DISTRIBUTION OF DIATOM SPECIES IN THE SURFACE SEDIMENTS OF LÜTZOW-HOLM BAY, ANTARCTICA

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ABSTRACT—Analysis of fifteen sediment core tops from Lützow-Holm Bay, Antarctica provides information on the modern distribution of diatoms deposited under coastal fast ice. Well-preserved diatoms occur in 14 of these core-tops, one of which is rich in marine littoral forms. Forty-seven diatom species and varieties belonging to 22 genera are identified in the cores. Almost all samples contain abundant *Nitzschia curta*, *Nitzschia cylindrus* and *Nitzschia kerguelensis*. High abundances of *N. curta* and *N. cylindrus*, epitonic or sea-ice forms, reflect a modern ice-covered environment of the bay, and the predominance of *N. kerguelensis*, one of the most common open ocean forms in the Southern Ocean, suggests penetration of open ocean currents beneath the coastal fast ice of the bay.

Key words: Diatom, Lützow-Holm Bay, Antarctica.

INTRODUCTION

Diatom valves are major components of sea floor sediments of southern seas (Lisitzin, 1971; Jenkyns, 1978; Seibold and Berger, 1982). Many previous studies have been made of these diatoms (Kozlova, 1964; Abbott, 1974; Truesdale and Kellogg, 1979; DeFelice and Wise, 1981; Burckle and Cirilli, 1987; Kellogg and Kellogg, 1987), but sediment floras deposited under fast ice are poorly known. On the 22nd Japanese Antarctic Research Expedition (JARE) in 1981, a series of 27 piston and trigger cores were collected from the western part of the bay by geological investigation members of the expedition. The acquisition of these cores provides material for analysis of the modern distribution of diatoms in surface sediments deposited under fast ice.

The bay is occupied by a wide continental shelf, and is bounded on the west by the Riser-Larson Peninsula and on the east by the Soya Coast. The northern shelf break, about 300–500 m deep, is located between 68.5°S and 68°S. A deep drowned glacial trough, trending from north to south, occurs in the central part of the bay. The sea floor of the bay is composed of the eastern and western parts (Moriwaki and Yoshida, 1983). Irregular topography resulting from erosion by ice sheets characterizes the eastern part, and a deep slightly undulating shelf occupies the western part (Moriwaki and Yoshida, 1983). Almost all of the bay is covered with coastal fast ice all year round. Puddles or ice-free areas are, however, formed at the Ongul Strait and/or the central part of the bay in austral summer. A coastal fast ice, 1–2 m thick, is about 37–74 km in width. The northern edge of the fast ice is roughly located on that of the continental shelf (Kusunoki, 1975). Flow leads and flow polygons are often formed between fast ice and pack ice. The northern extent of pack ice commonly reaches to about 58°S–59°S in austral winter (Kusunoki, 1981).

The purposes of this work are to report the modern distribution of diatoms deposited under fast ice, and to interpret processes controlling it. These data will be applied to down-core analysis for the reconstruction of paleoceanographic history of the bay and adjacent seas.

MATERIAL AND METHODS

A total of 15 core top samples were studied. The top 1–2 cm of trigger and piston cores each were analyzed. About 0.5 gram of sediment sample was placed in a 10 ml test-tube with about 1 ml of distilled water and several drops of 15% hydrogen peroxide. Organic contents were removed by subjecting the sample to ultraviolet irradiation for 2–3 hours. The test-tube was filled again with distilled water. A 0.1–0.5 ml suspension was diluted by distilled water to obtain a suspension of proper density. For slide preparation, 0.5 ml of the diluted suspension was taken by the aid of a micropipette with disposable plastic tips, and was placed on a square cover glass of 18×18 mm. After drying, it was mounted on a slide glass with Pleurux.

Observations and identification of diatoms were made at ×1250 magnification. For scanning electron microscopic observation, diatom valves were collected by filtration of the suspension through Millipore filters (0.8 μm pore size). The relative abundance of each diatom species in a flora was estimated by counting over 300 valves while traversing a slide under a light microscope.

RESULTS

Forty-seven diatom species and varieties belonging to 22 genera were identified in core-top samples (Table 1). Fourteen samples yielded well-preserved, marine, brackish and fresh water diatoms. A considerably dissolved diatom flora was found in one sample (W) collected from the sea floor off Skarvnes. Frustules of the vegetative cells of *Amphipleur a*, *Corethron*, *Chaetoceros*, *Pleurosigma*, *Rhizosolenia* and *Tropidoneis* were rarely found in sediment samples; despite these genera are present in abundance in sea-water and sea-ice floras (Tanimura et al., 1990). Some *Nitzschia* species with poorly silified valves such as *N. closterium* (Ehr.) Wm. Smith and *N. lecontei* Van Heurck are also not as commonly present in sediments.

All the samples, except for one (V), are dominated by a large number of *Nitzschia* species. A total of specimens
Table 1. Distribution of diatoms in Lützow-Holm Bay core-top sediments.

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of *Nitzschia curta* (Van Heurck) Hasle, *N. cylindrus* (Grunow) Hasle and *N. kerguelensis* (O’Meara) Hasle usually comprise over 50% (up to 74%; C-24) of the diatom valves in each sample (Fig. 2). *Nitzschia kerguelensis* accounts for more than 50% of the sediment flora at offshore sites (C-18, C-24), and decreases to 5–30% in the Ongul Strait and the coastal region off the Soya Coast. In the center of the strait, this species comprises about 20% of the flora. There is an apparent drop in abundance to both sides of the strait. Twelve to 30% occurrences of the species are also found in the samples collected from the sea floor off the Hönnor and Langhovde Glaciers. Only rare individuals occur in Langpollen (V; 0.6%) and Nesoya (F; 4.6%).

In contrast to *N. kerguelensis*, *N. curta* was found in abundance at coastal sites, A–F, G and X–Z. It ranged from 31 to 35% in the Ongul Strait and from 28 to 45% off the Langhovde and Hönnor Glaciers. At offshore sites (C-18, C-24), the species amounted to only 7–16% of the flora.

*Nitzschia cylindrus* occupies 0.3–7% of the flora in almost all the sediment samples. The sample from Nesoya (F) contained these valves reaching 12% of the flora. *Nitzschia angulata* Hasle, *N. barkleyi* Hustedt, *N. obliquecostata* (Van Heurck) Hasle, *N. ritscheri* (Hustedt) Hasle, *N. separanda* (Hustedt) Hasle, *N. sublineata* Hasle and *N. turgiduloides* Hasle were also found in many samples. These *Nitzschia* species together usually occupy over 10–24% of each flora in quantitative analysis.

gracilis (Karsten) Hustedt, *T. lentiginosa* (Janisch) Fryxell, *Thalassiosira* spp. a and *Thalassiothrix longissima* Cleve and Grunow, are also present in almost all the core tops. None of these forms reach 10% of the flora. These species appear to be distributed nearly uniformly throughout the Lützow-Holm Bay core-top samples with a slightly higher abundance of *T. lentiginosa* at offshore sites, and of *Fragilaria* (?) sp. a, *Navicula* spp., *P. quadratarea* and *Thalassiosira* sp. a at coastal ones.

Sample V is rich in marine littoral forms, which reflect a shallow and embayed environment at the core site.

**DISCUSSION**

*Nitzschia kerguelensis* has been recognized as one of the most abundant "open ocean" species in the Southern Ocean. Burckle *et al.* (1987) identified two groups of diatom assemblages in surface water samples taken along a north-south track between New Zealand and the Ross Ice Shelf. Their northern group was characterized by "open ocean" forms, and their southern one consisted primarily of "ice-edge" and "near-ice" species. *Nitzschia kerguelensis* and *Chaetoceros* species were major components of the former. In southern seas, several workers (Hendey, 1937; Hart, 1942; Fukase, 1962; Hasle, 1969; Fenner *et al.*, 1976; Fukuchi *et al.*, 1978; Ioriya and Kato, 1982) also documented water floras dominated by *N. kerguelensis*. Among them, Fukuchi *et al.* (1978) reported diatom floras in eight surface water samples taken along a north-south track (34°E, from 57°S to 68°S) between South Africa and the Soya Coast of Antarctica, in February, 1976. They identified *Fragilariopsis antarctica* (= *N. kerguelensis*)-dominated assemblages in these samples. Fukase (1962) also reported
diatom floras in surface water samples collected along tracks between South Africa and the Soya Coast, and showed abundant occurrences of the species in Subantarctic and Antarctic waters between 52°S and 65°S. In contrast to the species, N. curta and N. cylindrus are known as sea-ice forms. Van Heurck (1900), Hendey (1937) and Hasle (1965b) observed N. curta and/or N. cylindrus in the brownish under-surface of sea ice. Hasle (1965b) also showed that Fragilariaopsis curta (= N. curta) and F. cylindrus (= N. cylindrus) increased in abundance southward to the Antarctic Continent, and were predominant species of the genus in sea-ice samples.

At and around the core sites (Fig. 1), N. curta and N. cylindrus were also major constituents in sea-ice and the underlying water samples (St. 3 = northeast off the Ongul Islands, 68°59'57"S, 39°37'16"E, 50 m in water depth; St. 5 = the Ongul Strait, 68°59'57"S, 39°40'25"E, 675 m in water depth), while N. kerguelensis was a minor component in the water samples (Tanimura et al., 1990). The ice flora contained abundant Berkeleya sp., Eucampia balaustium Castracane, Nitzschia closterium, N. curta, N. cylindrus, N. lecomtei, N. stellata Manguin, N. turgiduloides, Pleurosigma sp., Rhizosolenia alata Brightwell, and Tropidonella sp., and the water flora was dominated by Chaetoceros spp., Fragilaria sp., N. curta, N. cylindrus, N. turgiduloides, N. vanheurckii, Porosira pseudodenticulata (Hustedt) Jouès and Porosira sp.

In spite of the prevailing ice-covered environments, the sediment flora of the bay is rich in a high southern latitude open ocean form, N. kerguelensis. Several possible explanations for the dominance of N. kerguelensis in the flora are considered. One explanation is that N. kerguelensis was introduced by open ocean currents penetrating beneath the coastal fast ice of the bay. Another one is that heavily silicified valves of N. kerguelensis resisted dissolution during sinking and burial so as to become more abundant in sediment than in water and/or in sea-ice. Both factors are significant to explain the formation of a N. kerguelensis-rich sediment flora. The penetration process, however, seems to have played a more important role in the enrichment of the species, and dissolution was not the only factor operating on the dominance of the species in the sediments. Since the water and sea-ice floras at stations 3 and 5 (Tanimura et al., 1990) represent only a short period, a strict comparison between the sediment flora and the seawater or sea-ice flora needs caution. The available data, however, show that N. kerguelensis is too scarce in the sea-water and sea-ice floras to constitute a sediment flora dominated by this species. The presence of well-preserved and poorly silicified diatoms in the sediment flora supports this inference.

Furthermore, oceanographical and biological observations suggest the inflow of open ocean currents to the bay. The current measurements at the Ongul Strait (Fukuchi et al., 1985) and biological investigation around the Ongul Islands (Tanimura, 1987) showed that prevailing currents are northward at the strait, the water underlying fast ice has the same characteristics as Antarctic Surface Water, and copepod faunas in the strait are dominated by oceanic forms. Possibly, the prevailing westward currents around Antarctica change their course to the south in the southern part of the Ganners Banks. Then they flow into the bay from the western part, and subsequently penetrate beneath the fast ice. A counterclockwise stream in the bay may be thus originated. Available light and the formation of ice-free area in the lighter summer months may also be a factor for the large production of N. kerguelensis.

CONCLUSIONS

Three Nitzschia species, N. kerguelensis, N. curta and N. cylindrus, are abundant in almost all the Lützow-Holm Bay sediment samples. A total number of these species usually reach over 50% of the sediment flora. Together with abundant N. curta and N. cylindrus reflecting the ice-covered environment of the bay, N. kerguelensis is a dominant species of the flora, while this species predominantly occurs in high southern latitude open ocean. Open ocean currents penetrating beneath the coastal fast ice may have played an important role in the introduction of N. kerguelensis to the bay. The distribution and abundance of these diatom species and their relationship to modern currents and sea-ice conditions provide information on the reconstruction of paleo-oceanographic history in the regions covered with fast ice.

ANNOTATED LIST OF SELECTED DIATOM TAXA

Floral composition is tabulated for each of the studied sample (Table 1). Only those taxa which have been used for describing the modern distribution pattern of diatom species on the sea floor of Lützow-Holm Bay are included in the following list with brief remarks. Synonyms are also herein listed.

All the permanent slides are reposited in the micropaleontological reference collection of the National Science Museum, Tokyo: MPC 4895-4909.

Charcotia actinochilus (Ehrenberg) Hustedt, 1958, p. 126, pl. 7, figs. 57–80; Fenner et al., 1976, p. 771, pl. 5, fig. 5.
Valve diameter of observed specimens varies between 30 and 50 μm. The number of areolae in 10 μm is 9–12.

Figs. 3-1–16. 1, Thalassiosira lentigiosa (Janisch) Fryxell, site C-18, valve with labiate process (arrow). 2, Actinocyclus actinochilus (Ehrenberg) Simonsen, site V, valve with pseudonodule (arrow). 3–6, Thalassiosira gracilis (Karsten) Hustedt, sites C-24, C-18 and Y. 7a–b, Schimpferiella antarctica (Grunow) Karsten, site V. 8, Thalassiosira sp. a, site V. 9, Thalassiosira lentigiosa (Janisch) Fryxell, site V, valves with labiate process (arrow). 10, Aspergillus tabulisus (Grunow) Fryxell and Sims (?), site V. 11, Actinocyclus sp., site V. 12, Thalassiosira sp., site V. 13, Eucampia balaustium Castracane, site V. 14, Hyalodiscus sp., site V. 15, Rhizosolenia hebata l. semispina (Hensen) Gran, site C-24. 16, Rhizosolenia alata Brightwell, site C-10. (scale bar=10 μm)
This species occurred uniformly in core-top samples, but not common. (Figs. 3-2; 5-3)

**Eucampia balaustium** Castracane, 1886, p. 97, pl. 18, fig. 5;
Karsten, 1905, p. 120, pl. 11, figs. 7, 10; Hendey, 1937, p. 285, pl. 13, figs. 8-10; Fenner et al., 1976, p. 774, pl. 5, figs. 7-9; Hoban et al., 1980, p. 592, figs. 1-4.

This diatom has two phenotypes; vegetative cell and resting spore (Hoban et al., 1980). The former is lightly silicified, and the latter has heavily silicified and coarsely ornamented valves. Almost all the observed specimens were the resting spore of the species. This species was found consistently in core-top samples. (Fig. 3-13)

**Fragilari** (!) sp. a.

Fustules in girdle view are rectangular. Valves are linear-lanceolate with weakly drawn out or long beak-like ends, about 20-45 μm long and 4-7 μm wide. Small pores form a line on valve margins, 8-16 in 10 μm. This species has only one terminal labiate process per valve. I have some reservations about placing this form under the genus *Fragilari*, because some specimens are similar to those of the species of *Synedra* in general morphological characters. I found it common at near-shore sites; V and E. (Figs. 4-30, 31; 5-7)

**Nitzschia angulata** (O’Meara) Hasle, 1972, p. 115.

**Fragilari rhombica** (O’Meara) Heiden et Kolbe, 1928, p. 552.

**Nitzschia antarctica** Okuno, 1954, p. 24, pl. 3, fig. 7.

**Fragilariopsis rhombica** (O’Meara) Hustvedt, 1958, p. 296, figs. 6, 7;
Hustvedt, 1958, p. 163, pl. 10, figs. 113-120, pl. 12, fig. 158; Frenguelli and Orlando, 1958, p. 108, pl. 3, fig. 12; Hasle, 1964, pl. 6, fig. 7;
Hasle, 1965b, pl. 24, pl. 1, fig. 6, pl. 4, fig. 19, pl. 6, fig. 5, pl. 8, fig. 11, pl. 9, figs. 1-6, pl. 10, figs. 2-6.

This highly variable taxon was observed to range from 10 to 40 μm in length, and from 8 to 12 μm in width. The valve outlines of smaller specimens are elliptical, while larger specimens have peculiar rhombic valve outlines with parallel margins. The number of transapical costae of observed specimens varies from 9 to 15 in 10 μm, and that of poroids in intercostal membrane is 20-24 in 10 μm. This species was observed, though mostly rather rare, in every sample of the bay. (Figs. 4-24-26)

**Nitzschia barkleyi** Hustvedt, 1952, p. 293, figs. 13, 14;
Hustvedt, 1958, p. 167, pl. 13, fig. 196; Hasle, 1965a, p. 30, pl. 2, figs. 4, 5, pl. 12, figs. 17-21, pl. 13, figs. 11-14, pl. 14, figs. 1-3.

This long and lightly silicified *Nitzschia* is similar to *N. turguiduloides* and *N. lineola* (Hasle, 1965a, p. 29, pl. 12, figs. 15-16) in their long apical axes and finely structured transapical costae. Rather acute apices, however, characterize *N. barkleyi*. The range of length could not be defined, because almost all specimens of the species were found in fragments. Individuals have 13-15 keel punctae and 21-24 transapical costae in 10 μm. This species was quite regularly observed, though mostly not frequent, at near-shore sites.

**Nitzschia curta** (Van Heurck) Hasle, 1972, p. 115.

**Fragilari curta** Van Heurck, 1909, p. 24, pl. 3, fig. 37;
**Fragilariopsis linearis var. curta** (Van Heurck) Frenguelli, Frenguelli and Orlando, 1958, p. 107, pl. 4, fig. 31.

**Fragilari curta** (Van Heurck) Hustvedt, 1958, p. 160, pl. 11, figs. 140-144, pl. 12, fig. 159; Hasle, 1965b, p. 32, pl. 6, fig. 12, figs. 2-5, pl. 13, figs. 1-6, pl. 16, fig. 6, pl. 17, fig. 5.

This small *Nitzschia* is similar to *N. cylindrus*. Fenner et al. (1976) reported the occurrence of transitional forms between these two forms in water samples collected during Leg 35 of D/V Glomar Challenger from Callao, Peru to Ushuaia, Argentina. In the Lützow-Holm Bay sediment samples, the characteristics of *N. curta*, the heteropole apical axis and curved transapical costae near the pole, were observed in almost all specimens of this species, and transitional forms were rarely found. Specimens recovered from core samples are 11-48 μm long, 3-7 μm wide, and have 12-14 transapical costae in 10 μm. The perforations of intercostal membrane are 28-34 in 10 μm. This species was recognized as an indigenous species to the Antarctic Zone (Hasle, 1965b). (Figs. 4-17-23)

**Nitzschia cylindrus** (Grunow) Hasle, 1972, p. 115.

**Fragilari cylindrus** Grunow, 1883; Hustvedt, 1931, p. 152, fig. 665;
Okuno, 1954, p. 24, pl. 1, fig. 4.

**Fragilariopsis cylindrus** (Grunow) Krieger, 1954; Hasle, 1965b, p. 34, pl. 2, figs. 6-12, pl. 14, figs. 1-10, pl. 17, figs. 2-4.

Two groups were observed in valve size distribution. The smaller group has a mean of 8 μm, and the larger one has that of about 20 μm. The former is weakly silicified, and the latter has rather heavily silicified valves. The smaller group was rare in core top materials. Dissolution during sinking and burial is considered to be a factor causing the scarcity of the smaller group in the sediment flora. The transapical costae of the observed specimens vary from 13-15 in 10 μm, and perforations between these costae are very fine, about 6-8 in 1 μm.

A large number of small *N. cylindrus* cells in water samples obtained from the northeastern coast of the Ongul Islands (St. 3; Tanimura et al., 1990) were attached to Cilata. These may be the source of the smaller group in sediments. (Figs. 4-14-16)

**Nitzschia kerguelensis** (O’Meara) Hasle, 1972, p. 115.

**Fragilari antarctica** Castracane, 1886, p. 56, pl. 25, fig. 12; Karsten, 1905, p. 122, pl. 17, figs. 7, 7a-d.

**Fragilariopsis kerguelensis** (O’Meara) Hustvedt, 1952, p. 294; Hustvedt, 1958, p. 162, pl. 10, figs. 121-127, pl. 12, fig. 158; Hasle, 1965b, pl. 14, pl. 3, figs. 4, pl. 4, figs. 11-18, pl. 5, figs. 1-11, pl. 6, figs. 2-4, pl. 7, fig. 9, pl. 8, fig. 10, pl. 16, figs. 3-5.

This heavily silicified and coarsely structured taxon was observed to range from 18 to 72 μm in length, and from 7 to 13 μm in width. Transapical costae vary from 7 to 8 in 10 μm. The perforations of intercostal membrane are easily perceivable on the valves mounted in Pleurux; 6-9 in 10 μm. (Figs. 3-1-9)
Nitzschia obliquecostata (Van Heurck) Hasle, 1972, p. 115.
Fragilaria obliquecostata Van Heurck, 1909, p. 25, pl. 3, fig. 38.
Examined specimens have apical axes of 62–82 μm long, with widths of 8–10 μm. Transapical costae are 6–8 in 10 μm. The perforations of intercostal membrane are 16–22 in 10 μm. Transitional forms between N. obliquecostata and N. ritscheri were observed among small- and medium-sized specimens, which have more rounded apices. This species was observed in every sample from the bay, but not frequent. (Figs. 4–32–35)

Nitzschia ritscheri (Hustedt) Hasle, 1972, p. 115.
Fragilaria ritscheri Hustedt, 1958, p. 164, pl. 11, figs. 133–136, pl. 12, figs. 153, Hasle, 1965b, p. 20, pl. 1, fig. 20, pl. 3, fig. 3, pl. 4, figs. 1–10, pl. 5, figs. 12, 13, pl. 6, fig. 1, pl. 7, fig. 8.
The size of specimens observed in the Lützow-Holm Bay sediment samples varies between 28 and 42 μm in length, and 8 and 9 μm in width. The number of transapical costae is 6–8 in 10 μm, and the perforations of intercostal membrane, arranged in two or three rows, are visible under a light microscope, 18–20 in 10 μm. This species occurred regularly in every sample of the bay. (Figs. 4–10–13)

Nitzschia separanda (Hustedt) Hasle, 1972, p. 115.
Fragilaria separanda Hustedt, 1958, p. 165, pl. 10, figs. 108–112; Hasle, 1965b, p. 26, pl. 9, figs. 7–10, pl. 10, fig. 1.
This small and coarsely structured Nitzschia was observed to range from 11 to 18 μm in length and from 7 to 10 μm in width. Transapical costae are well silicified, 12–14 in 10 μm, and poroids between them are somewhat irregular both in size and shape, about 12–15 in 10 μm. This species was common in almost all the samples, except for two near-shore cores (V and F), obtained from the bay. (Figs. 4–27–29)

Nitzschia sublineata (Van Heurck) Hasle, 1972, p. 115.
Fragilaria sublineata Van Heurck, 1909, p. 25, pl. 3, fig. 39.
Fragilaria sublineata (Van Heurck) Heiden in Heiden and Kolbe, 1928, p. 554; Hasle, 1965b, p. 21, pl. 7, fig. 1, pl. 11, figs. 1–10, pl. 12, fig. 1.
Observed specimens are 42–83 μm long, 6–7 μm wide, and have 8–9 heavily silicified transapical costae in 10 μm and 37–40 poroids of intercostal membrane in 10 μm. This species was observed regularly in all the samples from the bay. (Figs. 4–36–40)

Nitzschia turgiduloides Hasle, 1965a, p. 28, pl. 12, figs. 9–14, pl. 13, figs. 3–6.
The range of length and width could not be defined because of the fragmental nature of valves. The numbers of keel punctae and transapical costae of observed specimens vary from 12 to 13, and from 19 to 22 in 10 μm, respectively. The intercostal membrane is perforated, 7–9 in 1 μm. This species was found quite regularly, but not frequent, at coastal sites.

Pinnularia quadratarea (Schmidt) Cleve, 1895, p. 95; Schmidt et al., 1874–79, pl. 260, figs. 33–35; Hendey, 1964, p. 232.
This heavily silicified and coarsely structured taxon was observed to range from 55 to 95 μm in length, from 16 to 19 μm in width, and has conspicuous striae on the valve face, about 8 in 10 μm. The striae in the central field are thinned out toward the axial area. The striae are perforated in two or three rows of small pores, 20–24 in 10 μm. Transitional forms between the species and P. quadratarea var. constricta (Oestrup) Heiden (1905, in Schmidt et al., 1874–1959, pl. 260, figs. 3–8, 36) were found in samples obtained from Langpollen. This species and its variety were observed in abundance at near-shore sites, V and F. (Figs. 4–41, 42)

Thalassiosira gracilis (Karsten) Hustedt, 1958, p. 109, pl. 3, figs. 4–7;
Fenner et al., 1976, p. 780, pl. 9, figs. 12–22.
Coccosidiscus gracilis Karsten, 1905, p. 78, pl. 3, fig. 4.
The valve diameter of observed specimens varies between 14 and 22 μm. Areolae are 5–7 in 10 μm in the central area, and about 17 in 10 μm in the marginal field. (Figs. 3–3–6)

Thalassiosira lentiginosa (Janisch) Fryxell, 1977, p. 100, figs. 13, 14.
Coccosidiscus lentiginosus Janisch in Schmidt et al., 1874–79, pl. 58, fig. 11; Casasante, 1886, p. 160, pl. 5, fig. 4; Karsten, 1905, p. 155, pl. 26, fig. 11; Hendey, 1937, p. 248.
Individuals are 37–75 μm in diameter, and have radial rows of areolae, 8–10 in 10 μm. This species was observed in almost all samples of the bay, but mostly rather rare. (Figs. 3–1, 9; 5–1, 2)

Thalassiosira sp. a.
This small Thalassiosira resembles the resting spore of T. antarctica Comber (Hasle and Heimdal, 1968, p. 359, figs. 4, 7, 13; Krebs, 1983, pl. 5, figs. 4a–b, 4d–f) in their radially arranged areolae and in having central pores, but has no row of marginal spines. The diameter is generally 15–35 μm. Areolae are radial, about 7–8 in 10 μm. This species occurred at near-shore sites. (Figs. 3–8a, b)

Thalassiothrix longissima Cleve and Gronow, 1880, p. 108;
The range of length and width could not be defined because of the fragmental nature of valves. The number of marginal punctae is 12–14 in 10 μm. This species was
Figs. 5–1–8. 1, 2. Thalassiosira lentiginosa (Janisch) Fryxell, site B; 1, inside view of whole valve; 2, detail showing marginal area with labiate process and strutted processes. 3. Actinoehusus acinoehusia (Ehrenberg) Simonsen, site V, outside view, whole valve showing radially arranged areolae and pseudonodules (arrow). 4. Azpeitia tabularis (Grunow) Fryxell and Sims, site B, outside view of whole valve. 5, 6. Thalassiosira australis Peragallo, site Y; 5, outside view of whole valve; 6, detail of the same valve showing cluster and ring of strutted processes and occluded processes. 7. Fragilaria (?) sp. a, site V, whole valve showing a line of marginal pores. 8. Cocconeis fasciolata (Ehrenberg) Brown, site V, outside view of whole valve. (scale bars = 10 μm)
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