulphia mobiliensis	—	—	—	—	×	×	×	×	×	—	×	×	—	—	×	×	—	O	—	—	—	—	—	—	—	—	—
— *pulchella*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *regia*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cerataulina Bergonii	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	×	—	—	O	×	×	×	×	×	—	—	—
Cerataulus Smithii	—	—	—	—	—	—	—	—	O	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chaetoceros affinis	×	—	—	—	—	—	—	×	×	—	—	—	—	—	×	×	—	—	—	×	×	×	×	—	—	×	—
— — var. *Willei*	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	×	×	—	×	×	—	—	—
— *anastomosans*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	×	×	—	—	—
— *atlanticus* var. *neapolitana*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	O	×	×	—	—	—	—	—	—
— *borealis* f. *concavicornis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	×	×	O	×	×
— — f. *typica*	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
— *brevis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—
— *cinctus*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *compressus*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	×	×	×	—	—	×	×	×	×	×	—	—	—
— *constrictus*	×	—	—	—	×	—	—	× sp.	—	—	—	—	—	—	×	×	—	—	—	—	×	—	×	—	—	—	—
— *convolutus*	×	—	—	—	—	—	—	—	—	×	—	×	—	×	—	—	—	×	—	×	—	—	—	—	—	—	—
— *costatus*	—	—	—	—	—	× sp.	—	—	—	—	—	—	—	—	—	×	—	—	—	×	×	×	×	×	—	—	—
— *curvisetus*	× sp.	—	—	—	×	× sp.	× sp.	× sp.	× sp.	—	×	× sp.	—	—	×	×	×	—	×	—	×	×	×	—	—	—	—
— *Dadayi*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—
— *debilis*	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *decipiens*	×	×	—	×	×	×	×	×	×	—	×	×	—	×	×	×	×	×	×	×	×	×	×	×	—	×	—
— *densus*	×	—	—	—	—	—	—	×	—	—	—	—	—	—	×	×	—	—	—	—	—	—	×	—	—	—	—
— *diadema*	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *didymus*	×	×	—	×	×	×	×	× sp.	×	—	—	—	—	—	×	×	—	×	×	×	×	×	×	×	—	—	—
— — var. *anglica*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
— *imbricatus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—
— *laciniosus*	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Lorenzianus*	—	×	—	—	—	—	—	×	×	—	—	—	—	×	×	×	—	×	×	×	×	×	×	×	—	—	×
— *messanensis*	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	×	—	—	—	×	×	×	×	×	—	—	—
— *pelagicus*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *peruvianus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
— *pseudocurvisetus*	—	—	—	—	×	×	×	× sp.	× sp.	—	×	×	—	×	×	×	—	×	×	×	×	×	×	×	—	—	—
— *radicans*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *rostratus*	—	—	—	—	—	O	×	×	×	—	—	—	—	—	×	×	—	×	×	×	×	—	×	×	—	×	—

in s. = in salpae, sp. = resting spores.

urope
given

and North Africa. (April 21st—May 22nd).
on pp. 3 and 4. O singly, × present, ● abundant.

5	8/5	27			28			29	30	31	32	11/5	34				35			36	37		38		39		40			Station
200—100	Pump sample	200 - 100	100—50	50 - 0	200—0	500—200	100 - 0	100—0	200 - 0	180—0	100—0	Pump sample	50—0	100—50	200—100	500—200	100—0	200—100	500 - 200	40—0	•20 - 0	40 - 5	80—40	40—0	220—100	100—0	100—0	200—100	1000—200	Depth in metres
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	O	—	—	—	—	O	—	—	—	—	*Actinocyclus Ehrenbergii*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	×	— *tenuissimus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	*Actinoptychus splendens*
—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	O	—	—	—	—	×	×	×	×	—	—	—	—	O	—	— *undulatus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*Asterionella japonica*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	— *notata*
—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	× in s.	—	—	—	*Asteromphalus flabellatus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *heptactis*
—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *robustus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Bacteriastrum comosum*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *elegans*
—	—	—	—	×	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	— *hyalinum*
—	—	—	—	—	×	—	×	—	—	—	—	—	—	×	—	—	×	—	—	—	—	×	—	—	—	×	—	—	—	— spp.
—	—	—	—	—	—	—	—	—	—	—	×	O	—	—	—	—	—	—	O	×	×	—	×	×	O	—	—	—	—	*Biddulphia mobiliensis*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	O	—	×	—	—	—	O	— *pulchella*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	— *regia*
—	—	—	—	—	×	—	—	—	—	—	×	×	—	—	×	—	—	—	—	O	—	O	×	×	—	—	—	—	—	*Cerataulina Bergonii*
—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	*Cerataulus Smithii*
—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	*Chaetoceros affinis*
—	—	—	—	—	×	—	×	—	—	×	×	—	—	—	—	—	×	×	—	—	—	—	—	×	×	—	—	—	—	— — var. *Willei*
—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	— *anastomosans*
—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *atlanticus* var. *neapolitana*
×	—	—	—	×	×	—	×	—	—	×	—	—	O	×	×	—	×	×	×	—	—	—	—	—	×	×	×	×	—	— *borealis* f. *concavicornis*
—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— — f. *typica*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *brevis*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	×	—	—	—	—	—	— *cinctus*
—	—	—	—	—	×	—	×	—	—	—	×	—	—	—	×	—	×	×	—	×	×	×	×	×	—	×	—	—	—	— *compressus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	× sp.	×	×	× sp.	×	—	—	—	—	—	— *constrictus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	O	×	×	×	—	—	—	— *convolutus*
—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	×	×	—	×	—	—	—	×	—	—	—	—	—	— *costatus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	×	—	—	—	—	—	— *curvisetus*
—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *Dadayi*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *debilis*
—	—	×	—	—	×	—	×	—	—	—	—	—	—	—	—	—	×	×	×	×	×	×	×	×	—	×	—	—	—	— *decipiens*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *densus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—	—	—	— *diadema*
—	—	—	—	—	×	—	×	—	—	—	×	—	—	—	—	—	×	—	—	×	×	—	×	×	O	—	—	—	—	— *didymus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	— — var. *anglica*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	×	—	—	—	—	—	—	— *imbricatus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *laciniosus*
×	—	×	—	×	×	—	×	—	—	×	×	—	—	×	×	—	×	×	×	×	—	—	×	×	×	×	—	—	—	— *Lorenzianus*
—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	— *messanensis*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	— *pelagicus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *peruvianus*
—	×	O	—	—	×	—	×	—	—	—	×	×	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—	—	—	— *pseudocurvisetus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	×	×	—	—	—	—	—	— *radicans*
—	—	—	—	—	×	—	×	—	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	— *rostratus*

Table II. (Cont.)

Station	11	12	13		22/4	25/4	18				19				20		5/5	22				23			25		
Depth in metres	50 - 0	50 - 0	75—40	40—0	Pump sample	Pump sample	350—200	200—100	100—50	•50—0	200—0	400 - 200	•100 - 50	50—0	130—80	80 0	Pump sample	500—200	200 - 100	100 - 50	50—0	200 100	100—50	50—0	100—50	50 - 0	200 - 100
Chaetoceros seiracanthus	—	—	—	—	—	—	—	× sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *teres*	×	—	—	—	×	×	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	×	×	×	—	—	—
— *tetrastichon*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—
Climacodium Frauenfeldianum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cocconeis sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Corethron hystrix	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Coscinodiscus centralis	×	—	—	—	×	—	—	×	×	—	—	—	—	—	O	—	—	O	—	—	O	—	—	O	—	—	O
— *concinnus*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—
— *curvatulus*	—	—	—	—	—	—	—	—	—	—	—	—	O	×	×	—	—	—	—	O	O	×	—	—	—	—	—
— *divisus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *excentricus*	—	×	—	—	—	—	×	×	×	—	O	O	O	—	×	O	—	×	—	—	—	—	—	O	—	—	O
— *gigas*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Granii*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *lineatus*	—	—	—	—	—	—	—	O	—	—	—	O	—	—	O	O	—	—	—	—	—	O	—	—	—	—	×
— *nodulifer*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
— *oculus iridis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *radiatus*	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	O	—	×	O	—	—	×	—	—	—	×
Coscinosira polychorda	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dactyliosolen mediterraneus	×	—	—	—	—	×	—	—	—	—	—	—	—	—	×	×	—	×	×	×	×	×	×	×	—	×	—
Ditylum Brightwellii	×	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — f. *pentagona*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — f. *tetragona*	×	×	—	—	×	—	×	×	×	—	×	O	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
Eucampia cornuta	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—
— *zoodiacus*	—	×	—	×	×	×	—	×	×	—	×	—	—	—	—	×	—	—	×	—	—	×	×	×	—	—	—
Gossleriella tropica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
Grammatophora longissima	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *marina*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— sp.	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guinardia flaccida	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hemiaulus Hauckii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
— *sinensis*	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—
Hemidiscus cuneiformis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	×	—	—
— — var. *ventricosa*	—	—	—	—	—	—	×	×	×	×	×	×	×	—	×	×	—	×	×	—	×	×	×	×	×	×	×
Lauderia borealis	×	—	—	—	×	×	—	—	—	—	—	—	—	—	×	×	—	—	—	—	×	—	×	—	—	—	—
Leptocylindrus danicus	—	×	—	×	—	×	—	—	—	—	—	—	—	—	×	×	—	—	—	—	×	—	—	—	—	—	—
— *minimus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Licmophora sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lithodesmium undulatum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Melosira sulcata	—	×	—	×	×	×	—	×	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—
Nitszchia closterium	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—
— *delicatissima*	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	×	—	—	—	×	×	—	—	—	—	—	—
— *paradoxa*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *seriata*	×	—	—	×	×	×	—	×	×	—	—	—	—	—	×	×	—	—	—	×	×	×	×	×	—	—	—
Planktoniella sol	×	—	—	O	—	—	—	—	—	O	×	×	—	—	—	—	—	—	×	—	—	—	O	—	—	—	—
Pleurosigma spp.	×	—	—	—	—	×	—	—	O	O	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
Podosira hormoides	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *stelliger*	—	×	—	—	—	—	O	×	×	—	O	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—
Rhabdonema adriaticum	—	—	—	—	—	×	—	O	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhizosolenia acuminata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	O	—
— *alata*	×	—	—	×	—	×	×	×	×	×	×	—	—	×	×	×	●	×	×	×	×	×	×	×	×	×	×

sp. = resting spores.

200-100	8/3	27			28			29	30	31	32	11/3	34				35			36	37		38		39		40			Station
	Pump sample	200-100	100-50	50-0	200-0	500-200	100-0	100-0	200-0	180-0	100-0	Pump sample	50-0	100-50	200-100	500-200	100-0	200-100	500-200	40-0	*20-0	40-5	80-40	40-0	220-100	100-0	100-0	200-100	1000-200	Depth in metres
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Chaetoceros seiracanthus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	O	—	—	—	—	—	—	— *teres*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *tetrastichon*
—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— sp.
—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Climacodium Frauenfeldianum*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	*Cocconeis* sp.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	*Corethron hystrix*
O	—	—	—	—	O	×	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Coscinodiscus centralis*
—	—	—	—	O	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *concinnus*
—	—	—	O	—	—	O	—	O	×	—	—	—	—	×	×	×	—	×	—	×	O	O	—	—	—	—	O	×	—	— *curvatulus*
—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	O	—	—	O	—	—	—	—	—	—	O	—	—	×	— *divisus*
O	—	—	—	O	—	O	—	—	O	O	O	—	—	—	O	O	—	×	×	×	×	×	×	×	×	O	O	O	×	— *excentricus*
—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *gigas*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *Granii*
×	—	—	—	—	—	—	—	×	×	×	—	—	O	O	×	—	—	×	O	—	—	—	—	O	×	×	—	×	O	— *lineatus*
—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *nodulifer*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	O	—	—	—	—	—	—	—	— *oculus iridis*
×	—	×	×	O	×	—	O	—	×	×	×	O	—	O	O	O	O	×	×	×	×	×	×	×	×	×	×	×	×	— *radiatus*
—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*Coscinosira polychorda*
—	—	×	—	×	×	×	×	—	—	—	×	—	—	×	×	×	×	×	×	—	—	—	—	—	×	—	—	×	×	*Dactyliosolen mediterraneus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Ditylum Brightwellii*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— — f. *pentagona*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— — f. *tetragona*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Eucampia cornuta*
—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	×	×	×	—	×	—	—	—	—	—	— *zoodiacus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Gossleriella tropica*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	O	—	—	—	—	—	—	*Grammatophora longissima*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	— *marina*
—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— sp.
—	—	—	—	—	×	—	O	—	—	—	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	*Guinardia flaccida*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	*Hemiaulus Hauckii*
—	—	—	—	×	×	—	×	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	— *sinensis*
—	—	—	—	—	×	×	—	—	×	O	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Hemidiscus cuneiformis*
×	×	O	—	×	—	×	×	×	×	×	×	—	O	—	O	×	—	×	×	—	—	—	—	—	×	O	O	×	×	— — var. *ventricosa*
—	—	—	—	—	—	—	—	—	—	—	×	●	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—	—	—	*Lauderia borealis*
—	—	—	—	—	×	—	×	—	—	—	×	×	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—	—	—	*Leptocylindrus danicus*
—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	O	—	—	—	—	—	—	—	—	O	—	—	—	— *minimus*
—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	O	—	—	O	—	×	—	—	O	×	—	—	*Licmophora* sp.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	O	—	—	—	—	—	—	*Lithodesmium undulatum*
—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	×	—	×	×	×	—	—	—	×	×	*Melosira sulcata*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	*Nitzschia closterium*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	— *delicatissima*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	— *paradoxa*
—	—	—	—	—	×	—	—	—	—	—	×	×	—	—	—	—	—	—	—	×	×	×	×	×	—	O	—	—	—	— *seriata*
—	—	×	—	—	—	—	O	×	×	—	O	—	—	—	×	O	—	—	×	—	—	—	—	—	O	—	O	×	×	*Planktoniella sol*
—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—	—	—	*Pleurosigma* spp.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Podosira hormoides*
—	—	—	—	×	—	—	O	—	—	—	O	—	—	—	—	—	—	—	×	×	×	×	×	×	×	—	—	—	×	— *stelliger*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	O	×	—	—	—	—	—	—	×	*Rhabdonema adriaticum*
—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Rhizosolenia acuminata*
×	—	×	×	—	●	×	●	×	—	—	×	×	—	×	×	×	●	×	×	×	×	×	×	×	×	●	●	×	—	— *alata*

Table II. (Cont.)

Station	11	12	13		22/4	25/4	18				19				20		5/5	22				23			25		
Depth in metres	50—0	50—0	75—40	40—0	Pump sample	Pump sample	350—200	200—100	100—50	*50—0	200—0	400—200	*100—50	50—0	130—80	80—0	Pump sample	500—200	200—100	100—50	50—0	200—100	100—50	50—0	100—50	50—0	200—100
Rhizosolenia alata f. *gracillima*	—	—	—	—	—	×	×	×	×	×	×	×	—	×	×	× a. sp.	×	×	×	× a. sp.	×	×	×	×	×	×	—
— — f. *indica*	—	—	—	—	—	—	—	—	—	—	×	×	—	×	×	×	—	—	—	—	×	×	×	×	—	—	—
— *Bergonii*	×	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	×	×	—	×	×	—	—	—	—
— *calcar avis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Castracanei*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	—	O	—
— *delicatula*	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	×	×	—	×	×	—	—	—
— *hebetata* f. *semispina*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	×
— *imbricata* var. *Shrubsolei*	×	×	—	×	×	×	—	×	—	—	—	—	—	—	—	×	—	—	×	×	×	×	×	×	×	—	×
— *robusta*	—	—	—	—	—	O	O	×	×	—	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—
— *setigera*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
— *Stolterfothii*	×	—	—	×	—	×	—	×	×	—	—	—	—	—	—	×	—	×	—	×	×	×	×	×	—	—	—
— *styliformis*	×	—	—	—	—	×	×	—	×	×	×	×	—	—	—	×	×	×	×	×	×	×	×	×	—	—	—
— — var. *latissima*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	×	—	—	—	—	—	—	—
— — var. *longispina*	×	×	—	—	—	×	×	×	×	×	×	—	—	×	×	×	×	×	×	×	×	×	×	×	—	—	—
Roperia tessellata	×	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—
Sceletonema costatum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Schroederella delicatula	—	×	×	●	●	×	×	×	×	×	×	—	—	—	×	×	×	—	×	×	×	×	×	×	—	—	—
Stephanopyxis Palmeriana	—	—	—	—	×	—	×	—	×	—	—	—	—	—	—	×	—	×	O	—	—	×	×	×	—	—	O
— *turris*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stictodiscus parallelus var. *balearica*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Streptotheca thamesis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Striatella unipunctata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Synedra sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Terpsinoë musica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thalassionema nitzschioides	×	×	—	—	×	×	×	×	×	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
Thalassiosira monile	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
— *rotula*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *subtilis*	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	×	×	—	×	×	—	—	—	—
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thalassiothrix Frauenfeldii	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *longissima*	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *mediterranea*	×	—	—	—	—	—	—	O	—	—	—	—	—	—	×	×	—	—	—	×	×	×	×	×	—	—	—
Triceratium alternans	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
— *formosum*	—	—	—	—	—	—	O	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pentacrinus* f. *quadrata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Shadboltianum*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. sp. = auxospores, in s. = in salpae.

Station	25		8/5	27			28			29	30	31	32	11/5	34				35			36	37		38		39		40		
Depth in metres	50—0	200—100	Pump sample	200—100	100—50	50—0	200—0	500—200	100—0	100—0	200—0	180—0	100—0	Pump sample	50—0	100—50	200—100	500—200	100—0	200—100	500—200	40—0	*20—0	40—5	80—40	40—0	220—100	100—0	100—0	200—100	1000—200
Rhizosolenia alata f. *gracilli*	×	—	×	×	—	×	●	×	×	×	×	×	×	×	—	×	×	—	● a. sp.	× a. sp.	×	×	×	—	—	—	×	×	●	—	—
— — f. *indica*	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	×	—	—	—	×	×	×	●	—	—
— *Bergonii*	—	—	—	×	O	—	—	—	—	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	O	—
— *calcar avis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Castracanei*	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *delicatula*	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *hebetata* f. *semispina*	—	×	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *imbricata* var. *Shrubs*	—	×	—	×	×	—	×	—	×	O	×	×	×	×	—	×	×	—	×	×	×	×	O	—	—	×	×	×	×	×	—
— *robusta*	—	—	—	—	—	—	—	—	—	—	—	—	×	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *setigera*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Stolterfothii*	—	—	—	—	—	—	×	—	—	—	—	—	×	×	—	—	—	—	—	—	—	×	—	—	×	×	—	O	—	—	—
— *styliformis*	—	—	—	—	×	—	×	×	×	—	—	×	×	×	—	—	—	O	×	O	—	—	—	—	O	—	—	×	×	—	—
— — var. *latissima*	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — var. *longispina*	—	—	—	—	—	×	×	×	×	—	—	×	×	×	—	—	—	—	×	—	—	—	—	—	—	—	×	O	—	—	—
Roperia tessellata	—	—	—	—	—	—	×	—	—	—	×	O	×	×	×	—	—	O	O	O	×	—	—	—	—	—	—	O in s.	—	O	—
Sceletonema costatum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
Schroederella delicatula	—	—	—	×	—	×	×	×	—	—	×	—	×	×	—	—	—	—	—	—	—	× a sp.	× a sp.	×	×	×	—	×	—	—	—
Stephanopyxis Palmeriana	—	O	—	—	—	—	×	—	×	—	—	—	×	×	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—
— *turris*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stictodiscus parallelus var. *b*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—
Streptotheca thamesis	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	O	O	—	—	—	—	—	—	—	—	—
Striatella unipunctata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	×	×	O	—	—	—	—	—	—	—	—	O	—
Synedra sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Terpsinoë musica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
Thalassionema nitzschioides	—	—	—	—	—	—	—	—	—	—	—	O	×	×	—	—	×	—	×	×	—	×	×	×	×	×	×	×	—	—	—
Thalassiosira monile	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—
— *rotula*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *subtilis*	—	—	—	×	—	×	×	—	×	—	—	×	×	—	—	—	×	—	—	×	—	×	—	—	—	—	—	—	—	—	—
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—
Thalassiothrix Frauenfeldii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *longissima*	—	—	—	—	—	—	—	—	—	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *mediterranea*	—	—	—	—	×	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Triceratium alternans	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	×	—	—	—	—	—
— *formosum*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pentacrinus* f. *quadr*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—
— *Shadboltianum*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—

Table III. *The Central Atlantic from the Canaries to the Azores, and*

Date and position of the stations are given on p. 4.

Station	44			46		48	49 c			50			51		53			54
Depth in metres	*100—0	200—100	100—0	500—200	200—100	0	100—0	200—100	500—200	100—0	200—100	500—200	100—0	200—100	100—0	*200—100	500—200	200—0
Actinocyclus Ehrenbergii	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
— *subtilis*	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—
— *tenuissimus*	—	—	—	O	O	—	—	—	—	—	—	O	—	×	O	—	—	—
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Actinoptychus undulatus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Asterionella notata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Asterolampra Grevillei	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *marylandica*	—	—	—	—	—	—	—	O	—	O	—	—	O	—	—	—	—	—
— *Van Heurckii*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
Asteromphalus arachne	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *flabellatus*	—	—	—	×	—	—	—	—	O	—	—	—	O	O	—	—	—	—
— *heptactis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O
— *robustus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
Aulacodiscus nigricans	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bacteriastrum spp.	—	×	—	—	—	—	—	—	—	—	×	—	×	O	×	—	—	×
Biddulphia aurita	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pulchella*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *regia*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Tuomeyi*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cerataulina Bergonii	—	—	—	—	—	—	O	—	—	—	—	—	—	—	×	—	—	×
Cerataulus turgidus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chaetoceros affinis var. *Willei*	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—
— *atlanticus* var. *neapolitana*	—	×	—	—	—	—	—	×	—	—	—	—	O	—	×	—	—	×
— — var. *skeleton*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *borealis* f. *concavicornis*	—	×	—	×	—	—	—	O	—	—	—	—	—	—	—	—	—	—
— — f. *typica*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *compressus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *convolutus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *costatus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *curvisetus*	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—
— *Dadayi*	—	—	—	—	—	×	—	—	—	—	—	—	×	—	×	—	—	×
— *decipiens*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *didymus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *imbricatus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Lorenzianus*	—	—	—	—	—	—	—	—	—	—	—	—	O	—	×	—	—	×
— *messanensis*	—	—	—	—	—	—	—	—	—	—	—	—	—	O	×	—	—	×
— *perpusillus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *peruvianus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—
— — f. *gracilis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
— *pseudocurvisetus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *teres*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Wighami*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— sp.	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
Cocconeis sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Corethron hystrix	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coscinodiscus centralis	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	×	O
— *concinnus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *curvatulus*	—	×	O	—	—	—	—	×	O	—	—	O	O	—	—	—	—	—
— *divisus*	—	—	—	—	—	—	—	O	—	O	—	O	O	—	×	×	×	×
— *excentricus*	—	×	×	O	—	—	—	×	O	—	×	—	—	×	—	×	×	O
— — var. *fasciculata*	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—

in s. = in salpae.

from the Azores to the Newfoundland Banks. (*May 28th—June 29th*).

O singly, × present, ● abundant.

Station	58	Fayal	59		60		63				64			65	66			68	69
Depth in metres	200—0	0	50—0	200—0	100—0	500—200	100—0	200—100	500—200	200—0	200—0	200—100	100—0	200—0	500	100—0	500—200	200—0	200—0
Actinocyclus Ehrenbergii	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *subtilis*	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *tenuissimus*	—	×	—	×	—	—	—	O	O	O	O	—	O	—	—	—	—	O	—
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O in s.	—	—	—	—
Actinoptychus undulatus	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Asterionella notata	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Asterolampra Grevillei	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
— *marylandica*	—	—	—	—	—	—	—	—	—	—	×	—	O	—	—	—	—	—	—
— *Van Heurckii*	—	—	—	—	—	—	—	—	—	—	×	×	×	—	—	—	—	—	—
Asteromphalus arachne	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
— *flabellatus*	—	—	—	O	O	—	O	—	—	—	—	—	—	—	—	—	—	—	—
— *heptactis*	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
— *robustus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aulacodiscus nigricans	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bacteriastrum spp.	×	—	×	×	×	—	×	—	—	O	×	×	×	×	—	×	—	×	×
Biddulphia aurita	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pulchella*	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *regia*	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Tuomeyi*	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cerataulina Bergonii	×	×	×	×	×	—	—	—	—	×	O	—	O	—	—	—	—	O	—
Cerataulus turgidus	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chaetoceros affinis var. *Willei*	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *atlanticus* var. *neapolitana*	—	—	—	×	—	—	×	—	—	×	×	—	×	O	—	—	—	—	—
— — var. *skeleton*	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—
— *borealis* f. *concavicornis*	—	—	—	—	—	—	×	—	O	—	—	—	—	O	—	—	—	—	—
— — f. *typica*	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	O	—	—
— *compressus*	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	O	—
— *convolutus*	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *costatus*	—	—	O	—	—	—	O	—	—	×	—	—	—	—	—	—	—	—	—
— *curvisetus*	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Dadayi*	—	—	O	—	×	—	—	—	—	—	×	—	×	—	—	—	—	—	—
— *decipiens*	—	—	×	×	—	—	—	—	—	—	O	—	×	—	—	—	×	—	—
— *didymus*	—	—	O	—	—	—	×	O	—	O	—	—	—	—	—	—	—	O	—
— *imbricatus*	—	—	—	—	—	—	—	—	—	O	O	—	—	—	—	—	—	—	—
— *Lorenzianus*	—	×	×	×	—	—	—	—	—	×	×	×	×	—	—	—	—	O	—
— *messanensis*	×	×	×	×	—	—	×	—	—	—	×	×	×	O	—	—	—	—	—
— *perpusillus*	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *peruvianus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — f. *gracilis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pseudocurvisetus*	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *teres*	—	O	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Wighami*	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—
— sp.	—	—	—	—	—	—	—	×	—	—	×	—	—	×	—	×	—	—	—
Cocconeis sp.	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Corethron hystrix	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coscinodiscus centralis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *concinnus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—
— *curvatulus*	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *divisus*	O	×	—	O	×	×	—	—	O	—	—	—	×	—	—	—	—	—	—
— *excentricus*	O	—	—	×	×	O	×	—	—	—	×	×	O	—	—	—	×	×	—
— — var. *fasciculata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table III. (Cont.)

Station	44			46		48	49 c			50			51		53			54
Depth in metres	•100–0	200–100	100–0	500–200	200–100	0	100–0	200–100	500–200	100–0	200–100	500–200	100–0	200–100	100–0	•200–100	500–200	200–0
Coscinodiscus lineatus	O	×	×	×	×	—	O	×	×	—	×	—	×	×	—	×	O	×
— *nodulifer*	—	×	—	—	×	—	—	×	—	×	O	×	×	×	×	×	—	×
— *radiatus*	—	×	—	×	O	—	—	—	—	—	—	—	O	×	—	—	—	O
— *Thorii*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dactyliosolen mediterraneus	—	×	—	×	×	—	O	×	O	O	×	—	×	×	×	—	—	×
Ditylum Brightwellii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Eucampia zoodiacus	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—
Fragilaria oceanica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Gossleriella tropica	—	×	—	—	—	—	—	×	O	—	×	—	×	×	×	—	—	×
Grammatophora sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guinardia flaccida	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—
Hemiaulus Hauckii	O	—	—	—	—	—	—	—	—	×	—	—	×	—	O	—	—	×
— *sinensis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hemidiscus cuneiformis	—	O	—	×	×	—	—	×	×	—	×	×	×	—	×	—	×	×
— — var. *ventricosa*	O	×	×	×	×	—	O	×	×	×	×	×	×	×	×	O	×	×
Lauderia borealis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Leptocylindrus danicus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Licmophora sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Melosira moniliformis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *sulcata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitzschia paradoxa	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *seriata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Planktoniella sol	—	×	—	O	×	—	O	×	×	—	×	O	—	×	×	×	×	×
Pleurosigma spp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Podosira hormoides	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *stelliger*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhabdonema adriaticum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhizosolenia acuminata	—	×	—	—	—	—	—	—	—	—	×	—	—	×	×	—	—	—
— *alata*	O	×	—	—	—	—	—	×	—	O	—	—	O	—	×	—	—	×
— — f. *gracillima*	—	×	—	—	—	—	O	×	—	—	×	—	—	—	—	—	—	O
— — f. *indica*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Bergonii*	—	×	—	O	×	—	×	×	×	—	×	O	—	×	×	—	—	×
— *calcar avis*	O	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Castracanei*	—	×	—	—	—	O	O	—	—	—	×	—	—	×	O	—	—	×
— *cylindrus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×
— *hebetata* f. *hiemalis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — f. *semispina*	—	×	—	—	—	—	—	O	—	O	O	—	×	O	×	—	—	×
— *hyalina*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *imbricata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — var. *Shrubsolei*	—	—	—	—	—	—	—	O	—	—	—	—	—	—	×	—	—	×
— *setigera*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Stolterfothii*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *styliformis*	—	O	—	—	—	—	—	O	—	×	—	—	×	—	—	—	—	×
— — var. *latissima*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—
— — var. *longispina*	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
— sp.	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—
Roperia tessellata	—	O	—	O	—	—	—	—	—	O	—	—	—	—	—	—	—	×
Sceletonema costatum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Schroederella delicatula	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stephanopyxis Palmeriana	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. sp. = auxospores.

	54	58	Fayal	59		60		63				64			65	66			68	69	Station
500—200	200—0	200—0	0	50—0	200—0	100—0	500—200	100—0	200—100	500—200	200—0	200—0	200—100	100—0	200—0	500	100—0	500—200	200—0	200—0	Depth in metres
O	×	—	O	—	×	×	—	—	—	—	—	O	O	O	×	—	—	—	—	—	*Coscinodiscus lineatus*
—	×	O	O	O	×	×	—	×	—	×	×	×	×	×	O	—	—	—	O	—	— *nodulifer*
—	O	×	—	—	×	—	—	O	O	×	—	×	×	O	—	—	—	—	×	—	— *radiatus*
—	—	—	—	—	—	—	—	×	—	—	—	—	—	O	—	—	—	—	O	—	— *Thorii*
—	×	×	—	×	×	×	×	×	×	×	×	×	O	O	—	—	O	—	×	×	*Dactyliosolen mediterraneus*
—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Ditylum Brightwellii*
—	—	—	—	×	×	—	—	×	—	—	O	—	—	—	—	—	—	—	O	—	*Eucampia zoodiacus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	*Fragilaria oceanica*
—	×	O	—	—	×	—	—	×	—	—	—	×	×	×	—	—	—	—	×	—	*Gossleriella tropica*
—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Grammatophora* sp.
—	—	×	—	—	—	—	—	—	—	—	×	—	O	—	—	—	—	—	—	—	*Guinardia flaccida*
—	×	—	—	—	×	×	—	×	—	—	—	×	—	×	O	—	—	—	O	—	*Hemiaulus Hauckii*
—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	— *sinensis*
×	×	—	—	×	×	×	×	×	×	×	—	×	O	×	×	—	—	—	×	—	*Hemidiscus cuneiformis*
×	×	×	×	×	×	×	×	×	×	×	×	×	O	×	×	—	O	O	×	—	— — var. *ventricosa*
—	—	—	×	×	×	—	—	×	O	—	×	—	—	—	—	—	—	—	O	—	*Lauderia borealis*
—	—	—	×	—	O	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	*Leptocylindrus danicus*
—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Licmophora* sp.
—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Melosira moniliformis*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	— *sulcata*
—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Nitzschia paradoxa*
—	—	—	×	×	×	—	—	—	—	—	×	O	—	—	—	—	—	—	—	—	— *seriata*
×	×	●	×	×	×	×	×	×	×	×	×	×	—	×	×	O	—	—	×	—	*Planktoniella sol*
—	—	—	×	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Pleurosigma* spp.
—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Podosira hormoides*
—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *stelliger*
—	—	—	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Rhabdonema adriaticum*
—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*Rhizosolenia acuminata*
—	×	×	×	×	×	×	—	×	×	—	×	×	×	×	×	—	—	—	—	—	— *alata*
—	O	—	×	× a. sp.	×	×	—	×	—	—	×	×	—	—	×	—	—	—	—	—	— — f. *gracillima*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	— — f. *indica*
—	×	×	×	×	×	O	—	O	—	—	×	×	×	×	×	—	—	—	O	—	— *Bergonii*
—	—	—	—	—	—	—	—	×	—	—	O	—	—	—	O	—	—	—	—	—	— *calcar avis*
—	×	O	—	—	—	—	—	—	—	—	—	×	O	×	—	—	—	—	—	—	— *Castracanei*
—	×	—	—	—	—	—	—	—	—	—	O	×	O	—	—	—	—	—	—	—	— *cylindrus*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	— *hebetata* f. *hiemalis*
—	×	O	—	—	×	×	—	—	×	—	—	×	—	—	—	—	—	—	O	—	— — f. *semispina*
—	—	—	—	—	—	—	—	×	×	—	×	×	—	—	—	—	—	—	—	—	— *hyalina*
—	—	—	—	—	—	—	—	—	—	—	×	O	—	—	—	—	—	—	—	—	— *imbricata*
—	×	O	×	×	×	×	—	×	—	—	×	×	O	O	O	—	—	—	—	—	— — var. *Shrubsolei*
—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— *setigera*
—	—	—	—	×	×	—	—	—	—	—	O	—	—	—	—	—	—	—	×	—	— *Stolterfothii*
—	×	×	O	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	— *styliformis*
—	—	—	—	—	—	—	—	×	—	—	—	×	—	O	—	—	—	—	—	—	— — var. *latissima*
—	—	O	—	×	×	—	—	—	—	—	—	×	—	—	O	—	—	—	—	—	— — var. *longispina*
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	— sp.
—	×	×	—	—	O	O	—	O	—	—	—	—	—	—	—	—	—	—	—	—	*Roperia tessellata*
—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	O	*Sceletonema costatum*
—	—	—	×	×	×	—	—	×	O	×	×	×	×	O	×	—	—	—	O	—	*Schroederella delicatula*
—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	×	—	*Stephanopyxis Palmeriana*
—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	— sp.

Table III. (Cont.)

Station	44			46		48	49 c			50			51		53			5[illegible]
Depth in metres	•100 – 0	200 – 100	100 – 0	500 – 200	200 – 100	0	100 – 0	200 – 100	500 – 200	100 – 0	200 – 100	500 – 200	100 0	200 – 100	100 – 0	•200 – 100	500 – 200	200 – 0
Streptotheca thamesis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Striatella unipunctata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Synedra sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thalassionema nitzschioides	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O
Thalassiosira subtilis	—	×	—	—	—	—	×	×	—	—	×	—	—	×	×	—	—	×
Thalassiothrix Frauenfeldii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *longissima*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Triceratium antediluvianum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *formosum*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pentacrinus* f. *quadrata*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Shadboltianum*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table IV. *The Newfoundland Banks.* (*June 30th–July 11th*).

Date and position of the stations are given on p. 4. O singly, × present, ● abundant.

Station	70			76	77		80	
Depth in metres	100 – 0	350 – 150	20 – 0	100 – 0	50 – 0	150 – 50	50 – 0	200 – 50
Chaetoceros atlanticus	—	×	O	×	—	×	—	×
— *borealis* f. *typica*	—	—	—	×	—	O	—	×
— *compressus*	—	—	—	—	—	—	—	×
— *convolutus*	—	—	—	—	O	—	—	O
— *decipiens*	O	×	—	×	×	O	—	×
— *diadema*	—	—	—	—	—	O	—	×
— *didymus*	—	—	—	—	—	—	—	O
— *laciniosus*	—	—	—	—	O	—	—	—
— *perpusillus*	—	—	—	—	—	—	—	O
— sp.	×	—	—	—	—	—	—	—
Corethron hystrix	—	—	—	—	×	—	—	×
Coscinodiscus centralis	—	—	—	●	—	O	O	×
— *curvatulus*	×	—	—	—	O	×	—	×
— *excentricus*	—	—	—	O	—	×	—	×
— *oculus iridis*	—	—	—	—	—	—	—	O
— — var. *borealis*	O	—	—	—	O	—	—	O
— *radiatus*	O	—	—	—	—	—	—	—

Station	54	58	Fayal	59		60		63				64			65	66			68	69
Depth in metres	200 - 0	200—0	0	50—0	200—0	100 - 0	500 - 200	100—0	200—100	500—200	200—0	200 0	200 - 100	100—0	200 - 0	500	100 - 0	500 - 200	200—0	200—0
Streptotheca thamesis	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—
Striatella unipunctata	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Synedra sp.	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—
Thalassionema nitzschioides	O	×	—	×	×	—	—	×	×	—	×	—	—	—	—	—	—	—	O	—
Thalassiosira subtilis	×	×	—	O	×	×	—	×	×	×	×	×	×	O	×	—	—	—	—	—
Thalassiothrix Frauenfeldii	—	—	—	—	—	—	—	×	×	—	×	O	×	×	—	—	—	—	O	—
— *longissima*	—	—	—	—	—	—	—	×	—	—	O	—	—	—	—	—	—	—	—	—
Triceratium antediluvianum	—	—	×	O	×	×	O	—	—	—	—	—	—	—	—	—	—	—	—	—
— *formosum*	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *pentacrinus* f. *quadrata*	—	—	O	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Shadboltianum*	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table IV. (Cont.)

Station	70			76	77		80	
Depth in metres	100—0	350—150	20 - 0	100 - 0	50—0	150—50	50—0	200—50
Dactyliosolen mediterraneus	—	—	—	—	—	—	—	O
Fragilaria oceanica	—	—	—	×	—	O	—	×
— — f. *convoluta*	—	—	—	—	—	—	—	×
Guinardia flaccida	—	—	—	—	O	—	—	—
Planktoniella sol	—	—	—	—	—	—	—	×
Rhizosolenia alata	—	—	—	—	—	O	—	—
— — f. *gracillima*	—	—	—	—	—	—	—	O
— *hebetata* f. *semispina*	×	×	—	×	×	×	O	×
— *imbricata*	—	—	—	—	—	—	—	O
— *setigera*	—	—	O	—	—	—	—	O
— *styliformis*	—	×	—	×	×	×	—	×
— — var. *latissima*	—	—	—	—	—	—	—	O
Thalassionema nitzschioides	—	—	—	—	—	—	—	×
Thalassiosira gravida	—	—	—	×	—	—	—	—
— *monile*	—	—	—	—	—	—	—	×
— *subtilis*	—	—	—	—	—	×	—	—
Thalassiothrix longissima	—	—	—	×	—	—	—	×

Table V. *The northern Atlantic Section. (July 12th—23rd).* *Ireland—Rockall—Shetla*

Date and position of the stations are given on p. 4. O singly, × present, ● abundant. *(August 4th—10*

Station	81 a			83	84	85		86	87			88				90		92		97	98	99		103
Depth in metres	50—0	*100—0	200—100	100—0	0	100—0	200—100	10	1000—0	100—0	200—100	100	1000—0	100—0	200—40	100—0	200—100	50—0	200—50	50—0	100—0	130—50	50—0	50—0
Asteromphalus heptactis	—	—	—	—	—	—	O	—	—	×	×	—	—	×	×	×	×	—	×	—	—	—	—	—
Bacteriastrum spp.	×	—	—	—	—	×	O	—	—	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—
Cerataulina Bergonii	O	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chaetoceros atlanticus	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—
— — var. *neapolitana*	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	O	—	—	O	—	—	—	—	—
— — var. *skeleton*	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *borealis* f. *concavicornis*	—	—	×	—	—	×	×	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—
— — f. *typica*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—
— *compressus*	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *convolutus*	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *decipiens*	×	O	×	—	—	—	—	—	—	×	—	—	—	—	—	O	×	—	—	—	—	—	—	×
— *diadema*	× sp.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *laciniosus*	—	—	× sp.	—	—	O	O	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Lorenzianus*	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *perpusillus*	—	—	—	—	—	×	O	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—
— *Wighami*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O
— sp.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—
Corethron hystrix	×	—	—	—	O in s.	×	×	—	—	×	×	—	—	O	—	—	—	—	—	—	—	—	—	—
Coscinodiscus centralis	O	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—
— *curvatulus*	O	—	×	—	—	—	—	—	—	—	—	×	—	O	O	—	—	—	—	—	—	—	—	—
— *excentricus*	—	—	—	×	—	—	O	—	O	×	×	—	—	—	×	—	—	—	×	—	—	×	O	—
— *lineatus*	O	—	—	—	× in s.	×	O	—	×	×	—	×	O in s.	×	—	O	—	—	O	—	—	—	—	—
— *nodulifer*	O	—	—	—	—	—	—	—	—	×	O	—	—	O	O	—	—	—	O	—	—	—	—	—
— *radiatus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	×	—	—	●	×	×
— *Rothii*	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coscinosira Oestrupii	×	—	×	—	O in s.	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dactyliosolen mediterraneus	O	—	×	×	—	×	×	—	—	×	×	—	O in s.	×	—	×	×	×	×	—	—	—	—	—
Eucampia zoodiacus	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guinardia flaccida	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—
Hemidiscus cuneiformis	—	—	—	O	× in s.	×	O	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— — var. *ventricosa*	O	—	O	—	—	×	—	—	—	×	×	—	O in s.	×	—	O	—	—	×	—	—	—	—	—
Lauderia borealis	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Leptocylindrus danicus	×	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Melosira sulcata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
Navicula sp.	—	—	—	—	× in s.	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitzschia closterium	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *delicatissima*	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
— *seriata*	×	—	×	O	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Planktoniella sol	×	O	×	O	O	×	×	—	—	×	×	—	—	×	×	—	—	O	×	—	—	—	—	—
Pleurosigma spp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Podosira stelliger	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhabdonema adriaticum	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhizosolenia alata	×	—	—	×	×	×	×	—	—	×	×	×	O	×	×	×	×	×	×	×	—	—	—	—
— — f. *curvirostris*	—	—	—	—	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—

sp. = resting spores, in s. = in salpae.

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Table V. (Cont.)

Station	81 a			83	84	85		86	87			88				90		92		97	98	99		1
Depth in metres	50—0	*100—0	200—100	100—0	0	100—0	200—100	10	1000—0	100—0	200—100	100	1000—0	100—0	200—40	100—0	200—100	50—0	200—50	50—0	100—0	130—50	50—0	50—0
Rhizosolenia alata f. *gracillima*	× a. sp.	—	—	—	O	—	—	—	—	O	—	—	—	—	—	—	—	—	—	×	—	×	O	●
— — f. *indica*	—	—	—	—	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *Bergonii*	—	—	—	—	—	×	×	—	—	×	×	○	—	×	×	×	O	—	—	—	—	—	—	—
— *delicatula*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *fragilissima*	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *hebetata* f. *semispina*	×	—	O	—	—	×	×	—	—	×	O	—	—	×	×	—	O	×	O	—	—	—	—	O
— *imbricata* var. *Shrubsolei*	×	—	—	—	—	×	O	—	×	×	×	—	—	—	×	O	—	O	—	—	—	—	O	×
— *Stolterfothii*	×	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O
— *styliformis*	O	—	O	×	—	—	O	—	—	—	O	—	—	—	—	—	O	O	O	×	O	●	●	—
— — var. *longispina*	×	—	O	×	O	—	O	—	—	×	—	—	—	—	—	×	—	—	O	—	×	●	●	×
Roperia tessellata	—	—	—	—	—	—	—	—	—	O	O	—	—	O	—	O	—	O	O	—	—	—	—	—
Thalassionema nitzschioides	×	—	×	—	—	×	×	—	—	×	—	—	—	O	O	—	—	—	O	—	—	—	—	—
Thalassiosira monile	×	—	—	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— *subtilis*	×	—	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thalassiothrix longissima	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. sp. = auxospores.