



TITLE:

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CITATION:

Negoro, Kenichiro. Diatoms from Some Inlandwaters of the Antarctica. Memoirs of the Faculty of Science, Kyoto University. Series of biology. New series 1968, 1(2): 125-138

ISSUE DATE:

1968-03-30

URL:

<http://hdl.handle.net/2433/258774>

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Diatoms from Some Inlandwaters of the Antarctica*

By

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ABSTRACT An author's examination of the algal material collected by two members of the First Wintering Party of the Japanese Antarctic Research Expedition from some inlandwaters of the Antarctica yielded 22 species of diatoms, of which a half belongs to the freshwater forms and another half to the marine forms. G. W. Carlson (1913) has suggested that strong winds may be the most effective factor upon the distribution of marine diatoms into the inlandwaters of the Antarctica. His opinion will be supportable. As the main freshwater diatoms of the Antarctica may be enumerated the following species: *Navicula muticopsis*, *Hantzschia amphioxys*, *Navicula perpusilla*, *Navicula austroshetlandica*, *Achnanthes coarctata* var. *elliptica* etc.

I. Materials

Through the kindness of Prof. Dr. Riozo Yosii (zoologist) of Kyoto University, a member of the Second Japanese Antarctic Research Expedition, I had an opportunity to study the diatom-flora and -communities of some inlandwaters around the Syowa Base on the Ongul Islands in Lützow-Holm Bay, the Antarctica. The present article deals with the results of this study, on which I have already a preliminary report described (K. Negoro, 1961).

The materials afforded me from him for my study were collected by two members of the First Wintering Party, Dr. Seiki Nakano (surgeon) and Dr. Taiichi Kitamura (geophysist), at the following places:

I. East Ongul Island.

- 1) The bottom-muds of some pools in 3 vials; coll. by Dr. Kitamura.
- 2) The algae of a pool in a vial; coll. by Dr. Nakano in February, 1958.

II. Langhovde Mountains.

All the materials of this district were collected by Dr. Kitamura.

- 1) The bottom-muds of some pools in 4 vials.

* Contributions from the Otsu Hydrobiological Station, Kyoto University, No. 194.

- 2) The sand from the bottom of a pool in a vinyl-sac.
 - 3) The paper-like specimens taken up from some pools in 4 vials.
- III. Eutre Island.
- 1) The bottom-mud of a pool in a vial; coll. by Dr. Kitamura on August 14th, 1957.

I wish to express my sincere thanks to Messrs. R. Yosii, S. Nakano and T. Kitamura for giving the opportunity to examine these precious collections.

II. East Ongul Island

On January 29th, 1957, the First Japanese Antarctic Research Expedition succeeded in landing on the Ongul Islands to build the Syōwa Base on the northeast coast of East Ongul Island and to leave here the First Wintering Party composed of 11 members from February 15th, 1957 to February 11th, 1958.

The Ongul Islands consist of two main islands and many small islands scattered around them. The two main islands, i. e. East Ongul Island and West Ongul Island, are separated by a narrow strait about 30 meters broad. These islands are hilly lands, about 30 meters in height, of which the highest summit has an altitude of 48 meters. They are partly covered by snow fields and are composed of injection gneisses and granitic gneisses (gneisses and granodiorites of Pre-Cambrian Period). Some of depressions on these hilly lands are filled by pools or lakelets, whose bottoms are mostly covered by sands and gravels. These pools are free from ice in summer.

Having examined the above-mentioned materials collected from the pools of East Ongul Island, I have found the following 11 species of diatoms, whose frequencies of appearance in the community were shown in the right column:

	Frequency of appearance (%)
<i>Navicula muticopsis</i> van Heurck	45.4
<i>Hantzschia amphioxys</i> (Ehr.) Grunow	32.7
<i>Navicula perpusilla</i> Grunow	14.6
<i>Navicula austroshetlandica</i> Carlson.....	2.6
<i>Achnanthes coarctata</i> (Bréb.) Grunow	
var. <i>elliptica</i> Krasske	2.6
<i>Cocconeis pinnata</i> Greg.	0.6
<i>Amphora libyca</i> Ehr. var. <i>baltica</i> (G. Brander)	
A. Cleve-Euler	0.3
<i>Amphora acutiuscula</i> Kützing	0.3
<i>Diploneis stigmosa</i> Heiden et Kolbe	0.3
<i>Pinnularia borealis</i> Ehr. f. <i>rectangularis</i>	
Carlson	0.3
<i>Coccinodiscus polyradiatus</i> Castracane.....	0.3
	100.0

The dominant species is *Navicula muticopsis* which has been recognized as one of the endemic diatoms in the Antarctica and the subdominant form is *Hantzschia amphioxys*, a cosmopolitan species in the world. *Navicula perpusilla*, which is widely distributed in the mountains of Central Europe and in North Europe, occurs also abundantly. Another endemic fresh-water diatom of the Antarctica, *Navicula austroskottlandica*, is not so abundant here. The diatom community of this island contains three marine forms in relatively small quantity, namely *Cocconeis pinnata*, *Diploneis stigmosa*, and *Coscinodiscus polyradiatus*.

III. Langhovde Mountains

About 15 kilometers south of the Ongul Islands are situated the Langhovde Mountains, which are considered to be a part of the margin of the Antarctic Continent and join the ice sheet at their southeastern border. The mountains are composed of injection gneisses and granitic gneisses as the same state as on East Ongul Island and are mostly free from ice and snow.

These mountains are divided into two parts by glacial troughs in the central part, where exist a number of small lakes filling shallow depressions among low "roches moutonnées" and morains. The northern part of the mountains is a 50-150 m high, gently rolling hill land and there exist several isolated dome-like peaks of 200-400 m height. The southern part of the mountains is plateau-like, 300-400 m high. Some glacial cirques are filled by small lakes. (T. Yoshikawa and H. Toya, 1957).

In the materials collected from small lakes of this district, the following 16 species of diatoms were found. Among them *Cocconeis pinnata*, *Cocconeis costata* var. *pacifica*, *Coscinodiscus polyradiatus*, and *Navicula cryptocephala* are relatively abundant. The diatom-flora is composed of mostly marine species; the fresh-water or submarine species are retracted there.

- Cocconeis pinnata* Greg.
- Cocconeis costata* Greg. var. *pacifica* Grunow
- Coscinodiscus polyradiatus* Castracane
- Navicula cryptocephala* Kützing
- Diploneis stigmosa* Heiden et Kolbe
- Denticula antarctica* (Castr.) Carlson
- Diploneis Smithii* (Bréb.) Cleve ?
- Navicula entomon* Ehr. var.
- Navicula muticopsis* van Heurck
- Amphora proteus* Greg. var. *kariana* Grunow
- Amphora libyca* Ehr. var. *baltica* (G. Brander) A. Cleve-Euler
- Cocconeis diminuta* Pantoczek
- Paralia sulcata* (Ehr.) Cleve var. *crenulata* Grunow
- Actinocyclus bifrons* (Castr.) Mann
- Cymbella norvegica* Grunow

Syneara antarctica Heiden et Kolbe

IV. Eutre Island

The Eutre Island is located ca. 20 km south-west from the Ongul Islands and about 7 km west from the Langhovde Mountains. There are scattered many lakelets of about 100 m² superficies, in one of which the material was collected by Dr. T. Kitamura on August 14th, 1957.

Having examined the material, I found the following 9 species of diatoms:

Coscinodiscus polyradiatus Castracane

Cocconeis pinnata Greg,

Diploneis stigmosa Heiden et Kolbe

Diploneis Smithii (Bréb.) Cleve ?

Denticula antarctica (Castr.) Carlson

Navicula muticopsis van Heurck

Hantzschia amphioxys (Ehr.) Grunow

Achnanthes coarctata (Bréb.) Grunow var. *elliptica* Krasske

Amphora libyca Fhr. var. *baltica* (G. Brander) A. Cleve-Euler

The dominant or subdominant species of this community are *Coscinodiscus polyradiatus* and *Cocconeis pinnata*. There are found both the marine and the freshwater (or submarine) species.

V. Brief Description of Species

A. Centricae

1. Discineae

Fam. Coscinodiscaceae

1) *Paralia sulcata* (Ehr.) Cleve var. *crenulata* Grunow

Syn.: *Melosira sulcata* (Ehr.) Kützing var. *crenulata* Grun. A. Cleve-Euler (1951): Diat. Schweden u. Finnland. Teil I, S. 34-35.

Marine plankter.

Langhovde Mountains. Valves about 14 μ in diameter.

2) *Coscinodiscus polyradiatus* Castracane

Castracane (1886): Diat. Challenger. Botany, Vol. II, p. 161, Pl. III, Fig. 4; Mann (1937): Diat. Aust. Antarc. Exp., p. 45.

Common in the Antarctic Sea.

East Ongul Island, Langhovde Mountains, Eutre Island.

Valves 18-47 μ in diameter.

Fam. Eupodiscaceae

3) *Actinocyclus bifrons* (Castr.) Mann

Syn.: *Coscinodiscus* (?) *bifrons* Castracane

Castracane (1886): Diat. Challenger, p. 156-157, Pl. II, fig. 1; Mann (1937): Diat. Austr. Antarc. Exp., p. 17-19, Pl. I, figs. 2-4.

Plankter in the Antarctic Sea.

Langhovde Mountains. Valves 32-50 μ in diameter.

B. Pennatae

1. Araphidineae

Fam. Fragilariaceae

4) *Synedra antarctica* Heiden et Kolbe

Heiden u. Kolbe (1928): Diat. Deut. Südpol.-Exp., 1901-3, S. 562-563, Taf. 7, Fig. 155.

Plankter in the Antarctic Sea (near Mt. Gauss).

Langhovde Mountains. Valves 150 μ long, 4 μ wide. Striae 9 in 10 μ .

2. Monoraphidineae

Fam. Achnantheaceae

5) *Cocconeis costata* Gregory var. *pacifica* Grunow.

Syn.: *Cocconeis pacifica* Grunow, *Cocconeis imperatrix* Schmidt. Van Heurck (1884): Syn. Diat. Belg., Atlas, Pl. 30, figs. 13, 14; Carlson (1913): Süßwasseralg. Schwed. Südpol.-Exp., Bd. 4, Lief. 14, Taf. III, Fig. 2.

Marine form. Known from California, Chile, Ceylon, Bohemia. In the Antarctic districts, this diatom was found by Carlson (1913) from the Falkland Islands (South Shetland Islands, South Georgia).

Langhovde Mountains. Valves 33-41 μ long, 19-28 μ wide.

6) *Cocconeis diminuta* Pantoczek

Syn.: *Cocconeis disculus* (Schum.) Cleve var. *diminuta* (Pant.) A. Cleve-Euler

Hustedt (1930): Bacill., S. 190-191, Fig. 265; Cleve-Euler (1953): Diat. Schweden u. Finnland, Teil IV, S. 11, Fig. 495 i-1.

A widely distributed, halophile form. Specially often found from many lakes of Holstein, Germany.

Langhovde Mountains. Valves about 15 μ long, 8 μ wide.

Striae of epitheca 10-11 in 10 μ .

7) *Cocconeis pinnata* Gregory

Van Heurck (1884): Syn. Diat. Belg., Atlas, Pl. 30, Figs. 6, 7; Cleve-Euler (1953): Diat. Schweden u. Finnland, Teil III, S. 4, Fig. 487.

Marine diatom. Distributed as same as *C. costata* var. *pacifica*.

East Ongul Island, Langhovde Mountains, Eutre Island.

Valves 40-47 μ long, 22-32 μ wide.

8) *Achnanthes coarctata* (Bréb.) Grunow var. *elliptica* Krasske

Hustedt (1933): Kieselalgen. Rabenhorst's Krypt.-Fl., Bd. VII, Teil 2, Lief. 3, S. 420, Fig. 872 d, e.

Freshwater form. Generally on the wet rocks or moos in the mountains of North Europe. Rarely found in the lowlands of Central Europe.

East Ongul Island, Eutre Island. Valves 30-38 μ long, 8-9 μ wide. Striae 10-13 in 10 μ .

3. Biraphidineae

Fam. Naviculaceae

9) *Diploneis Smithii* (Bréb.) Cleve ?

Hustedt (1930): Bacill. S. 253, Fig. 402; Hustedt (1937): Kieselalg. Teil 2, S. 647-654, Fig. 1051.

Marine or brackish form in North Europe.

Langhovde Mountains. Valves 43-45 μ long, 15.5-17 μ wide. Costae 9-10 in 10 μ .

Eutre Island. Valve 62 \times 32 μ , costae 7-8 in 10 μ .

10) *Diploneis stigmosa* Heiden et Kolbe

Syn.: *Navicula entomon* A. S., *Navicula bomboides* var. *media* Grunow, *Diploneis entomon* (A. S.) Cleve, *Diploneis subcincta* var. *media* Jörgensen. Cleve und Grunow (1880): Arct. Diat., S. 41-42, Taf. III, Fig. 54; Heiden u. Kolbe (1928): Mar. Diat. Deutsch. Südpolar-Exp. 1901-3, S. 613, Taf. 2, Fig. 56.

Marine form in the polar seas (Kara Sea, Southern Ocean).

East Ongul Island, Langhovde Mountains, Eutre Island.

Valves 75-100 μ long, 21-33 μ (Constriction in the middle Part 17-24 μ) wide.

11) *Navicula austroshetlandica* Carlson

Carlson (1913): Süswasseralg. Schwed. Südpolar-Exp., S. 16, Taf. I, Fig. 25.

An endemic freshwater diatom in the South Shetland Islands.

East Ongul Island. Valves 29-45 μ long, 6.5-8.5 μ wide.

Striae 24-25 in 10 μ .

12) *Navicula cryptocephala* Kützing

Hustedt (1930): Bacill., S. 295, Fig. 496.

A cosmopolitan freshwater species. Rarely found in brackish waters.

Langhovde Mountains. Valves 18-29 μ long, 5-6.5 μ wide.

Striae 16 in 10.

13) *Navicula entomon* Ehr. var. (?)

Castracane (1886): Diat. Challenger, p. 28, Pl. XX, fig. 10.

A marine diatom in the Antarctic Sea.

Langhovde Mountains. Valves 22-29 μ long, 8-9 μ wide.

Striae 13-15 in 10 μ .

14) *Navicula muticopsis* van. Heurck

Fritsch (1912): Freshwater Alg. South Orkneys, p. 336, p. 323 (Text figure); Carlson (1913): Süswasseralg. Schwed. Südpolar-Exp., S. 14-15, Taf. I, Figs. 19-21.

A. freshwater diatom in South Orkneys. It is notable that there is a conspicuous isolated point on one side of the middle area of the valve.

East Ongul Island, Langhovde Mountains, Eutre Island.

Valves 21-34 μ long, 8.5-10 μ wide. Striae 14-16 in 10 μ .

15) *Navicula perpusilla* Grunow

Hustedt (1930): Bacill., S. 278, Fig. 459; Cleve-Euler (1953): Diat. Schweden u. Finnland, Teil III, S. 167-168, Fig. 848 a, b.

A freshwater form. Widely distributed in the mountainous districts.

East Ongul Island. Valves 17-36.5 μ long, 4.5-6 μ wide.

Striae 20-24 in 10 μ .

16) *Pinnularia borealis* Ehr. f. *rectangularis* Carlson

Carlson (1913): Süßwasseralg. Schwed. Südpolar-Exp., S. 21, Taf. III, Fig. 15.

A freshwater form in the Falkland Islands.

East Ongul Island. Valve 34 μ long, 8 μ wide. Costae 5 in 10 μ .

17) *Amphora acutiuscula* Kützing

Syn.: *Amphora coffeaeformis* Agardh var. *acutiuscula* (Kütz.) Hust.

Cleve-Euler (1953): Diat. Schweden u. Finnland, Teil III, S. 98, Fig. 686 a, b.

Marine or brackish. An ice-sea form. Known from Ostsee, Gotl. Vrsby.

East Ongul Island. Valves 26-34 μ long, 12-15 μ wide.

Striae 13 in 10 μ .

18) *Amphora libyca* Ehr. var. *baltica* (G. Brander) A. Cleve Euler

Syn.: *Amphora baltica* G. Brander, *Amphoraa ovalis* Kützing var. *libyca* O. Müller

Cleve-Euler (1953): Diat. Schweden u. Finnland, Teil III, S. 90, Fig. 666 e-h.

Freshwater or brackish. Known from South Lapland.

Found as fossil in South Finland.

East Ongul Island, Langhovde Mountains, Eutre Island. Valves 42-44 μ long, 7.5 μ wide. Rows of punctae 10-11 in 10 μ .

19) *Amphora proteus* Gregory var. *kariana* Grunow

Cleve-Euler (1953): Diat. Schweden u. Finnland, Teil III, S. 93, Fig. 673 b, c.

A marine form in the Arctic Sea.

Langhovde Mountains. Valves 48-49 μ long, 8.5-9.5 μ wide. Rows of punctae 10-11 in 10 μ .

20) *Cymbella norvegica* Grunow

Hustedt (1930): Bacill., S. 359-360, Fig. 664.

In North Europe and Alpes.

Langhovde Mountains. Valves 35-37 μ long, 5 μ wide. Striae 12 in 10 μ .
Fam. Epithemiaceae

21) *Denticula antarctica* (Castr.) Carlson

Syn.: *Fragilaria antarctica* (Schwartz) Castracane, *Denticula tenuis* Kütz. var. *antarctica* Fritsch. Castracane (1886): Diat. Challenger, S. 56, Taf. XXV, Fig. 12; Karsten (1905): Phytopl. Antarkt. Meer, S. 122-123, Taf. XVII, Fig. 7-7d; Fritsch (1912): Freshw. Alg. Nat. Antarc. Exp., p. 49, Pl. III, figs. 156, 157; Carlson (1913): Süßwasseralg. Schwed. Südpolar-Exp., S. 31-32, Taf. III, Fig. 21.

A planktonic diatom in the Antarctic Sea.

Langhovde Mountains, Eutre Island. Valves 19.5-22 μ long, 5.5-6 μ wide.

Fam. Nitzschiaceae

22) *Hantzschia amphioxys* (Ehr.) Grunow

Syn.: *Nitzschia amphioxys* (Ehr.) W. Smith. Hustedt (1930): Bacill., S. 394-395, Fig. 747.

A cosmopolitan freshwater diatom.

East Ongul Island, Eutre Island. Valves 75-95 μ long, 8-11 μ wide. Costae 6-9 in 10 μ . Striae 18-20 in 10 μ .

VI. Summary

A careful examination of the algal samples collected by two members of the First Wintering Party from some inlandwaters of the Antactica (around the Syōwa Base of Japan on the Ongul Islands in the Lützow-Holm Bay) yielded the following 22 species of diatom, whose distributions in the collecting districts were also here shown:

	East Ongul Island	Langhovde Mountains	Eutre Island
<i>Paralia sulcata</i> (Ehr.) Cleve			
var. <i>crenulata</i> Grunow	-	+	-
<i>Coccinodiscus polyradiatus</i> Castracane	+	+	+
<i>Actinocyclus bifrons</i> (Castr.) Mann	-	+	-
<i>Synedra antarctica</i> Heiden et Kolbe	-	+	-
<i>Cocconeis costata</i> Gregory			
var. <i>pacifica</i> Grunow	-	+	-
<i>Cocconeis diminuta</i> Pantoczek	-	+	-
<i>Cocconeis pinnata</i> Gregory	+	+	+
<i>Achnanthes coarctata</i> (Bréb.) Grunow			
var. <i>elliptica</i> Krasske	+	-	+
<i>Diploneis Smithii</i> (Bréb.) Cleve ?	-	+	+
<i>Diploneis stigmata</i> Heiden et Kolbe	+	+	+
<i>Navicula austroschetlandica</i> Carlson	+	-	-
<i>Navicula cryptocephala</i> Kützing	-	+	-
<i>Navicula entmon</i> Ehr. var. (?)	-	+	-
<i>Navicula muticopsis</i> van Heurck	+	+	+
<i>Navicula perpusilla</i> Grunow	+	-	-
<i>Pinnularia borealis</i> Ehr.			
f. <i>rectangularis</i> Carlson	+	-	-
<i>Amphora acutiuscula</i> Kützing	+	-	-
<i>Amphora libyca</i> Ehr.			
var. <i>baltica</i> (G. Brander) A. Cleve-Euler	+	+	+
<i>Amphora proteus</i> Gregory			
var. <i>kariana</i> Grunow	-	+	-
<i>Cymbella norvegica</i> Grunow	-	+	-

<i>Denticula antarctica</i> (Castr.) Carlson	—	+	+
<i>Hantzschia amphioxys</i> (Ehr.) Grunow	+	—	+

Among these diatoms, only 5 forms are found from all 3 districts (East Ongul Island, Langhovde Mountains, and Eutre Island), namely *Coscinodiscus polyradiatus*, *Cocconeis pinnata*, *Diploneis Smithii*?, *Navicula muticopsis*, and *Amphora libyca* var. *baltica*.

The species, which are common in 2 districts, are as follows:

- a) East Ongul Island and Langhovde Mountains.....None,
- b) Langhovde Mountains and Eutre Island.....*Denticula antarctica* and *Diploneis Smithii*,
- c) East Ongul Island and Eutre Island.....*Achnanthes coarctata* var. *elliptica* and *Hantzschia amphioxys*.

The dominant or subdominant species of the communities in 3 districts are respectively as follows:

- I. East Ongul Island.....*Navicula muticopsis*, *Hantzschia amphioxys*,
- II. Langhovde Mountains.....*Cocconeis pinnata*, *Cocconeis coarctata* var. *pacifica*,
- III. Eutre Island.....*Coscinodiscus polyradiatus*, *Cocconeis pinnata*.

In the above mentioned diatom-flora, the marine or brackish forms are *Paralia sulcata* var. *crenulata*, *Coscinodiscus polyradiatus*, *Actinocyclus bifrons*, *Synedra antarctica*, *Cocconeis costata* var. *pacifica*, *Cocconeis pinnata*, *Diploneis Smithii*?, *Diploneis stigmosa*, *Navicula entomon* var. (?), *Amphora proteus* var. *kariana* and *Denticula antarctica*, and the freshwater or brackish forms are *Cocconeis diminuta*, *Achnanthes coarctata* var. *elliptica*, *Navicula austroshe-tlandica*, *Navicula cryptocephala*, *Navicula muticopsis*, *Navicula perpusilla*, *Pinnularia borealis* f. *rectangularis*, *Amphora libyca* var. *baltica*, *Cymbella norvegica*, and *Hantzschia amphioxys*.

Only two species, namely *Navicula austroshe-tlandica* and *Navicula muticopsis*, seem to be the endemic freshwater diatoms in the inlandwaters of the Antarctica, at least around the Syōwa Base of the Japanese Antarctic Research Expedition. *Navicula muticopsis* is perhaps the most noticeable species of the diatom-flora of the inlandwaters of the Antarctica.

That the diatom-flora of the inlandwaters in the coastal region of the Antarctica contains many marine species, has already been noticed by G. W. Carlson (1913). He has suggested that strong winds may be the most effective factor upon the distribution of marine diatoms into the inlandwaters. Carlson's opinion will be supportable.

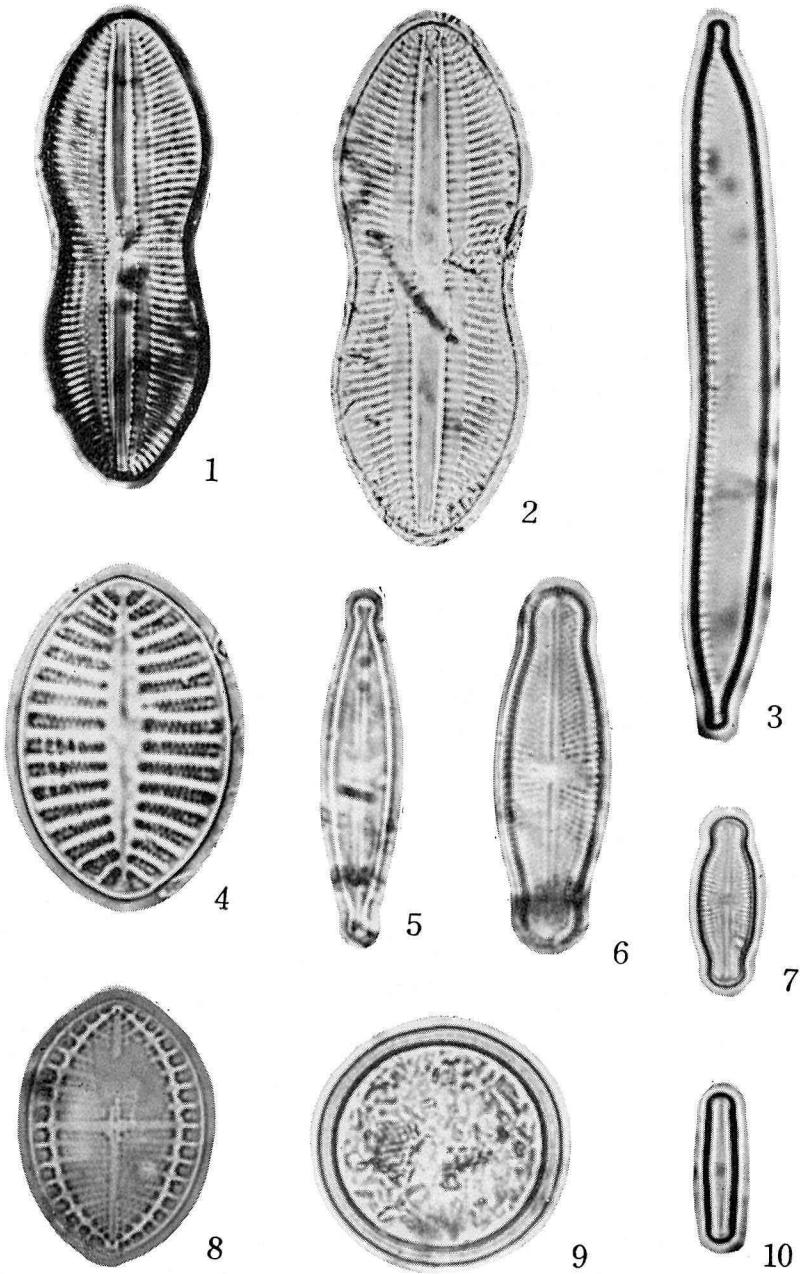
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Explanation of Plates

- Pl. I. Diatoms from some inlandwaters of the Antarctica
Figs. 1, 2. *Diploneis stigmosa* Heiden et Kolbe
Fig. 3. *Hantzschia amphioxys* (Ehr.) Grunow
Fig. 4. *Cocconeis pinnaea* Gregory
Fig. 5. *Navicula austroshetlandica* Carlson
Figs. 6, 7. *Navicula muticopsis* van Heurck
Fig. 8. *Cocconeis costata* Gregory var. *pacifica* Grunow
Fig. 9. *Coscinodiscus polyradiatus* Castracane
Fig. 10. *Navicula perpusilla* Grunow
- Pl. II. Diatoms from some inlandwaters of the Antarctica
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Figs. 13, 14. *Cocconeis pinnata* Gregory
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Figs. 17, 18. *Navicula muticopsis* van Heurck
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Figs. 20, 21. *Navicula cryptocephala* Kützing
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Figs. 30, 31. *Navicula entomon* Ehr. var. (?)
Fig. 32. *Pinnularia borealis* Ehr. f. *rectangularis* Carlson
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Figs. 36, 37. *Amphora proteus* Gregory var. *kariana* Grunow
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Pl. II.

