

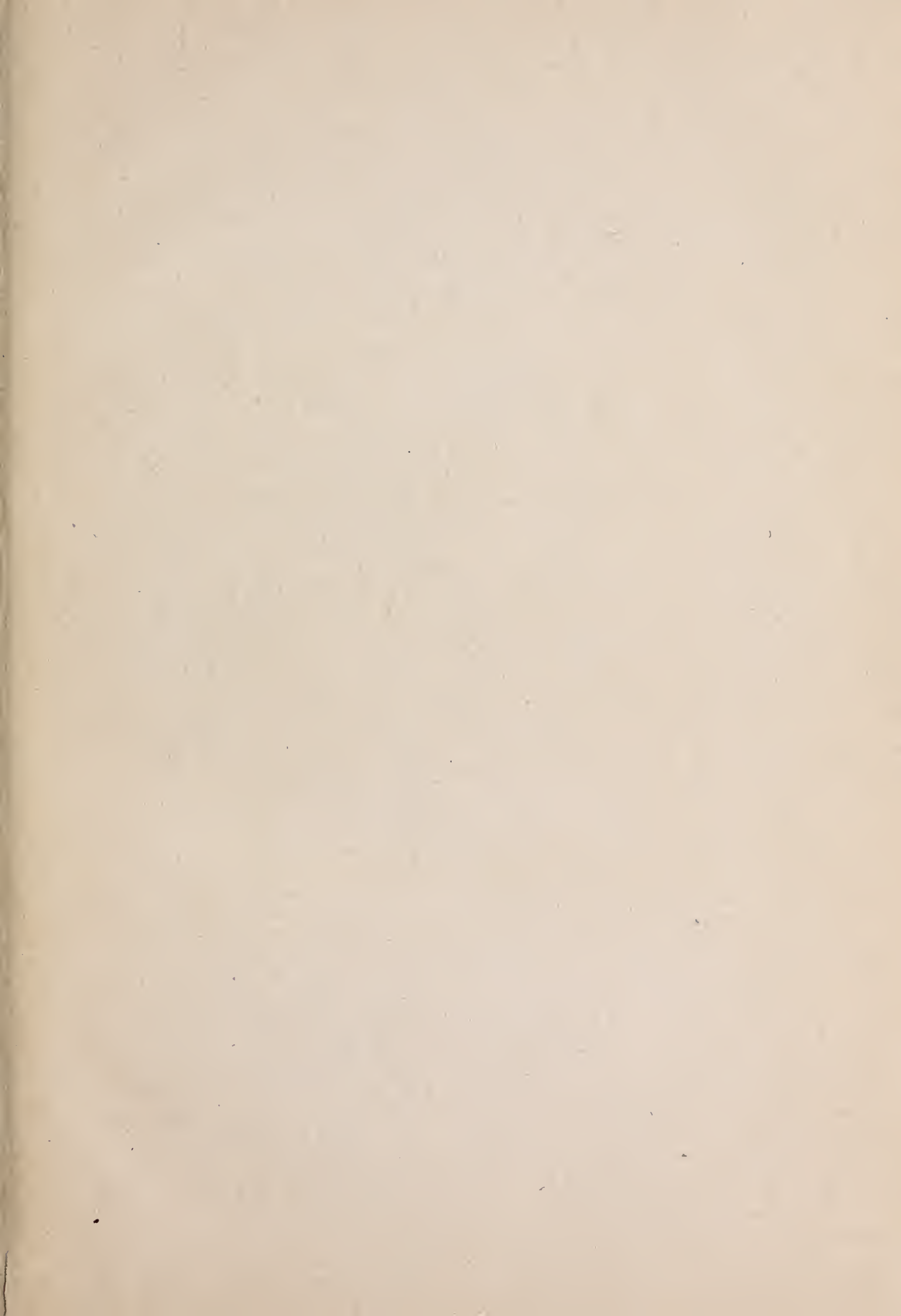
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DIATOMS,  
COLLECTED  
DURING  
THE EXPEDITION OF THE VEGA

EXAMINED

BY

P. T. CLEVE.

(COMMUNICATED 1883, MARCH 27.)

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During the expedition of the Vega Mr. Kjellman collected a number of samples containing diatoms, which with the permission of Prof. Nordenskiöld were delivered to me for examination.

The gatherings were the following:

1. Five bottles with diatoms collected on the ice near Cape Wankarema.

2. Diatoms washed from algæ, collected near Pitlekaj, Cape Deschnew (East Cape).

3. Surface diatoms from the Behring Sea.

4. Fresh-water diatoms from Japan.

5. Diatoms from algæ collected on the Island of Labuan near Borneo.

6. Diatoms washed from algæ collected near Point de Galle, Ceylon, and coarse bottom-mud, dredged in the same locality.

7. Mud from the bottom between Aden and Bab-el-Mandeb.

Besides there were taken several samples of mud from the bottom of the North Siberian sea, which all proved free from diatoms.

For the examination of several of these samples, sufficiently clean slides could not be prepared by the usual cleaning process, so that the specimens must be selected and mounted. In this difficult work I had the good fortune to be helped by the german microscopist Mr. Weissflog, who prepared for me, with the most exquisite skill, slides containing diatoms from Labuan, Ceylon and Bab-el-Mandeb. For this considerable assistance, without which I should hardly have found so many species, I render him my best thanks.

## I. Diatoms of the Arctic Sea.

The first notices about the diatoms of the Arctic Sea have been given in 1841 by Ehrenberg, who examined some

samples from Spitsbergen and later, in 1853, some from Assistance Bay (73° 50' N. lat.)<sup>1</sup>. The limited number of arctic species found by Ehrenberg was considerably increased by O'Meara<sup>2</sup>, who published, in 1860, a list of diatoms, gathered during the arctic expedition of the »Fox» under the command of Sir Leop. M'Clintock. O'Meara enumerates not less than 85 species, among which several are fresh-water inhabitants and some doubtful, the limits of the species being at that time in many cases others than admitted at present.

The Swedish expedition to Spitsbergen, in 1861, under the direction of Torell, procured some material containing marine diatoms, which were examined by myself<sup>3</sup>. Later I obtained better materials, especially many very rich and interesting gatherings from the surface of the northern Atlantic and Davis Strait, collected during the Swedish expedition under Norden-skiöld to Greenland in 1870. The result of the examination of these materials, as well as many others from Spitsbergen, obtained from the Riksmuseum of Stockholm, was published in 1873<sup>4</sup>. Afterwards Mr. O'Meara published a catalogue of species<sup>5</sup> collected by Mr. Eaton on the voyage of Mr. Leigh-Smith. Mr. O'Meara found several new species, which, however, have been figured in such a manner, that the identification may be impossible without original specimens for comparison.

During the Swedish expedition in 1875 and 1876 to the Kara Sea and to Yenisei M. M. Kjellman, Lundström and Stuxberg collected several samples containing diatoms, which were of the greatest interest for the knowledge of the diatoms in the Arctic Sea, east of Spitsbergen. Also has Mr. Kjellman, during his exploration of the algæ of the coasts of Finmarken, collected most rich and interesting materials, containing diatoms from the northern part of Norway. All these materials were examined by Mr. Grunow and myself<sup>6</sup>. During the expedition of the Vega Mr. Kjellman collected extremely rich and important materials on the ice-flakes near Cape Wankarema. The species contained in these samples were numerous and in a most astonishing or almost incredible a manner variable, so that it was in many cases scarcely possible

<sup>1</sup> Monatsber. der Berl. Akad. 1841, page 206 and 1853, page 522.

<sup>2</sup> Journ. Roy. Dublin Soc. 1860 July.

<sup>3</sup> Öfvers. K. Sv. Vet. Akad. Förh. 1867, page 661.

<sup>4</sup> Bihang till K. Sv. Vet. Akad. Handlingar, Vol. I, N:o 13.

<sup>5</sup> Micr. Journ., Vol. XIV (NS) pag. 253.

<sup>6</sup> K. Sv. Vet. Akad. Handl. Vol. XVII, N:o 2, 1880.



to trace out the limits of the species. Also were rich, but less interesting materials obtained from algæ, collected near Cape Deschnew. Several samples of the bottom-mud from the North Siberian Sea were also taken, but in examining them I could not find a trace of diatoms. All the materials from the expedition of the Vega have been examined by myself. Still more materials from the hyperboreal America were collected during the British expedition under the command of Sir George Nares and examined by Mr. G. Dickie<sup>1</sup>. Afterwards I have received, through the kindness of Prof. Oliver, some of these samples. Among them only three were rich enough to be subjected to the usual cleaning-process, viz. from *Bessel's Bay*, 81° 7' N, *Mushroom Point*, 82° 28' N, and *Discovery Bay*, 81° 41'.

The result of my examination of these gatherings are to be found in the following pages. Also from the distant Franz Joseph Land some diatomaceous gatherings have been collected on the ice-flakes during the Austrian expedition under Weyprecht. Some of the species found by Mr. Grunow in these materials have been published in Van Heurck's Synopsis and issued in Cl. and Möller Diat. No 314. Mr. Grunow will later publish in a more complete manner his researches in regard to these most interesting diatoms. The materials brought together from the Arctic Sea are thus very considerable, and their examination may give a tolerably complete idea of the diatomaceous vegetation the Arctic Sea. I have therefore tried to give in the following pages a complete list of all the arctic species, found by myself and by Mr. Grunow, omitting those found by other authors, not being sure about their determinations.

## Index of marine arctic Diatoms.

### A. Placochromaticæ.

#### I. Cocconeidæ.

*Cocconeis Scutellum* Ehb. (Van Heurck Syn. XXIX, 1—12)  
Greenl., Mushroom Point, Fr. J. L.<sup>2</sup>, Spitsb., Finm., Kara,  
Cape Deschnew (East Cape).

<sup>1</sup> Jour. Linn. Soc. Vol. XVII, page 6.

<sup>2</sup> F. J. L. Franz Joseph Land according to Grunow.

var. *stauroneiformis*, Spitsb., Finm., Mushr. P., Cape Deschnew (East Cape).

forma *parva*, — Cape Deschnew (East Cape).

f. *minutissima* Grun. — F. J. L.

*C. distans* Greg. (D. of Cl. Pl. IX, fig. 23, A. Schm. N. Sea Diat. III, fig. 22—23) Mushroom Point, Kara.

*C. pseudomarginata* Greg. (D. of Cl. Pl. IX, fig. 27, *C. pellucida* Grun. Verh 1863 Clev. D. of the A. S. pag. 14) Greenl., Spitsb., Finm., Kara.

*C. dirupta* Greg. (Van Heurck Syn. Pl. XXIX, fig. 13—14) Greenl.

*C. decipiens* Cl. (D. of the A. S. pag. 14, Pl. I, fig. 6, lower valve, Pl. II, fig. 11 *a*, upper valve) striæ on the upper valve 19 in 0,01 mm. — Greenl., Bessel's Bay, Finm.

*C. arctica* Cl. (D. of the A. S. pag. 14, Pl. II, fig. 11 *b*, upper valve). Length 0,03 mm. Br. 0,018 mm. Lower valve with sigmoid median line and coarse striæ, composed of distinct puncta, 12 in 0,01 mm. Central nodule, surrounded by a small area. Upper valve without distinct median line and central nodule. Striæ interrupted, marginal and axial 11 in 0,01 mm.

Pl. 35, fig. 4 *a*, lower, *b*, upper valve.

Greenl., Bessel's Bay, Finm.

*C. costata* Greg. (Van Heurck Syn. Pl. XXX, fig. 11—12) Greenl., Mushroom Point, Spitsb., Finm.

*C. finmarchica* Grun. (Arct. Diat. p. 16 Pl. I, fig. 1) Bessel's Bay, Finm.

*C. quarnerensis* (Grun.) A. Schm. (N. Sea Diat. Pl. III, fig. 15—16) Greenl., Spitsb., Finm.

## 2. Mastogloiaceæ.

*Mastogloia ovata* Grun. (A. Diat. Pl. I, fig. 2) Finm., Kara.

*M. kariana* Grun. (A. Diat. pag. 17, Pl. I, fig. 3) Kara.

## 3. Achnantheæ.

*Achnanthes subsessilis* Kütz. (*Achnanthidium arcticum* Cl. D. of the A. S. p. 25, Pl. IV, fig. 22, *A. brevipes* Ag.) Greenl., Mushroom Point, Spitsb., Finm.

*A. coarctata* (Bréb) Grun. Mushroom Point.

*A. grønlandica* (Cl.) Grun. (*Achnanthid.* Cl. D. of the Arct. Sea, pag. 25, Pl. IV, fig. 23) Greenl., Bessel's Bay (common), Spitsb., Finmark.



The fig. previously published by myself is taken from balsam-mounted specimens and not sufficiently exact, for which reason I have drawn a new sketch of the upper and lower valves Pl. 35, fig. 3 *a*, lower valve, *b*, upper valve.

*A. (hungarica* Grun. var.?) *jamalinensis* Grun. (A. Diat. pag. 20, Pl. I, fig. 4) Kara.

*A. (?) tæniata* Grun. (Arct. Diat. p. 22, Pl. I, fig. 5) Kara.  
var.? *hyperborea* Grun. F. J. L.

*A. delicatula* (Kg.) Grun. (Van Heurck Syn. Pl. XXVII, fig. 3—4) Greenl., Bessel's Bay.

#### 4. Amphoreæ.

*Amphora lævis* Greg. (Grun. Arct. Diat. pag. 24, Pl. I, fig. 8) Kara.

*A. lævissima* Greg. (D. of Cl. pag. 513, Pl. XII, fig. 72) Kara, Finm.

*A. ostrearia* Bréb. (A. Schm. Atl. Pl. XXVI, fig. 23) Finm.  
var. *nova caledonica* Grun.? (A. Schm. Atl. Pl. XXVI, fig. 24) Davis Strait.

var. *vitrea* Cl. (Öfvers. af K. Sv. V. Ak. Förh. 1868, pag. 237, Pl. IV, fig. 5—6) Spitsb. — Length 0,085 mm. Br. 0,068 mm. Striæ, composed of distinct puncta, 9 in 0,01 mm., on the connect. membrane 11 in 0,01 mm.

*A. ocellata* Donk. var. *jamalinensis* Cl. & Grun. (A. Diat. pag. 24, Pl. I, fig. 6) Kara.

*A. Weissflogii* A. Schm. (Atl. Pl. 25, fig. 59) Davis Strait. Length 0,06 mm. Striæ costate, 10 in 0,01 mm.

*A. acuta* Greg. (D. of Clyde, pag. 524, Pl. XIV, fig. 93 and 93 b.) Greenl., Spitsb., Finm.

*A. hyalina* Kütz. (A. Schm. Atl. Pl. XXVI, fig. 52—55) Spitsb.

*A. lineolata* Ehb. Kara (sec. Grun.) Small form with 20—21 striæ in 0,01 mm.

*A. lineata* Greg. (A. Schm. Atl. Pl. XXVI, fig. 59, *A. granulata* Greg.?) Greenl., Bessel's Bay, Spitsb., Finm., Kara.

*A. tenera* W. Sm. (Syn. I, pag. 20, Pl. XXX, fig. 252)? Finm.

*A. coffeæformis* Kütz. (A. S. Atl. Pl. XXVI, fig. 56—58) Kara.

*A. lanceolata* Cl. (Öfvers. K. Sv. Vet. Ak. Förh. 1867, pag. 667, Pl. XXIII, fig. 2) Greenl., Finm., Spitsb., Kara.

Valve acute, median line straight, striæ costate, parallel in the exterior, more or less radiant in the interior part of the valve not reaching the median line. Striæ in typical speci-

mens 8 in 0,01 mm., but vary more dense. In a small specimen var. *minor* Cl. from Pitlekaj Cape Deschnew (East Cape) I counted 14 striæ in 0,01 mm.

*A. angusta* Greg. var. *arctica* Grun. (A. Diat. pag. 24, Pl. I, fig. 29) Spitsb., Kara.

*A. Proteus* Greg. (Diat. of Cl. pag. 518, Pl. XIII, fig. 81) Greenl., Bessel's Bay, Mushroom Point, Spitsb., Finm., Kara.  
var. *kariana* Grun. (A. Diat. pag. 24, Pl. I, fig. 7) Kara, Cape Deschnew (East Cape), Greenland.

*A. robusta* Greg. (D. of Cl. pag. 516, Pl. XIII, fig. 79) Spitsb.  
var.? *A. Schm.* Atl. Pl. XXVII, fig. 44 — Greenl., Spitsb., Cape Deschnew (East Cape).

*A. Erebi* Ehb. (*A. cymbifera* Greg. Diat. of Cl. pag. 526, Pl. XIV, fig. 97, *A. Schm.* Atl. Pl. XXV, fig. 17, 18, 19, 33, 36, Pl. XXVI, fig. 33, *A. Leighsmithiana* O'M.?) Striæ costate. — Greenl. Mushroom Point, Spitsb., Finm., Kara, Cape Deschnew (East Cape).

*A. cymbifera* (Greg.?) Cl. (*A. Schm.* Atl. Pl. XXV, fig. 35) Striæ composed of distinct puncta. — Greenl., Spitsb.

One specimen from Greenl. measures in length 0,12 mm. and has 7 striæ in 0,01 mm.

*A. spectabilis* (Greg.?) *A. Schm.* (Atl. Pl. XL, fig. 20—23. *A. furcata* Leuduger Fortmorel) Davis Strait.

*A. Grevilleana* Greg. Finm.

*A. fasciata* Greg. (Tr. M. S. V. Pl. I, fig. 36, D. of Cl. Pl. XIII, fig. 91) Finm.

*A. complexa* Greg. (D. of Cl. fig. 90) Spitsb., Brandewijne Bay. — Striæ composed of distinct puncta 12 1/2 in 0,01 mm. on the valve, 17 in 0,01 mm. on the connecting membrane.

*A. Arcus* Greg. (T. M. Soc. V. pag. 75, Pl. I, fig. 37) Spitsbergen, Hinlopen Strait.

*A. Eunotia* Cl. (D. of the A. S. pag. 21, Pl. III, fig. 17) Greenl., Finm., Spitsb., Kara.

Specimens from Spitsbergen have 7 1/2 striæ in 0,01 mm. on the valve and 11 in the connecting membrane.

*A. crassa* Greg. (D. of Cl. pag. 524, Pl. XIV, fig. 94) Greenl., Spitsb., Finm., Kara, Cape Deschnew (East Cape).

*A. subinflata* Grun. (A. S. Atl. Pl. XXVI, fig. 49) Finm.

*A. plicata* Greg. (T. M. S. V. pag. 70, Pl. I, fig. 31) Spitsb.

*A. (baltica* Grun. var.?) *arctica* Grun. (Cl. & M. Diat. No 172) Davis Strait. Not known to me.



## 5. Gomphonemeæ.

*Rhoicosphenia curvata* (Kütz) Grun. (*Gomphonema curvata* and *G. marina* W. Sm. Syn. 1, Pl. XXIX, fig. 245—246) Greenl., Bessel's Bay, Spitsb., Finm., Cape Deschnew (East Cape).

*Gomphonema kamtschaticum* Grun. (Casp. S. Alg. pag. 12, Pl. III, fig. 4. Van Heurck Syn. Pl. XXV, fig. 29) Greenl., Bessel's Bay (a small form, length 0,03 mm. br. 0,005 mm. Striæ 15 in 0,01 mm. in the middle 18 in the end.) Mushroom Point. Cape Wankarema (var. *sibirica* Grun. in Cl. M. Diat. 315—318, more slender and linear; striæ less radiant.)

*G. pachycladum* Bréb. (Van Heurck Syn. Pl. XXV, fig. 31—32) Cape Wankarema. Striæ parallel, 16 in 0,01 mm. Length 0,027 mm. Br. 0,006 mm.

*G. arcticum* Grun. (Van Heurck Syn. Pl. XXV, fig. 30) F. J. L., Novaya Zemlya (on the ice), Cape Wankarema.

## 6. Naviculaceæ.

*Navicula* Bory.

Sectio: *Pinnularia*.

*Navicula Pinnularia* Cl. (Öfvers. af K. Sv. Vet. Ak. Förh. 1868, pag. 224, Pl. IV, fig. 1—2. *N. quadratarea* A. S. N. Sea Diat. Pl. II, fig. 26) Greenl., Mushroom Point, Spitsb., Finm., Kara, Cape Wankarema.

In the Cape Wankarema material occur a number of varieties. The valve varies from subconstricted to gibbous in the middle with all possible transitions to *N. Stuxbergii* Cl. The striæ are in some specimens from the same locality interrupted and vary from 9 to 12 in 0,01 mm. var. *interrupta* Cl. Pl. 36, fig. 21.

Another variety, *asymmetrica* Cl., has the striæ on one half of the valve more approximate to the median line, than on the other. Length 0,08. Br. 0,018, striæ 8 in 0,01 mm. obscurely punctate.

*N. Stuxbergii* Cl. (A. Diat. pag. 13, Pl. I, fig. 15) F. J. L., Kara, Cape Wankarema.

var. *subcontinua* Grun. F. J. L. (unknown to me).

var. *leptostauron* Grun. F. J. L. (unknown to me).

*N. fluminensis* Grun. (Verh. 1860 pag. 520, Pl. I, fig. 7) Kara.

var. *minor* Grun. (A. Diat. pag. 28, Pl. I, fig. 12) Finm.

*N. cruciformis* Donk. (Brit. Diat. Pl. X, fig. 4) Finm.

var. *brevior* Cl. — Length 0,035 mm. Br. 0,009 mm. Str. 14 in 0,01 mm. Cape Deschnew (East Cape). — Pl. 35, fig. 18.

\* *Théelii* Cl. (A. Diat. pag. 13, Pl. I, fig. 22) Kara, Cape Deschnew (East Cape). Specimens from Cape Deschnew (East Cape) have the length 0,05 mm. and the br. 0,018 mm. Striæ 12 in 0,01 mm. In the Cape Deschnew (East Cape) material occur some specimens, which seem to connect *N. Théelii* with *N. Pinnularia*.

*N. decurrens* (Ehb.) Grun. In the Cape Deschnew (East Cape) gathering occurs a *Navicula*, which Grunow refers to *N. decurrens*. It has about 11 costate and radiant striæ in 0,01 mm., which do not reach the median line. Length 0,06 mm. Breadth 0,013 mm. The valve is linear with gibbous middle and rounded obtuse ends. Median line is slightly undulating. In some specimens the striæ are absent in the middle of the valve, in which case the form seems to be closely allied with *Nav. cruciformis* although the latter has the striæ reaching to the median line. On the other side it seems also akin to *Nav. bicapitata* Ldt. — Pl. 36, fig. 20.

*N. globiceps* var. *crassior* Grun. (A. Diat. pag. 27, Pl. I, fig. 13) Kara (fresh-water species?).

*N. megastauros* Cl. — Small, elliptic, probably depressed in the middle. Striæ costate, oblique, reaching the median line, except in the middle, where they are very short or marginal, so that the central nodule is surrounded by a large stauros. Striæ 16 in 0,01 mm. Length 0,02 mm. Breadth 0,008 mm. Cape Deschnew (East Cape). — Pl. 36, fig. 19.

*Sectio: Limosæ.*

*N. ventricosa* (Ehb.?) Donk var. *subundulata* Grun. (A. Diat. pag. 29, Pl. I, fig. 16) Kara.

var. *Kjellmaniana* Cl. (A. Diat. pag. 29, Pl. I, fig. 17) Finm.

*N. subventricosa* Grun. (A. Diat. pag. 29, Pl. I, fig. 19) Kara.

*N. liber* W. Sm. (A. S. Atl. Pl. L, fig. 16—18) Greenl., Spitsb., Finm.

var. *elongata* Grun. (*N. elongata* Grun. A. S. Atl. Pl. L, fig. 27—29).

*N. Scopulorum* Bréb. — Cape Deschnew (East Cape); a large specimen, 0,17 mm. in length, 0,01 mm. in breadth; striæ 23 in 0,01 mm.

*Sectio: Quadriseriatæ.*

*N. subdivisa* Grun. (A. Diat. pag. 29, Pl. I, fig. 20) Greenl., Mushroom Point, Kara, Cape Deschnew (East Cape).



A specimen from Cape Deschnew (East Cape) has 21 striæ in 0,01 mm. in the middle and 23 near the ends. Length 0,035 mm. Br. 0,005 mm.

*N. latefasciata* Grun. (A. Diat. Pl. I, fig. 21) Greenl., Mushroom Point, Kara, Cape Deschnew (East Cape).

Specimens from Cape Deschnew (East Cape) have not so strongly interrupted striæ as specimens from Kara.

*N. grønlandica* Cl. (K. Sv. Vet. Ak. Handl. 18 No 5, pag. 7, Pl. I, fig. 13) Davis strait.

*Sectio: Palpebrales.*

*N. palpebralis* Bréb. var. Davis Strait. — Length 0,045 mm. Breadth 0,013 mm. Striæ 10 in 0,01 mm. costate, scarcely punctate.

var. *minor* Grun. (A. Diat. pag. 30, Pl. I, fig. 23) Finm.

A variety from Spitsbergen has 16 striæ in 0,01 mm. Length 0,04 mm. Breadth 0,008 mm. *N. minor* Greg.

*N. semiplena* (Grev.) Donk (Brit. Diat. Pl. IV, fig. 5) Finm., Spitsb. (Length 0,065 mm. Breadth 0,001 mm. Striæ 10 in 0,01 mm.).

*N. solida* Cl. (A. Diat. pag. 13, Pl. I, fig. 24) Finm.

*Sectio: Amphibænae.*

*N. brevis* Greg. (Diat. of Cl. pag. 478, Pl. IX, fig. 4, A. Schm. N. Sea Diat. Pl. II, fig. 15) Greenl., Davis Strait, Finm., Spitsb., Cape Deschnew (East Cape).

var. *vexans* Grun. (A. Schm. N. Sea Diat. Pl. II, fig. 14) Finm., Matotschkin, Kara.

var. *distoma* Grun. (A. Diat. pag. 30, Pl. I fig. 25—26) Finm.

*N. amphibæna* var. *fuscata* (Schum) Grun. (A. Diat. pag. 31, Pl. I, fig. 27) Kara.

*N. subsalina* Donk. (Brit. Diat. Pl. IV, fig. 2, *N. Fenzlii* Grun. *N. lacustris* Grun.) Greenl., Spitsb., Finm.

*Sectio: Radiosæ.*

*N. flantica* Grun. has been indicated in Cl. Diat. of the A. S. pag. 17 as an arctic species. I have, however, not found this species in reexamining my old slides, so there may be a mistake in the determination.

*N. Gastrum* (Ehb.?) Donk. (Van Heurck Syn. Pl. VIII, fig. 25 and 27) Kara, Cape Deschnew (East Cape) (Fresh-water species?).

var. *jenisejensis* Grun. (A. Diat. pag. 31, Pl. I, fig. 28) Cape Deschnew (East Cape).

*N. digito-radiata* Greg. (A. Schm. N. Sea Diat. Pl. III, fig. 4) Greenl., Mushroom Point, Finm., Spitsb., Kara.

*N. peregrina* (Ehb.?) Kütz. (Van Heurck Pl. VII, fig. 2, A. Schm. Atl. Pl. XLVII, fig. 57—60) Greenl., Mushroom Point, Kara, Cape Wankarema.

var.? *polaris* Ldt. (Bih. t. K. Sv. Vet. Ak. Handl. I, No 14, pag. 26, Pl. II, fig. 3) Kara.

*N. valida* Cl. at Grun. (A. Diat. pag. 32, Pl. II, fig. 29) Kara, Cape Wankarema.

In the latter locality *N. valida* occurs in a great profusion of varieties, which are all asymmetric, the striæ on one half of the valve being more approximate to the median line than on the other. The striæ are always distinctly transversely lineate. One variety *minuta* Cl. has not alternately longer and shorter striæ in the middle. Striæ 8 in 0,01 mm. Length of the valve 0,025 mm. Br. 0,013 mm. Typical specimens have the length 0,08 mm., the breadth 0,023 mm. and 8 striæ, which in the middle are alternately longer and shorter. One variety is 0,11 mm. in length and 0,026 mm. in breadth, has 8 striæ in 0,01 mm., scarcely alternately longer and shorter in the middle, and is very asymmetric. It comes near to *N. distans* var. *borealis* Grun, but has more dense striæ. It approaches also fig. 17 and 18 in A. Schm. Atl. Pl. XLVI, which, however, are not distinctly asymmetric.

*N. imperfecta* Cl. — Broadly oval, 0,065 mm. in length and 0,03 mm. in breadth. Striæ coarse, minutely transversely lineate, on one half of the valve more approximate to the med. line than on the other, shortened around the central nodule, 8 in 0,01 mm., interrupted. — Pl. 36, fig. 34. — Kara, Cape Wankarema.

This form comes near to *N. valida*, but differs in its striæ, which are much less distinctly transversely lineate and many times interrupted, so that they seem to be composed of fragments.

*N. Placentula* var. *lanceolata* Grun. (A. Diat. pag. 34) Kara.

*N. salinarum* Grun. (A. Diat. pag. 33, Pl. II, fig. 34) Spitsb., Kara.

*N. rhynchocephala* Kütz (Grun. A. Diat. pag. 33) Kara, Cape Deschnew (East Cape).

*N. bottnica* Grun. (A. Diat. pag. 32, Pl. II, fig. 32) Finm.

*Sectio: Directæ.*

*N. directa* W. Sm. In the gatherings collected by Mr. Kjellman on the ice of Cape Wankarema occurs an almost incredible profusion of varieties and forms, all connected with each other and more or less akin to *N. directa*. Many of these forms are very different to the outline, number of striæ, which are entire or more or less interrupted, always distinctly transversely lineate. Many of these forms are distinctly asym-



metric, others not. There are also closely allied forms, which have *arcuate* valves and therefore belong to *Rhoikoneis*. The *Rh. Bolleana* Grun. is really nearly allied to the group of *Nav. directa*. Although all the forms of this section in my opinion are nearly allied, it may be necessary to name them and arrange them.

To *N. directa* I refer all slender, or almost linear forms, about 10 times longer than broad, which have parallel striae, shortened around the central nodule.

var. *remota* Grun. (A. Schm. Atl. Pl. XLVII, fig. 2) striae 4—5 in 0,01 mm. — Finm., Spitsb., Kara (Matotschkin Schar).

var. *Incus* Grun. (A. Schm. Atl. Pl. XLVII, fig. 7 from the Mediterranean Sea) Striae 4 in 0,01 mm. very slightly radiant, on one half of the valve interrupted. I have not seen typical specimens from the Arctic Sea.

var. *angusta* Grun. (A. Diat. pag. 39) striae 8 in 0,01 mm. Greenl. (Mushroom Point), Finm., Spitsb., Kara, Cape Deschnew (East Cape). Seems to me to be the typical *N. directa* W. Sm.

var. *subtilis* Greg. (Pinnul.? subt. Greg. D. of Cl. pag. 488, Pl. IX, fig. 19) striae 9—11 in 0,01 mm. Spitsb., F. J. L., Cape Deschnew (East Cape), Cape Wankarema.

var.? *decussatim-striata* Grun. — F. J. L. (unknown to me).

*N. transitans* Cl. — Intermediate forms between *N. directa* and *N. Zostereti* Grun. Valves more or less abbreviate, lanceolate. Striae parallel or slightly radiant.

forma *genuina*. — 6 to 4 times longer than broad, lanceolate. Striae coarsely lineate, 8 in 0,01 mm. almost parallel, shortened around the central nodule. Length 0,065 to 0,09 mm. Breadth 0,016 mm. to 0,02 mm. — Cape Wankarema. — Pl. 36, fig. 31 and 33.

var. *derasa* Grun. (*Nav. derasa* Grun. A. Diat. pag. 39, Pl. II, fig. 46). Striae on both sides of the median line interrupted by a linear area, 8 1/2—12 in 0,01 mm. in the middle, 10—14 near the ends, not so strongly transversely lineate as in typical specimens, (according to Grunow the striae are 10 in 0,01 mm. in the middle and 16 at the ends). Length 0,067 mm. Breadth 0,015 mm. — Kara, Cape Wankarema, Cape Deschnew (East Cape).

forma *minuta*. — Striae 12 in 0,01 mm., distinctly transversely lineate. Length 0,035 mm. Breadth 0,012 mm. — Cape Deschnew (East Cape). Pl. 36, fig. 37.

form. *gracilentata* Grun. l. c. Kara.

*N. incudiformis* Grun. (*N. Incus abbreviata* Grun. A. Diat.

pag. 39, Pl. II, fig. 43) Striæ 8 in 0,01 mm. on one half of the valve more approximate to the median line than on the other, and on this half interrupted. Length 0,095—0,05 mm. Valves sometimes arcuate.

Cape Wankarema. Pl. 36, fig. 26, 30.

This variety seems to connect *Nav. (Rhoikoneis) superba* Cl. with *N. transitans*.

*N. Zostereti* Grun. — More or less lanceolate. Striæ slightly radiant, distinctly transversely lineate; striæ 5 to 12 in 0,01 mm., more approximate at the ends.

forma *genuina* (A. Schm. Atl. Pl. XLVII, fig. 42—44 with about 7 striæ in 0,01 mm.). Specimens from Kara have 9 striæ in 0,01 mm. Length 0,1 mm. Breadth 0,02 mm.

var. *acutiuscula* Greg. (Pinn. acutiuscula Greg. T. M. Soc. IV, pag. 48, Pl. V, fig. 21) Striæ about 11 in 0,01 mm. — Kara. (Length 0,06 mm. Br. 0,01 mm.)

*Nav. longa* Greg. (l. c. fig. 18) with 5 str. in 0,01, may perhaps be regarded as a form of *N. Zostereti*, were not the median line described as generally twisted, which character seems to indicate that *N. longa* is a *Scoliopleura*.

*N. erosa* Cl. — More or less elliptic, about 5 times longer than broad, tapering regularly from the middle to the ends. Striæ coarse, 7 1/2—10 in 0,01 mm., transversely finely lineate, a little radiant, interrupted, so that they have the appearance of being composed of fragments. Central nodule surrounded by a small area. Length 0,1 mm. Breadth 0,02 mm. — Pl. 36, fig. 28. — Cape Wankarema.

*N. (Rhoikoneis) trigonocephala* Cl. N. Sp. — Linear with parallel sides and cuneate, sometimes protracted ends. Valves often arcuate. Striæ coarse 10—12 in 0,01 mm., almost parallel, interrupted as in *N. erosa*, transversely lineate. Length 0,05—0,065 mm. Breadth 0,01—0,012 mm. — Pl. 36, fig. 29. — Cape Wankarema.

*N. asymmetrica* Cl. N. Sp. — Elongated elliptic, 4—5 times longer than broad. Striæ almost parallel, interrupted, 9 1/2 in 0,01 mm., transversely lineate, on one half of the valve reaching the median line, on the other ending at some distance from it. Length 0,1 mm. Breadth 0,023 mm. — Pl. 36, fig. 27. — Cape Wankarema.

Perhaps an asymmetric variety of *N. erosa*.

*N. (Rhoikoneis) superba* Cl. Valves rhombic, arcuate (or sometimes straight), convex and concave valves being more or less different. Striæ almost parallel, transversely lineate, on the



*convex* valve 9 in the middle, 10 in 0,01 mm. toward the ends, reaching almost to the median line; on the *concave* valve 8—10, on one side of the valve not reaching the median line, on the other reaching the median line, but interrupted by a linear area.

Length 0,06 mm. Breadth 0,02 mm. — Pl. 36, fig. 23.

Cape Wankarema.

var. *elliptica* Cl. Valve elliptic. Striæ parallel, 10 in 0,01 mm. Length 0,065 mm. Breadth 0,02 mm. — Pl. 36, fig. 24. — Cape Wankarema.

The concave valve of this variety is scarcely different from *N. incudiformis* Grun.

*N. (Rhoikoneis) obtusa* Cl. N. Sp. (*Rhoic. obtusa* Cl. in Cl. & Möll. Diat. 315—318) Elongated, linear, with rounded obtuse ends. Striæ curved, not parallel, very faintly lineate, on one half of the valve reaching the median line, on the other ending at some distance, irregularly interrupted, 11 in 0,01 mm. Length 0,075 mm. Breadth 0,014 mm. — Pl. 36, fig. 25. — Cape Wankarema.

*N. (Rhoikoneis) Bolleana* Grun. (Verh. 1863, pag. 147, Pl. XIII, fig. 11) Greenl., Spitsb., Finm., Kara (Matotschkin), Cape Wankarema.

Specimens from Greenland have 8 radiant striæ in 0,01 mm. in the middle, 12 near the ends. Specimens from Wankarema are less arcuate, have in 0,01 mm. 10 striæ, which are almost parallel. The striæ are transversely finely lineate as in all species of the *directa*-group. Mr. Grunow has named this variety from Wankarema *Rh. Bolleana* var.? *Siberica* (Cl. & Möll. Diat. No 302.) — Pl. 37, fig. 38. — Another variety from Cape Wankarema has asymmetric striation and 11 striæ in 0,01 mm. var. *asymmetrica* Cl. length 0,045 mm. breadth 0,01 mm. Pl. 37, fig. 39.

*N. kariana* Grun. (A. Diat. pag. 39, Pl. II, fig. 44) Kara, F. J. L., Cape Wankarema.

*a. genuina* Striæ 12—14 in 0,01 mm. Length 0,085 mm. Breadth 0,026 mm. — Kara, F. J. L., Cape Wankarema.

*β. deterosa* Grun. Mpt. Striæ interrupted on both sides of the median line by more or less broad areas. Length 0,09 mm. Breadth 0,024 mm. — Kara, F. J. L., Cape Wankarema. — Pl. 36, fig. 36.

*γ. minor* Grun. (A. D. pag. 5. *N. frigida* Grun. A. D. pag. 39) Striæ 16—18 in 0,01 mm. Length 0,044—0,07 mm. Breadth 0,012—0,013 mm. — Kara, F. J. L.

forma *curta* Cl. Length 0,03—0,04 mm. Breadth 0,009—0,01 mm. Striæ 12 in 0,01 mm. — Davis strait, Cape Wankarema. Cape Deschnew (East Cape). — Pl. 37, fig. 40.

*N. kariana* Grun. passes over to *N. transitans*, which scarcely differs in anything but coarser striæ and is by the latter connected with *N. Zostereti* and *N. directa*. According to Grunow the lineation of the striæ of *N. Kariana* forms longitudinal fine lines, which may be explained by the approximation of the striæ. Nearly allied to *N. Kariana* seems to me to be the following species.

*N. subimprensa* Grun. (A. Diat. pag. 39, Pl. II, fig. 45) Kara. var.? *tenuior* Cl. Length 0,038 mm. Breadth 0,015 mm. Striæ 18 in 0,01 mm. — Pl. 37, fig. 49. — Cape Deschnew (East Cape).

*N. distans* Sm. (Syn. I, pag. 56, Pl. XVIII, fig. 169) Greenl., (Davis strait) Spitsb., Finm.

var. *borealis* Grun. (A. Diat. pag. 38, Pl. II, fig. 42) Spitsb., Finm.

*Sectio: Retusæ.*

*N. fortis* Greg. (A. Schm. Atl. Pl. XLVI, fig. 37—39) Greenl., Spitsb.

*N. opima* Grun. (A. Schm. Atl. Pl. XLVI, fig. 25—26) Greenl., (Davis strait).

*N. jamalinensis* Cl. (A. Diat. pag. 13, Pl. II, fig. 40) Jalmal, Cape Deschnew (East Cape).

*N. cancellata* Donk. var. *imprensa* Ldt. (*N. impressa* Ldt. Bih. t. K. Sv. Vet. Ak. Handl. B. III, No 15, pag. 33, fig. 3) Greenl. (Davis strait), Finm., Kara.

var. *Gregorii* Grun. (A. Diat. pag. 37) Finm., Kara.

var. *subapiculata* Grun. (l. c.) Kara.

var. *Schmidtii* Grun. (l. c.) Spitsb., Cape Deschnew (East Cape).

var. *minuta* Grun. (l. c.) Finm., Cape Deschnew (East Cape).

*N. inflexa* Greg. (A. Schm. Atl. Pl. XLVI, fig. 69—70) Kara.

*N. retusa* Bréb. Cape Wankarema.

I give a delineation of a specimen from Cape Wankarema, according to Grunow the typic *N. retusa*. It has been drawn Pl. 36, fig. 35 a, b, from a dry specimen in two different foci.

*Sectio: Decipientes.*

*N. Lundströmii* Cl. (A. D. pag. 13, Pl. II, fig. 29) Kara.

*N. plicata* Donk. (B. D. Pl. IX, fig. 21) Kara.

*N. subinflata* Grun. Mpt. — Linear oblong, more or less gibbous in the middle, with rounded obtuse ends, very convex. Central striæ stronger and more distant, the others rather pa-



rallel, reaching the median line. Length 0,04 mm. Breadth 0,008 mm. — Pl. 37, fig. 50. — Greenl. (Bessel's Bay), Cape Wankarema.

*Sectio: Punctatae.*

*N. pusilla* Sm. var *jamalinensis* Grun. (A. Diat. pag. 40, Pl. II, fig. 40) Kara (Fresh-water species?).

*N. marina* Ralfs (Prit. Inf. pag. 903, W. Sm. Syn. I, pag. 52, Pl. XVI, fig. 151) Greenl. (Davis strait), Finm., Kara (Matotschkin).

*N. cluthensis* var.? *finmarchica* Grun. (A. Diat. pag. 40, Pl. II, fig. 49) Finm.

*N. septentrionalis* Cl. (A. Schm. Atl. Pl. VI, fig. 37) Greenl. (Mushroom Point), Spitsb., Kara (Matotschkin).

*N. glacialis* Cl. (*Cocconeis gl.* Cl. D. of the A. S. pag. 14, Pl. III, fig. 12, A. Schm. Atl. Pl. VI, fig. 35—39 typical) Greenl., Spitsb., Kara (Matotschkin, Jalmaal), Cape Wankarema. In the latter locality there occur a number of varieties quite different from the typical form. In Pl. 37, fig. 41 I have figured a small variety, which seems to have very little to do with the typical forms.

*N. humerosa* Bréb. (A. Schm. Atl. Pl. VI, fig. 3—5) Finm., Spitsb., Kara (Jalmaal).

*N. latissima* Bréb. (A. Schm. Atl. Pl. VI, fig. 7) Finm.

*Sectio: Didymæ.*

*N. Bombus* Ehb. (*N. gemina* A. Schm. N. Sea D. Pl. I, fig. 1) Finm.

*N. splendida* Greg. (T. M. S. IV, pag. 44, fig. 14) Greenl., Beeren Id, Finm., Spitsb.

*N. interrupta* Kütz (A. Schm. Atl. Pl. XII, fig. 1—5) Greenl., (Mushroom Point), Finm., Spitsb., Kara (Matotschkin, Jalmaal).

*N. didyma* Kütz (A. Schm. Atl. Pl. XIII, fig. 1—3) Greenl. (Davis strait), Finm., Spitsb., Kara.

*N. Crabro* Ehb. (A. Schm. N. Sea Diat. Pl. I, fig. 5—6, Pl. II, fig. 4) Finm.

*N. bomboides* var. *media* Grun. (A. Diat. pag. 41, Pl. III, fig. 54) Greenl. (Mushroom Point), Finm., Spitsb., Kara (Matotschkin).

*N. Donkinii* A. Schm. (N. Sea Diat. Pl. II, fig. 8, Pl. I, fig. 12) Finm.

*N. incurvata* Greg. (A. Schm. N. Sea D. Pl. I, fig. 10—11, Pl. II, fig. 6) Finm.

*N. subcineta* A. Schm. (N. Sea D. Pl. II, fig. 7. *N. didyma* Ldt. Bih. t. K. Sv. Vet. Ak. Handl. III, No 15, pag. 37, fig. 4) Finm., Kara (Matotschkin).

*Sectio: Ellipticæ.*

*N. littoralis* Donk. (A. Schm. Atl. Pl. VIII, fig. 23—25) Greenl. (Mushroom Point) Finm., Kara, Cape Deschnew (East Cape).

*N. Smithii* Bréb. (A. Schm. Atl. Pl. VII, fig. 14—22) Greenl. (Mushroom Point) Finm., Spitsb., Kara (Matotschkin, Jalmal), Cape Deschnew (East Cape).

*N. fusca* Greg. (A. Schm. Atl. Pl. VII, fig. 1—4) Finm., Matotschkin Schar.

*N. æstiva* Donk. (A. Schm. Atl. VIII, fig. 26) Finm., Cape Wankarema.

*N. suborbicularis* Greg. (A. Schm. Atl. Pl. VIII, fig. 2—5) Greenl. (Davis strait).

*N. Eudoxia* A. Schm. (Atl. Pl. VIII, fig. 40) Cape Wankarema.

*N. Tschuktschorum* Cl. N. Sp. — Small, oval with rounded ends. The middle of the valve has, as in *N. Lyra*-section, two arcuate, convergent thickenings, connected by a transverse bar at the centre. The space between the margin and the thickenings has coarse, costate striæ, 13 in 0,01 mm. Length 0,01 mm. Br. 0,0065. — Pl. 37, fig. 48. — Cape Deschnew (East Cape).

This species comes nearest to *N. Reichardii* Grun. (Van Heurck Syn. Pl. X, fig. 9) which is larger and has closer, punctate striæ. The *N. Mauleri* R. J. Brun (Diat. des Alpes et du Jura Pl. I, fig. 18) is also an allied form, but more nearly related to *N. Borussica* Cl. (Schr. phys. oek. Ges. zu Königsberg Bd. XXII, pag. 139, A. Schm. Atl. Pl. VIII, fig. 17) in Dombritten deposit.

*Sectio: Lyrae.*

*N. pygmæa* Kütz. (A. Schm. N. Sea Diat. Pl. I, fig. 43) Finm., Spitsb., Kara, Cape Deschnew (East Cape).

*N. abrupta* Greg. (A. Schm. l. c. Pl. I, fig. 37) Finm., Spitsb.

*N. hyalina* Donk. (Brit. Diat. Pl. I, fig. 1) Finm.

*N. forcipata* Grev. (A. Schm. N. Sea Diat. Pl. I, fig. 45, Pl. II, fig. 16 & 18) Greenl. (Davis strait).

*N. spectabilis* Greg. (Diat. of Cl. pag. 481, Pl. IX, fig. 10) Greenl.

*N. circumsecta* Grun. (A. Schm. Atl. Pl. III, fig. 27—28) Finm.

*N. Henedyi* Sm. (A. Schm. N. Sea Diat. Pl. I, fig. 41) Greenl., Finm., Spitsb., Kara (Matotschkin).

*N. Lyra* Ehb. (A. Schm. Atl. Pl. II, fig. 16) Greenl., Finm., Spitsb., Kara (Matotschkin).

var. *elliptica* A. Schm. (N. Sea Diat. Pl. I, fig. 38—39) Greenl. (Mushroom Point), Finm., Kara.



*N. kryophila* Cl. — Elliptic oblong or elliptic with parallel sides. Striæ coarse, costate, about 8 in 0,01 mm., interrupted by large areas on both sides of the median line, over which areas the faint continuations of the striæ are visible. Length 0,05. Br. 0,018 mm. — Pl. 37, fig. 43. — Cape Wankarema.

*N. (kryophila var.?) gelida* Cl. — Elliptic. Striæ short, marginal, 9 in 0,01 mm., costate, separated from very short striæ on both sides of the median line by large areas, over which traces of the striæ are visible. Central nodule surrounded by a circular area. Length 0,08 mm. Breadth 0,04 mm. — Pl. 37, fig. 42. — Cape Wankarema.

*Sectio: Pseudo-amphiprora.*

*N. arctica* Cl. (K. Sv. Vet. Ak. Handl. XVIII, No 5, pag. 3) Finm., Kara (Matotschkin).

*Sectio: Complexæ.*

*N. (Schizonema) Grevillei* Ag. (Grun. A. Diat. pag. 42. Nav. Libellus Greg. *N. rhombica* Greg. Libellus *Grevillei* Cl. D. of the A. S. pag. 18) Greenl. (Bessel's Bay), Finm., Spitsb.

The largest specimen I have seen from Greenland measures 0,125 mm. in length and 0,024 mm. in breadth and has in the middle 15 striæ in 0,01 mm.

*N. (Schizonema) comoides* Grev. (Van Heurck Syn. Pl. XVI, fig. 3) Cape Deschnew (East Cape).

*N. complanata* Grun. (*Amph. complanata* Grun. A. Schm. Atl. Pl. XXVI, fig. 45) Finm., Kara.

*Sectio: Minutulæ.*

*N. crassirostris* Grun. (A. Diat. pag. 45, Pl. III, fig. 57) Kara.

*var. maasöensis* Grun. (l. c.) Finm.

*N. kryokonites* Cl. Elliptic, with obtuse ends. Striæ parallel, 22 in 0,01 mm., absent or obsolete in the middle of the valve. Length 0,034 mm. Breadth 0,011 mm. — Pl. 37, fig. 44. — Cape Wankarema.

*var. subprotracta* Cl. Rhombic with produced, subcapitate ends, striæ 22 in 0,01 mm. Length 0,033 mm. Breadth 0,007 mm. — Pl. 32, fig. 46. — Cape Wankarema.

*var. semiperfecta* Cl. Striæ 24 in 0,01 mm., covering one half of the valve, where they are of equal strength, and the other half, except in the middle, where they are obsolete. — Pl. 37, fig. 45. — Cape Wankarema.

*N. (kryokonites var.?) wankaremæ* Cl. Elongate lanceolate. Median line straight, central nodule small, terminal nodules near the ends. Striæ absent from the middle of the valve,

parallel, very fine, about 30 in 0,01 mm. — Pl. 37, fig. 47. — Cape Wankarema.

*N. Baculus* Cl. — Linear, elongate, with rounded ends. Median line broad. Central nodule small. Striæ parallel, 19 in 0,01 mm., absent from the middle of the valve, generally interrupted or as erased towards the middle. Length 0,065 mm. Breadth 0,007 mm. — Pl. 37, fig. 51. — Cape Wankarema.

This species seems to come near *N. Fistula* A. Schm. N. Sea Diat. Pl. II, fig. 29, which perhaps may be *N. inconspicua* Greg. Diat. of Cl. pag. 478, Pl. IX, fig. 3.

I do not know these two species. In some mediterranean gatherings I have seen a *Navicula* closely resembling *N. Baculus*, but with finer striæ, 26 in 0,01 mm., obsolete or absent from the middle of the valve, but not interrupted as in *N. Baculus*. Length 0,053, breadth 0,007 mm. It may perhaps be *N. Fistula*.

*N. inornata* Grun. (A. Diat. pag. 46, Pl. III, fig. 56. *N. Acus* Cl. l. c. pag. 14, Pl. III, fig. 55) Finm.

*Sectio: Vanheurckia.*

*N. (Schizonema) vulgaris* Thwaites — Kara (Fresh-water-species?).

*Sectio: Vegæ.*

*N. Vegæ* Cl. (*Pleurosigma Kjellmanii* Cl. A. D. pag. 14, Pl. IV, fig. 80) — Kara, Cape Wankarema.

var. *subconstricta* Grun. (in litt. c. icone) linear with parallel margins, constricted in the middle. Transverse striæ  $15\frac{1}{3}$ . Longitudinal striæ  $14\frac{1}{3}$  in 0,01 mm. — Cape Wankarema.

*Sectio: Decussatæ.*

*N. Placenta* (Ehb.?) Lewis (Grun. A. Diat. pag. 47, Pl. III, fig. 60) Finm.

Nav. *Incertæ sedis.*

*N. perlepida* Grun. F. J. L. (unknown to me).

*Stauroneis aspera* Ehb. (*St. pulchella* W. Sm.), var. *intermedia* Grun. Greenl. (Bessel's Bay, Mushroom Point), Finm., Spitsb., Kara (Matotschkin), Cape Deshnew (East Cape).

*St. finmarchica* Cl. & Grun. (A. Diat. pag. 47, Pl. III, fig. 63) Finm., Kara, Cape Deshnew (East Cape).

*St. scandinavica* Ldt. (Bih. t. K. Sv. Vet. Ak. Handl. III, No 15, pag. 47. *Navic. lacustris* A. Schm. N. Sea Diat. Pl. I, fig. 29) Kara.

*St. Spicula* Dickie (Van Heurck Syn. Pl. IV, fig. 9) Greenl. (Discovery Bay), Spitsb., Cape Wankarema.

*St. desiderata* Cl. (A. Diat. pag. 14, Pl. III, fig. 58) Kara.



*St. Gregorii* Rolfs var. *obtusiuscula* Grun. (A. Diat. pag. 47, Pl. III, fig. 64) Kara.

*St. pellucida* Cl. — Broadly oval, with rounded, obtuse ends, membranaceous. Central nodule dilated in a short stauros. Striæ 20 in 0,01 mm., obsolete, punctate. Length 0,053. Breadth 0,023 mm. — Cape Wankarema. — Pl. 35, fig. 10.

*St. pusilla* Grun. — F. J. L. — Unknown to me.

*St. perpusilla* Grun. — F. J. L. — Unknown to me.

*Scoliopleura tumida* (Bréb.) Grun. (*Nav. tumida* Bréb. *N. Jenneri* W. Sm.) Kara.

*Pleurosigma formosum* W. Sm. — Greenl.

*P. obscurum* W. Sm. — Spitsb.

*P. longum* Cl. (D. of the A. S. pag. 19, Pl. III, fig. 14, Grun. Arct. Diat. pag. 49, Pl. I, fig. 71) Greenl., Finm., Spitsb., Kara (Matotschkin).

*P. elongatum* W. Sm. (Syn. I, pag. 64, Pl. XX, fig. 199) Kara (Matotschkin).

var. *fallax* Grun. (A. Diat. pag. 50, Pl. III, fig. 36) Greenl. (Davis Strait), Finm., Kara.

*P. delicatulum* W. Sm. (Syn. pag. 64, Pl. XXI, fig. 202) Finm., Spitsb., Kara.

var. *kariana* Grun. (A. Diat. pag. 50, Pl. III, fig. 69) Kara.

*P. latum* Cl. (A. Diat. pag. 14, Pl. III, fig. 68) Finm.

*P. affine* Grun. (A. Diat. pag. 51. *P. naviculaceum* Cl. D. of the A. S. pag. 19) Greenl. (Davis Strait), Finm., Spitsb.

*P. angulatum* W. Sm. (Syn. I, pag. 65, Pl. XXI, fig. 205) Greenl., Finm., Spitsb.

*P. strigosum* W. Sm. (Syn. I, pag. 64, Pl. XXI, fig. 203) Finm., Kara.

*P. æstuarii* Bréb. (W. Sm. Syn. I, pag. 65, Pl. XXXI, fig. 275) Finm.

*P. finmarchicum* Cl. (= *P. Normani* Cl. A. D. pag. 14, Pl. III, fig. 67) Finm.

*P. Clevei* Grun. (A. Diat. pag. 52, Pl. III, fig. 70) Kara.

var. *siberica* Grun (in litt. c. icone) Striæ, oblique and transverse, 28 in 0,01 mm. Cape Wankarema. Pl. 35, fig. 14.

*P. nubecula* W. Sm. (Syn. I, pag. 64, Pl. XXI, fig. 201) Finm.

*P. intermedium* W. Sm. (Syn. I, pag. 64, Pl. XXI, fig. 200) Finm., Spitsb.

var. *subrecta* Cl. (A. Diat. pag. 14, Pl. III, fig. 72) Greenl., Finm., Spitsb.

*P. rigidum* W. Sm. (Syn. I, pag. 64, Pl. XX, fig. 198) Greenl., Spitsb.

*P. rhomboides* Cl. (A. D. pag. 14, Pl. IV, fig. 73) Kara, Cape Wankarema, F. J. L.

var. *angustior* Grun. — F. J. L.

*P. Stuxbergii* Cl. & Grun. (A. Diat. pag. 54, Pl. IV, fig. 74) F. J. L., Kara, Cape Wankarema.

var.? *hyperborea* Grun. (transv. striæ  $22\frac{1}{2}$  oblique  $25\frac{1}{2}$  in 0,01 mm.)

*P. distortum* W. Sm. (Syn. I, pag. 67, Pl. XX, fig. 210) Spitsb. (longit. striæ 28, transverse 25 in 0,01 mm.)

*P. Fasciola* W. Sm. (Syn. I, pag. 67, Pl. XXI, fig. 211) Greenl., Finm., Spitsb., Kara.

var. *sulcata* Grun. (A. Diat. pag. 55, Pl. IV, fig. 75) Spitsb., Kara.

var. *tenuirostris* Grun. (A. Diat. pag. 55, Pl. IV, fig. 76) Kara.

*P. balticum* W. Sm. (Syn. I, pag. 66, Pl. XXII, fig. 207) Spitsb.

*P. Wansbeckii* Donk. (T. M. S. VI, pag. 24, Pl. III, fig. 7) Kara.

*P. macrum* W. Sm. (Syn. I, pag. 67, Pl. XXXI, fig. 276) Kara.

*P. prolongatum* W. Sm. (Syn. I, pag. 67, Pl. XXII, fig. 212) Spitsb., Kara.

*P. tenuissimum* W. Sm. (Syn. I, pag. 67, Pl. XXII, fig. 213) Spitsb., Kara.

var. *subtilissima* Grun. (A. Diat. pag. 58) Kara.

var. *hyperborea* Grun. (l. c.) Kara, Cape Wankarema.

*P. Spenceri* var. *borealis* Grun. (A. Diat. pag. 60, Pl. IV, fig. 79) Kara.

Of *P. Spenceri* I found in a sample from Hackluyts, Spitsb., a variety with 19 transverse and 24 longitudinal striæ, length 0,11, breadth 0,013 mm. In the Wankarema gatherings occurs another variety with 20 transverse and 26 longit. striæ in 0,01 mm., length 0,085 mm., breadth 0,008 mm.

*P. vitreum* Cl. (A. D. pag. 15, Pl. IV, fig. 78) Kara, Cape Wankarema (transverse striæ 19, longit. 20 in 0,01 mm.).

*P. glaciale* Cl. N. S. — Sigmoid, acute, med. line almost straight. Longit. and transverse striæ 28 in 0,01 mm. Length 0,143. Breadth 0,019 mm. — Pl. 35, fig. 13. — Cape Wankarema.

*P. staurophorum* Grun. A. Diat. pag. 61) Greenl. (Davis Strait).

*Donkinia carinata* (Donk.) Ralfs (Donkin T. M. S. VI, pag. 23, Pl. III, fig. 5) Greenl. (Davis strait, Length 0,1 mm. Breadth 0,02 mm. Oblique striæ 18 in 0,01 mm.) Finm.



*D. minuta* (Donk.) Ralfs (Donkin l. c. f. 8) Finm.

*Rhoicosigma arcticum* Cl. (D. of the A. S. pag. 18, Pl. III, fig. 16) Greenl., Finm., Spitsb., Kara (Matotschkin).

Specimens from Hackluyts, Spitsbergen, have 21—22 striæ in 0,01 mm.

*R. Reichhardii* Grun. (M. J. 1877, pag. 181, Pl. CXCIV, fig. 19) Kara, Cape Wankarema.

*R. compactum* (Grev.) Grun. (Pleuros. comp. Grev. M. J. V. pag. 12, Pl. IV, fig. 9) Kara.

*Amphiprora (Plagiotropis) scaligera* Grun. (A. D. pag. 66, Pl. V, fig. 90) Finm.

*A. longa* Cl. (Diat. A. S. pag. 20, Pl. III, fig. 15) Finm., Spitsb., Kara (Matotschkin).

*A. maxima var. dubia* Cl. & Grun. (A. Diat. pag. 65, Pl. V, fig. 89) Finm.

*A. plicata v. subplicata* Grun. (A. Diat. pag. 65, Pl. V, fig. 88) Kara, Cape Wankarema.

*A. (amphitropis) paludosa* W. Sm. — Greenl. (Discovery Bay) Finm.

*var. Pokornyana* Grun. (Verh. 1860, pag. 569, Pl. IV, fig. 9) Kara.

*var.? hyperborea* Grun. (A. Diat. pag. 62, Pl. V, fig. 86) Kara.

*var.? polaris* Grun. Mpt. — F. J. L.

*var. punctulata* Grun. (A. Diat. pag. 62, Pl. IV, fig. 84) Kara, Cape Wankarema.

*var.? borealis* Grun. (l. c. Pl. IV, fig. 85) Kara, Cape Wankarema.

*var.? duplex* Donk. (Van Heurck Syn. Pl. XXII, fig. 15—16) Greenl. (Discovery Bay), Spitsb.

*A. (Amphitropis) Kjellmani* Cl. (A. Diat. pag. 15, Pl. IV, fig. 83). Kara, Cape Wankarema.

*A. (Amphitropis) kryophila* Cl. — Large, median line strongly sigmoid. Junction-line between the keel and the carina wavy. Striæ on the carina ending in small puncta, 13—17 in 0,01 mm. closer than on the valve, 10—14 in 0,01 mm. Length 0,13—0,16 mm. Breadth of valve 0,017 mm. of frustle 0,043—0,045 mm., at the constriction 0,028—0,03 mm. — Pl. 35, fig. 11. — Cape Wankarema.

*A. (Amphitropis?) glacialis* Cl. — Frustle almost linear, very little constricted in the middle; junction-line between the carina and the valve wavy. Striæ on the keel 14 in 0,01 mm. more distant than on the valve, 19 in 0,01 mm. Pl. 35, fig. 12.

Length 0,07 mm. Breadth 0,015 mm. — Cape Wankarema. Perhaps a variety of the following.

*A. (Amphitropis?) striolata* Grun. (A. Diat. pag. 62, Pl. IV, fig. 81) Kara.

*A. (Amphitropis?) kariana* Grun. (A. Diat. pag. 61, Pl. IV, fig. 82) Kara.

*A. (Amphitropis) decussata* Grun. var. *septentrionalis* Grun. (A. Diat. pag. 63, Pl. V, fig. 87) Finm., Cape Wankarema.

Specimens from Wankarema are very large, 0,14—0,18 mm. in length, and have 20—22 striæ on the valve. Median line sigmoid.

## 7. Amphipleureæ.

*Berkeleya Dillwynii* Grun. (Van Heurck Syn. Pl. XVI, fig. 15) Spitsb., Kara, Cape Deschnew (East Cape) (striæ 24 in 0,01 mm).

## 8. Nitzschieæ.

*Sectio: Tryblionella.*

*N. Tryblionella* Hantzsch. (Grun. A. Diat. pag. 69) var. *Victoriæ* Grun. — Kara.

var. *levidensis* W. Sm. — Finm., Kara.

*N. navicularis* (Bréb.) Grun. (*Trybl. marginata* Sm.) Spitsb. — I have indicated this species in the D. of the A. S. as an inhabitant of the Arctic Sea, but not having afterwards found it, I am uncertain as to the exactness of the determination.

*N. (?) seriata* Cl. N. Sp. — Fusiform with gradually attenuated ends. Puncta indistinct. Striæ 16—18 in 0,01 mm. pervious. Frustules coherent in long bands. Length 0,09—0,11 mm. Breadth 0,008 mm. — Pl. 38, fig. 75. — Greenland, Tindingen (N. O. Holst).

I am very uncertain as to the exact position of this diatom, whose nearest allies seem to be *N.?* (*Homoeocladia*) *pungens* Grun. Mpt. (Cl. & Möll. Diat. No 307) from Japan, also the *Fragilaria (?) Cylindrus* Grun. Mpt.

*Sectio: Panduriformes.*

*N. panduriformis* Greg. var. *delicatula* Grun. (A. Diat. pag. 71, Pl. V, fig 92) Finm., Spitsb.

*N. constricta* Kütz. In the Diat. of the Arctic Sea I have indicated this species as occurring near Spitsbergen, but I cannot be sure of the correctness of the determination, not having found it afterwards.



*Sectio: Apiculatæ.*

*N. marginulata* Grun. a. *genuina* Grun. (A. Diat. pag. 72, Pl. V, fig. 93) Kara (Matotschkin).

var. *minuta* Grun. (l. c.) Cape Deschnew (East Cape) (length 0,045 mm. puncta 12 and striæ 24 in 0,01 mm.) Greenl. (Mushroom Point).

*N. apiculata* (Greg.) Grun. (A. Diat. pag. 73) Greenl., Finm.

*Sectio: Dubiæ.*

*N. dubia* W. Sm. (Grun. A. D. pag. 77) Kara, Cape Deschnew (East Cape).

In the East Cape gathering occurs a small form, only 0,065 mm. in length, with 8 puncta and 29 striæ in 0,01 mm.

*N. Wankaremæ* Cl. N. Sp. — Keel not very eccentric; carinal puncta 5—7 in 0,01 mm. absent in the middle, where there is an indication of a central nodule. Striæ very fine, about 30 in 0,01 mm. Length 0,15—0,17 mm. — Pl. 38, fig. 71. — Cape Wankarema.

*Sectio: Bilobatæ.*

*N. hybrida* Grun. (A. Diat. pag. 79) Spitsb., Finm., Kara.

var. *kryokonites* Cl. — Length 0,13. Carinal puncta 9 in 0,01 mm. Striæ very fine, about 30 in 0,01 mm. Keel not very eccentric. Valve slightly constricted in the middle. — Pl. 38, — fig. 65. Cape Wankarema.

var.? *pellucida* Grun. (A. Diat. pag. 80, Pl. V, fig. 96) Finm.

*N. Mitchelliana* Greenl. (Grun. A. Diat. pag. 80, Pl. V, fig. 97) Finm., Spitsb., Kara.

*Sectio: Pseudo-amphiprora.*

*N. Amphiprora* Grun. (A. Diat. pag. 81. Amphipr. Nitzschoides Cl. D. of A. S. pag. 20, Pl. IV, fig. 18) Greenl., Spitsb., Cape Deschnew (East Cape).

*Sectio: Insignes.*

*N. insignes* var. *arctica* Grun. (A. D. pag. 84) Greenl., Finm., Spitsb., Kara (Matotschkin).

var.? *marginifera* Grun. (A. Diat. pag. 84. Pl. VI, fig. 105) Finm.

*Sectio: Bacillaria.*

*N. socialis* Greg. (Van Heurck Syn. Pl. LXI, fig. 8) Greenl., Finm., Kara (Matotschkin).

var. *kariana* Grun. (A. Diat. pag. 85, Pl. VI, fig. 108) Greenl. (Davis strait), Kara.

var. *baltica* Grun. (l. c. fig. 107) Kara, Cape Wankarema.

*N. paradoxa* (Gmel) Grun. (Van Heurck Syn. Pl. LXI, fig. 6) Kara.

*Sectio: Vivaces.*

*N. (vivax var.?) hyperborea* Grun. (A. D. pag. 86, Pl. V. fig. 104) Kara.

*var.?* *Nyströmii* Grun. (Cl. & M. Diat. No 172) Greenl. (Davis Strait), not known to me.

*Sectio: Spathulatae.*

*N. angularis* W. Sm. (Van Heurck Syn. Pl. LXII, fig. 11—14) Greenl., Finm., Kara (Matotschkin), Cape Deschnew (East Cape).

*var. borealis* Grun. (A. Diat. pag. 89, Pl. V, fig. 99) Finm., Kara.

*var. kariana* Grun. (l. c. p. 89, fig. 100) Kara.

*N. spathulata* Bréb. (Van Heurck Syn. Pl. LXII, fig. 7—8) Greenl. (Davis Strait), Finm.

*var. hyalina* Greg. (Van Heurck Syn. l. c. f. 9) Kara.

*Sectio: Sigmoideae.*

*N. macilenta* Greg. — In the Diat. of the A. S. I have indicated this species as occurring near Spitsbergen, but, not having met this species again, I think it may be a mistake.

*N. Brebissonii var. borealis* Grun. (Cl. & M. Diat. 316—318) Striæ 14—16 in 0,01 mm. Cape Wankarema.

*Sectio: Sigmata.*

*N. Sigma* Sm. (*Amphipleura rigida* Cl. D. of the A. Sea pag. 26. *Amphipleura sigmoidea* W. Sm.) Greenl., Finm., Spitsb.

*N. (Sigma var.?) scabra* Cl. — Valve large, in length 0,17—0,2 mm. breadth 0,01 mm., slightly sigmoid, or almost straight. Keel eccentric. Puncta about 4 in 0,01 mm. Striæ not seen, but the surface of the valve is covered by scattered puncta, which give it a shagreen-like appearance. — Pl. 38, fig. 73 a. b. — Cape Wankarema.

*N. lævissima* Grun. Mpt. — Greenl. (Discovery Bay), F. J. L., Cape Wankarema.

*Sectio: Obtusae.*

*N. (obtusae var.??) kryophila* Cl. Linear, slightly sigmoid toward the ends. Puncta 8, absent in the middle, where there is a small central nodule. Striæ 20 in 0,01 mm., composed of puncta. Length 0,14 mm. Breadth 0,006 mm. — Pl. 38, fig. 74. — Cape Wankarema.

*Sectio: Lineares.*

*N. gelida* Cl. & Grun. Straight with cuneate ends. Keel tolerably eccentric. Carinal puncta 6—8 in 0,01 mm., distant in the middle, where there is a distinct central nodule. Striæ composed of somewhat elongate puncta, which form irregularly wavy lines, 20—24 in 0,01 mm. Length 0,14 mm. Breadth 0,012 mm. — Pl. 38, fig. 70. — Cape Wankarema.

*N. (recta var.?) polaris* Grun. — Valve tolerably eccentric, linear with obtuse ends. Carinal puncta 7 in 0,01 mm., distant



in the middle. Striæ very fine. Length 0,075 mm. Breadth 0,006 mm. — Pl. 38, fig. 72. — F. J. L., Cape Wankarema.

*N. linearis* var. *tenuis* Grun. (A. D. pag. 93) Kara, Cape Wankarema. (Specimen from the latter locality have 11—12 puncta and 28—30 striæ in 0,01 mm. Length 0,13 mm. Breadth 0,009 mm.).

*N. vitrea* Norm. (Van Heurck Syn. Pl. LXVII, fig. 10) Spitsb. var. *finmarchica* Grun. (A. D. pag. 94, Pl. VI, fig. 106) Finm.

In the Wankarema gathering occurs a variety of *N. vitrea* 0,12 mm. in length 0,006 mm. in breadth with 8—10 puncta in 0,01 mm. and very fine striæ. In the Discovery Bay gathering occurs another variety with 8—9 puncta and 25 striæ in 0,01 mm.

*N. frigida* Grun. (A. Diat. pag. 94, Pl. V, fig. 101) Greenl. (Discovery Bay), Kara.

*Sectio: Lanceolatae.*

*N. lanceolata* var. *pygmæa* Cl. — Lanceolate, length 0,045 mm. Breadth 0,006 mm. Puncta 12 in 0,01 mm. Striæ very fine. — Cape Wankarema.

Seems to connect *N. lanceolata* with *N. acicularis*.

*N. ovalis* Arn. (Grun. A. Diat. pag. 95, Pl. V, fig. 103) Kara.

*Sectio: Nitzschiella.*

*N. Closterium* (Ehb.) W. Sm. (Van Heurck Syn. Pl. LXX fig. 5) Finm., Spitsb., Kara.

*N. acicularis* W. Sm. (Van Heurck Syn. l. c. fig. 6) Kara, Cape Wankarema.

*Hantzschia amphioxys* (Ehb.) Grun. — Kara (Fresh-water species). var. *vivax* Grun. (A. Diat. pag. 103) Kara.

*H. Weiprechtii* Grun. (A. Diat. pag. 104, *Nitzschia* Weipr. Grun. in Van Heurck Syn. Pl. LXII, fig. 16) F. J. L.

*H. virgata* Roper var. ? *borealis* Grun. (A. Diat. pag. 104, Pl. VI, fig. 110) Kara.

var. ? *kariana* Cl. & Grun. (l. c. fig. 109) Kara.

*H. marina* (Donk.) Grun. (Van Heurck Syn. Pl. LVI, fig. 14—15) Greenl. (Davis Strait).

## 9. *Surirellæ.*

*Surirella Smithii* Ralfs (S. *constricta* W. Sm. Syn. I, pag. 31, Pl. VIII, fig. 59) Finm.

*S. fastuosa* var. *lepida* A. Schm. (Atl. Pl. IV, fig. 7) Finm.

*S. Gemma* Ehb. (Van Heurck Syn. Pl. LXXIV, fig. 1) Spitsb.

*S. ovata* Kütz. (Van Heurck Syn. Pl. LXXIII, fig. 5—7) Spitsb.  
*Campylodiscus Helianthus* A. Schm. (Atl. Pl. XVII, fig. 15)  
 Spitsb., Kara (Matotschkin Schar).

*C. grönländicus* Cl. (D. of A. Sea pag. 13, Pl. II, fig. 9)  
 Greenl.

*C. angularis* Greg. (A. Schm. Atl. Pl. XVIII, fig. 7) Greenl.,  
 Finm., Spitsb., Kara (Matotschkin).

*C. Ralfsii* W. Sm. (Syn. I, pag. 30, Pl. XXX, fig. 257)  
 Greenl. (Davis Strait).

*C. Thureti* Bréb. (*C. simularis* Greg. *C. bicruciatum* Greg.)  
 Greenl., Spitsb., Finm., Kara (Matotschkin).

*C. echineis* Ehb. (*C. Argus* Bail. *C. cribrus* Sm.) Spitsb.

## 10. *Synedrea*.

*Synedra nitzschioides* Grun. (Verh. 1862, pag. 403, Pl. VIII,  
 fig. 18) Greenl. (Davis Strait, Bessel's Bay [Length 0,06 mm.,  
 breadth 0,003 mm. Striæ 11 in 0,01 mm.] Mushroom Point),  
 Spitsb.

var. *minor* Grun. (Nov. pag. 95, Pl. A. fig. 7) Kara.

*S. tabulata* Kg. (W. Sm. Syn. I, pag. 72, Pl. XII, fig. 96)  
 Greenl. (Bessel's Bay. Length 0,115 mm. Breadth 0,005 mm.  
 Striæ 9 1/2 in 0,01 mm.), Spitsb., Kara.

var. *angusta* Grun. (A. Diat. pag. 105) Finm.

*S. affinis* Kütz. — Greenl. (Mushroom Point, Bessel's Bay, a  
 variety, length 0,24 mm., breadth 0,0009, striæ 19 in 0,01 mm.)  
 Finm., Spitsb., Cape Deschnew (East Cape).

var. *delicatula* Grun. (A. D. pag. 105, Pl. VI, fig. 115) Finm.

var. *borealis* Grun. — Finm.

*S. hyperborea* Grun. Mpt. — F. J. L.

var. *brevis* Grun. — F. J. L.

var. *flexuosa* Grun. — F. J. L.

var. *rostellata* Grun. — F. J. L.

*S. investiens* W. Sm. — Greenl. (Striæ 13 in 0,01 mm. Length  
 0,05 mm. Breadth 0,006 mm.) F. J. L.

*S. kamtschatica* Grun. (Verh. 1862, pag. 404, Pl. VIII, fig.  
 6) Greenl. (Davis Strait, Bessel's Bay, Mushroom Point), Finm.,  
 Spitsb., Kara (Matotschkin), East Cape.

var. *minor* Grun. (A. Diat. pag. 106) Greenl. (Bessel's Bay),  
 Finm.

var. *intermedia* Grun. (l. c. Pl. VI, fig. 111) Finm.

var. *Kjellmanii* Cl. & Grun. (l. c. fig. 112) Finm.



var. *connectens* Grun. (l. c.) Finm.

var. *finmarchica* Cl. & Grun. (l. c. fig. 113) Finm.

*S. commutata* Grun. (A. D. pag. 107, Pl. VI, fig. 118) Greenl. (Mushroom Point, striæ 12 in 0,01 mm.). Finm.

*S. fasciculata* Kütz (Grun. A. Diat. pag. 105, Pl. VI, fig. 114) Finm.

*S. parva* Kütz. — Finm.

var. *major* Grun. (A. Diat. pag. 106, Pl. VI, fig. 117) Finm.

*S. pulchella* Kütz. — Finm.

var. *minutissima* (W. Sm.) Finm.

var. *Vertebra* Greg. — Finm.

*S. crystallina* (Ag.) Sm. (Syn. I, pag. 74, Pl. XII, fig. 101) Finm.

*S. superba* var. *minor* Grun. (A. Diat. pag. 108) Finm.

*Sceptroneis marina* (Greg.) Grun. (Van Heurck Syn. Pl. XXXVII, fig. 2) Finm.

*S.?* *gemmata* Grun. (Van Heurck Syn. Pl. XXXVII, fig. 3) »Arctic Ocean».

*Thalassiothrix longissima* Cl. & Grun. (A. D. pag. 108) North Atlantic Ocean, Cape Wankarema.

*Th. Fraunfeldii* var.? *arctica* Grun. (Van Heurck Syn. XXXVII, fig. 14) North Atlantic Ocean.

*Th. Fr.* var.? *tenella* Grun. (l. c. fig. 15) North Atlantic Ocean.

## II. Plagiogrammæ.

*Plagiogramma staurophorum* (Greg.) Heib. (P. Gregorianum Grev. Dentic. stauroph. Greg. D. of Cl. pag. 496, Pl. X, fig. 37) Greenl. (Davis Strait) Finm.

## B. Coccochromaticæ.

### 12. Fragilarieæ.

*Fragilaria oceanica* Cl. (Diat. of the A. S. pag. 22, Pl. IV, fig. 25. *F. arctica* Grun. A. Diat. pag. 110, Pl. VII, fig. 124) Greenl. (Tindingen, Bessel's Bay) Northern Atlantic Ocean, Kara.

A careful examination has proved the identity of *F. oceanica* Cl. and *F. arctica* Grun., and that my figure in D. of

A. S. is somewhat incorrect. The striæ are pervious as in Grunow's delineation.

*F. islandica* Grun. (Van Heurck Syn. Pl. XLV, fig. 37) Jan Mayen.

var. *hyperborea* Cl. — Area longer, striæ 12 in 0,01 mm. — Greenl., Bessel's Bay.

*F.?* *Cylindrus* Grun. Mpt. — Small, linear with parallel sides and broadly rounded ends. Striæ pervious 14—21 in 0,01 mm. Length 0,035—0,06 mm. Breadth 0,002—0,004 mm. — Pl. 37, fig. 64 a. b. c. — Greenl., Tindingen, F. J. L., Cape Wankkerema.

*Grammonema striatulum* Ag. (Sm. Syn. II, pag. 23, Pl. XXXV, fig. 298) Greenl., Finm., Spitsb.

### 13. Meridioneæ.

*Asterionella kariana* Grun. (A. Diat. pag. 110, Pl. VI, fig. 121) Kara.

### 14. Tabellarieæ.

*Grammatophora oceanica* (Ehb.) Grun. (*G. macilenta* W. Sm.) Greenl.

*G. arctica* Cl. (öfvers. K. Sv. V. Ak. Förh. 1867, pag. 664, Pl. XXIII, fig. 1. Van Heurck Syn. LIII B., fig. 3) Greenl. (Bessel's Bay, Assistance Bay etc.), Finm., Spitsb., Kara (Matotschkin).

*G. arcuata* Ehb. (Grun. Verh. 1862, pag. 420, Pl. XI, fig. 7) var. *arctica* Grun. (Bot. Centr. Bl. 1881, Bd VII, pag. 3) Greenl., Spitsb., Kara (Matotschkin), East Cape.

*G. angulosa* var. *islandica* (Ehb.) Grun. (Van Heurck Syn. Pl. LIII, fig. 7) Greenl. (Bessel's Bay), Finm., Spitsb., Kara (Matotschkin).

*Rhabdonema Torellii* Cl. (D. of the A. Sea pag. 24, Pl. IV, fig. 20) Greenl. (Bessel's Bay), Spitsb.

*R. arcuatum* (Lyngb.) (W. Sm. Syn. II, pag. 34, Pl. XXXVIII, fig. 305) Greenl. (Bessel's Bay), Finm., Spitsb., Kara (Matotschkin), Cape Deschnew (East Cape).

*R. minutum* (Kg.) (Sm. Syn. II, pag. 35, Pl. XXXVIII, fig. 306) Greenl., Finm., Spitsb., Kara (Matotschkin).

The *Rh. adiaticum* (Kg.) has been found once in a sample from Grötsund in Finmarken, but in no other arctic gathering.



*Striatella unipunctata* (Lyngb.) Sm. (Syn. II, pag. 37, Pl. XXXIX, fig. 307) Finm.

*St. chilensis* Grun. (Nov. pag. 96, Pl. I A., fig. 7) Greenl. Only one frustle has been observed, so that it may be doubtful as an arctic species.

*St. delicatula* Kütz. var. *rectangula* Kütz. (Van Heurck Syn. Pl. LIV, fig. 3) Greenl., Bessel's Bay.

## 15. Licmophoreæ.

*Licmophora grandis* (Kütz.) Grun. (Van Heurck Syn. Pl. XLVIII, fig. 2) Spitsb. (Hackluyts) Striæ at the base 22 in 0,01, at the top 24 in 0,01 mm. Length 0,11 mm. Breadth 0,027 mm.

*L. Jürgensii* (Kütz.) Grun. (Van Heurck Syn. Pl. XLVI, fig. 10—11) Greenl. (Bessel's Bay) Kara.

var. *finmarchica* Grun. (A. Diat. pag. 110, Pl. VII, fig. 125) Finm.

*L. borealis* (Kütz.) Grun. — Kara (sec. Grun.).

*L. nubecula* (Kütz.) Grun. — Kara (sec. Grun.).

*L. flabellata* Ekb. forma brevior -- Finm. (sec. Grun.).

*L. elongata* (Kütz.) Grun. — This species has been indicated by myself as occurring in Finmarken, but I have some doubts about the correctness of the determination.

## 16. Biddulphieæ.

*Triceratium, Biddulphia.*

*B. aurita* (Lyngb.) Bréb. (Sm. Syn. II, pag. 49, Pl. XLV, fig. 319) Greenl. (Bessel's Bay, Mushroom Point), Finm., Spitsb., Kara (Matotschkin), Cape Wankarema.

*B. Rhombus* Ehb. (Sm. Syn. II, pag. 49, Pl. XLV, fig. 320) Finm.

*B. Balæna* (Ehb.) Btw. (M. J. VII, pag. 18, Pl. IX, fig. 15. *Zygoceros radiatus* Bail. Smith's Contr. VII, Pl. II, fig. 29. *Triceratium arcticum* Btw. l. c. triangular form) Greenl. (Bessel's Bay), Finm., Spitsb., Kara.

var. *T. spitsbergense* Grun. (A. Diat. pag. 111) Spitsb.

*T. finmarchicum* Grun. (A. Diat. pag. 112, Pl. VII, fig. 126) Finm.

*Actinocyclus alienus* Grun. (Cl. & Möll. Diat. No 319) Cape Wankarema. — Unknown to me.

*Coscinodiscus Oculus Iridis* Ehb. — Greenl., Spitsb., Cape Wankarema.

var. *borealis* Bail. — Cape Wankarema.

*C. radiatus* Ehb. — Greenl. (Davis Strait), Beeren Eiland, Finm., Spitsb.

*C. concinnus* Roper (M. J. VI, pag. 20, Pl. III, fig. 12) Spitsb., Cape Wankarema.

*C. centralis* Ehb. (Greg. Diat. of Cl. pag. 501, Pl. XI, fig. 49) Spitsb., Greenl., Tindingen (A. Schm. Atl. Pl. LXIII, fig. 1).

var. *micraster* Grun. (Cl. and Möll. Diat. No 172) Davis Strait.

*C. subtilis* Ehb. (A. Sch. Atl. LVII, fig. 13—14) Greenl., Finm., Kara (Jalmal), Cape Wankarema.

*C. excentricus* Ehb. — Greenl. (Davis Strait), Spitsb., Kara, Cape Wankarema.

*C. lineatus* Ehb. — Beeren Ed, Spitsb., Finm., Kara (Jalmal).

*C. nitidus* Greg. (A. Schm. N. Sea Diat. Pl. III, fig. 32) Greenl. (Davis Strait), Finm.

*C. subglobosus* Cl. and Grun. (Cl. and Möll. Diat. No 172, A. Schm. Atl. Pl. LVIII, fig. 44) Greenl. (Davis Strait), Cape Wankarema.

*C. (Odontodiscus) curvatulus* Grun. (A. Schm. Atl. Pl. LVII, fig. 33) Greenl. (Davis Strait), F. J. L., Cape Wankarema.

*C. Normanni* Cl. D. of A. S. pag. 6 is only a variety of *C. curvatulus*.

var. *kariana* Grun. (A. Diat. pag. 113, Pl. VII, fig. 129) Finm., Kara.

var. *frigida* Grun. — F. J. L.

*C. concavus* Greg. (D. of Cl. pag. 500, Pl. X fig. 47) Kara.

*C. (Odontodiscus) polyacanthus* Grun. (A. D. pag. 112, Pl. VII, fig. 127) Greenl. (Tindingen) Kara (Jalmal).

*C. (Odontodiscus) hyalinus* Grun. (A. D. pag. 113, Pl. VII, fig. 128) Greenl. (Tindingen) F. J. L., Kara, Cape Wankarema.

*C. (Odontodiscus) bioculatus* Grun. Mpt. — Greenl. (Tindingen), F. J. L., Cape Wankarema.

*C. (Odontodiscus) pellucidus* Grun. (in Cl. & Möll. Diat. No 172) Davis Strait, Cape Wankarema.

Valve very thin and transparent, 0,065—0,08 mm. i diameter, covered with small puncta, arranged in repeatedly branching lines (16 in the middle and 20 in the margin on 0,01



mm.) Centre with some small, scattered puncta. Margin with small spines (6 in 0,01 mm.).

*C. (Odontodiscus) granulatus* Grun. (A. D. pag. 113, Pl. VII, fig. 130) Finm., Kara.

*C. (Odontodiscus) lacustris* Grun. (A. D. pag. 114) Matotschkin Schar, Kara.

var. *marinus* Grun. (in Cl. & Möll. Diat. No 172) Davis Strait.

var. *hyperboreus* Grun. (Cl. & Möll. Diat. No 315—18) with coarser puncta. — Cape Wankarema.

*C. bathyomphalus* Cl. N. Sp. — Disc 0,02—0,03 mm. in diameter, with funnel-shaped centre. Puncta arranged in lines, radiating from the centre to the margin, where they become smaller. — Pl. 38, fig. 81, — Spitsb., Cape Wankarema.

*Stephanodiscus Hantzschii* Grun. var. *pusilla* (A. D. pag. 115, Pl. VII, fig. 132, Van Heurck Syn. Pl. XCV, fig. 11) Finmark.

*Thalassiosira Nordenskiöldii* Cl. (Van Heurck Syn. Pl. LXXXIII, fig. 9) Greenl., Northern Atlantic Ocean, Finmarken, Spitsbergen, Kara, Cape Wankarema.

*Hyalodiscus scoticus* (Kg.) Grun. (A. D. pag. 116) Greenl. (Bessel's Bay, Mushroom Point) Finm., Spitsb., East Cape.

*Podosira hormoides* Mont. (Van Heurck. Syn. Pl. XXXIV) Greenl. (Mushroom Point).

var. *adriatica* (Kütz.) Grun. — Finm.

*P. maxima* (Kütz.) Grun. (Casp. Sea Alg. pag. 33. A. D. pag. 118, Hyal. arcticus Cl. & Möll. Diat. No 1. H. stelliger D. of A. S. pag. 4) Greenl., Finm., Spitsb., Matotschkin Schar, Cape Deschnew (East Cape).

*Skeletonema mirabile* Grun. (Cl. & Möll. Diat. No 318) Cape Wankarema.

I have seen of this species only a sketch, sent by Mr. Grunow. It has the appearance of a chain of auxospores of some *Chætoceros*, but not having seen a specimen I cannot say anything about it.

*Melosira nummuloides* (Lyngb.) Kütz. — Greenl., Finm., Spitsb., Kara.

var. *hyperborea* Grun. (*M. arctica* Dickie) Van Heurck. Syn. Pl. LXXXV, fig. 3—4) Discovery Bay, Novaia Zemlia.

*M. sulcata* (Ehb.) Kütz. (*Paralia sulcata* Cl.) Finm., Kara.

var. *siberica* Grun. (Van Heurck Syn. Pl. XCI, fig. 22) F. J. L.

var. *biseriata* Grun. (Van Heurck Syn. l. c. fig. 23—24) F. J. L.

*M. (mediterranea* Grun. var.?) *gelida* Cl. — Surface of the valve covered near the margin with puncta arranged in curved lines crossing each other, about 25 in 0,01 mm. Diam 0,02—0,03 mm. Pl. 38, fig. 83 a. b. — Mushroom Point.

*M. ornata* Grun. (Van Heurck Syn. XCI, fig. 19—21) F. J. L.

*M. Borreri* Grev. (Van Heurck Syn. Pl. LXXXV, fig. 5—7) Greenl., Bessel's Bay.

## II. Surface-diatoms from the Behring Sea.

Dr. Kjellman has collected in the Behring Sea diatoms living on the surface. The gathering contained:

*Thalassiothrix longissima* Cl. & Grun. in great abundance.

*Coscinodiscus borealis* Bail. (A. Schm. Atl. LXIII, fig. 11).

*Endictya oceanica* Ehb.

*Chaetoceros atlanticus* Cl.

*Rhizosolenia styliformis* Btw.

*Rh. hebeta* Bail.

## III. Fresh-water diatoms from Japan.

In Japan Dr. Kjellman made some gatherings of fresh-water diatoms, interesting because most of the species were perfectly identical with European ones. I have observed the following species, of which the greater part has been determined with the aid of Van Heurck's synopsis:

*Amphora affinis* Kütz.

*Cymbella cuspidata* Kütz. Length 0,092. Breadth 0,024 mm. Striæ 10 in the middle, 12 near the ends.

*C. affinis* Kütz.

*C. gastroides* Kütz.

*C. cymbiformis* Ehb.

*C. Cistula* Hempr.

*C. tumida* Bréb.

*Eucyonema caspitosum* Kütz.

*Epithemia gibba* (Ehb.).

*E. gibberula* Kütz.



- E. Sorex* Kütz.  
*E. Zebra* (Ehb.).  
*Anchanthes lanceolata* Bréb.  
*A. minutissima* var. *cryptocephala* W. Sm.  
*Cocconeis Placentula* Ehb.  
*Gomphonema constrictum* var. *capitatum* Ehb.  
*G. gracile* Ehb.  
*G. angustatum* Grun.  
*G. parvulum* Kütz.  
*Stauroneis anceps* Ehb.  
*Navicula major* Kütz.  
*N. viridis* Kütz.  
*N. Legumen* (Ehb.).  
*N. borealis* (Ehb.).  
*N. Brébissonii* Kütz. var.  
*N. bicapitata* Ldt.  
*N. Cymbula* Donk.  
*N. lanceolata* Kütz.  
*N. cryptocephala* Kütz.  
*N. amphicerus* Kütz.  
*N. tenella* Bréb.  
*N. dicephala* W. Sm.  
*N. elliptica* Kütz.  
*N. humilis* Donk.  
*N. cuspidata* Kütz.  
*N. ambigua* Ehb.  
*N. limosa* var. *ventricosa* Donk.  
*N. fasciata* Ldt.  
*N. affinis* Ehb.  
*N. Pseudobacillum* Grun. (Arct. Diat. pag. 45, Pl. II, fig. 52).  
*N. Pupula* (Kütz.) Grun.  
*N. Seminulum* Grun.  
*N. binodis* W. Sm. (Brit. D. XVII, fig. 159).  
*Schizonema vulgare* Thw.  
*Amphipleura pellucida* (Ehb.).  
*Pleurosigma Kützingii* Grun. (Arct. Diat. pag. 59) Transv. striæ 21, longitudinal 26 in 0,01 mm.  
*Syneda Ulna* Nitzsch var.  
*S. Acus* var. *tenuissima* Grun.  
*Staurosira brevistriata* Grun.  
*St. mesolepta* Rabh.  
*Nitzschia (Tryblionella) Levidensis* W. Sm.  
var. *Victoriæ* Grun.

*N. sigmoidea* (Ehb.)

*N. intermedia* Hantzsch.

*N. Denticula* Grun. var. *minor*, lanceolata, costis abbreviatis. A very remarkable variety with costæ not reaching half-way across the valve, 6 in 0,01 mm. and 17 striæ in 0,01 mm. Pl. 37, fig. 68. It is only on the authority of Mr. Grunow that I have accepted the determination as a variety of *N. Denticula*.

*N. Tabellaria* Grun.

*Hantzschia amphioxys* var. *californica* Grun. (A. Diat. pag. 103).

*Surirella elegans* Ehb.

*S. saxonica* Auersw. (A. Schm. Atl. Pl. XXII, fig. 1—2).

*S. linearis* W. Sm. (A. Schm. Atl. Pl. XXIII, fig. 27—33).

*S. apiculata* W. Sm. (A. Schm. Atl. Pl. XXIII, fig. 34—35).

*Cymatopleura Solea* (Bréb.) W. Sm.

*Cyclotella comta* Ehb.

*Melosira varians* Agardh.

#### IV. Diatoms from Labuan.

During the stay of the *Vega* in Labuan near Borneo Dr. Kjellman made some gatherings of marine algæ, among which was found a number of diatoms, which I have examined. I have registered the following forms:

*Amphora ostrearia* Bréb. (H. L. Smith Lens II, p. 72, Pl. I, fig. 16. — A. Schmidt Atl. Pl. XXVI, fig. 23? striæ not punctate!) This very variable species occurs in many forms, described as distinct species, as *A. vitrea* Cl. *A. quadrata* Bréb. *A. elegans* Greg. *A. membranacea* W. Sm. and Roper. *A. littoralis* Donk. Specimens from Labuan have 12 striæ in 0,01 mm., composed of distinct, separate puncta. Length of the valve 0,095 mm.

var. *Porcellus* (*A. Porcellus* Kitton in A. Schm. Atl. Pl. XXXIX, fig. 15—17. *A. novæ caledoniæ* Grun. l. c. Pl. XXVI, fig. 16 — conf. Grun. Arct. Diat. pag. 25). The variety from Labuan has the outline of *A. arcuata* (A. Schm. Atl. Pl. XXVI, fig. 27—29) but has much coarser striæ, composed of distinct puncta, 9 in 0,01 mm. Length 0,06 mm.

*A. Weissflogii* A. Schm. (Atl. Pl. XXV, fig. 58) Striæ 11 in 0,01 mm. Length 0,075 mm.

*A. Schmidtii* Grun. (A. Schm. Atl. XXVIII, fig. 2).

*A. turgida* Greg. (Diat. of Clyde. pag. 510, Pl. XII, fig. 63.  
*A. recta* Leud. Fortm. Ceyl. pag. 21, Pl. I, fig. 14). Length of  
 the frustle 0,024 mm. Br. 0,015 mm. Striæ 12 in 0,01 mm.

*A. cymbifera* Greg. — Length 0,09 mm. Striæ 9 in 0,01 mm.

*A. cymbelloides* Grun. (Hedwigia 1867, VI, pag. 24, Cl. &  
 Möll. Diat. No 147).

*A. Javanica* A. Schm. (Atl. XXVII, fig 27).

*A. Proteus* Greg. (Diat. of Clyde pag. 518, Pl. XIII, fig. 81).

var. *robusta* Greg. (*A. robusta* A. Schm. Atl. Pl. XXVII,  
 fig. 39—41).

var. *mexicana* A. Schm. (*A. mexicana* A. Schm. Atl. Pl.  
 XXVII, fig. 47—48).

*A. obtusa* Greg. (A. Schm. Atl. Pl. XL, fig. 16—17).

*A. furcata* Leuduger Fortm. (Diat. de Ceylon pag. 20, Pl.  
 I, fig. 11. *A. spectabilis* A. Schm. Atl. Pl. XL, fig. 20—23).

*A. labuensis* Cl. N. Sp. — Frustle rectangular, with straight  
 margins. Median lines straight. Central nodule small, not  
 transversely dilated. Connecting membrane without longitu-  
 dinal lines. Striæ very coarse and distant, 6 in 0,01 mm., pa-  
 rallel, with very fine transverse striation. Length 0,06 mm.  
 Breadth 0,02 mm. — Pl. 35, fig. 1 a Fr. V. fig. b. S. V.

This species, which has the outline of *A. Donkinii* Rab =  
*A. lineata* Donk. is remarkable for its very coarse striæ. Mr.  
 Grunow informs me that he has seen the same species in a  
 gathering from the Adriatic Sea.

*Stauroneis australis* Grev. (Ed. N. Phil. J. Vol. XVIII, pag.  
 187, fig. 13, 1863 H. *Stauroneis biformis* Grun. Verh. 1863, pag.  
 154, Pl. XIII, fig. 7). This most interesting form, described the  
 same year by Grunow and Greville, does not seem to belong  
 to the genus *Stauroneis*, but to a new genus, nearly related  
 to *Mastogloia* and distinct from the latter genus by having  
 short marginal costæ instead of the loculi. This form occurs  
 sparsely in the Labuan material. I have also seen it in a  
 gathering from Port Jackson. Mr. Grunow mentions it as an  
 inhabitant of the Red Sea. The Labuan specimens have 14—  
 15 finely punctate striæ in 0,01 mm. Length 0,086 mm. Breadth  
 0,035 mm.

*St. bistriata* Leuduger Fortm. (Diat. de Ceylon pag. 37,  
 Pl. IX, fig. 89). I have seen only a single valve of this spe-  
 cies, which seems to belong to the genus *Achnanthes*. The  
 striæ, 10 in 0,01 mm., are costate and less divergent than in  
 the figure of Mr. Leuduger. Length 0,057 mm. Breadth 0,009 mm.



*Mastogloia acuta* Grun. in litt. — Lanceolate, with produced ends. Rows of loculi at a little distance from the margin; loculi larger in the middle than near the ends. Striæ parallel, very fine (not counted) punctate, puncta forming longitudinal lines. Length 0,04 mm. Breadth 0,015 mm. — Pl. 35, fig. 8.

Mr. Grunow sent me some years ago a sketch of a new *Mastogloia*, called *acuta*, which resembles this form so much that I suppose they are identical. The *M. acuta* Grun. has the loculi more separate from the margins than the Labuan-specimens and the fine striæ (30 in 0,01 mm.) more radiant.

*M. laminaris* (Ehrb.) Grun. — Lanceolate, with produced ends. Loculi large, 4½ in 0,01 mm. marginal. Striæ fine, 20—24 in 0,01 mm., not interrupted, reaching the median line. Length 0,03 mm. Breadth 0,01 mm.

The determination is made by the aid of a sketch kindly sent me by Mr. Grunow, who supposes, with some doubts, that it may be the *Ceratoneis laminaris* Ehrb. It has been distributed in Cl. & Möll. Diat. No 153 (Corsica). I have found the same species in gatherings from the Adriatic Sea.

*M. undulata* Grun. (Verh. 1860, pag. 576, Pl. I, fig. 5. T. M. S. 1877, pag. 176, Pl. CXCIV, fig. 5).

*M. rhombica* Cl. N. Sp. — Rhombic. Med. line slightly undulate, without accompanying lines. Striæ coarse 11 in 0,01 mm. slightly radiant, composed of distinct pearl-like puncta, which form wavy longitudinal rows. Loculi marginal, equal in size, about 6 in 0,01 mm. Surface of the valve not perfectly plane, being a little impressed on both sides of the median line. Length 0,048 mm. Breadth 0,02 mm. — Pl. 35, fig. 9.

*M. lanceolata* Thw. (Van Heurck Syn. Pl. IV, fig. 15—17). Length of the valve 0,048 mm. Breadth 0,015 mm. Striæ 16—19 in 0,01 mm. Loculi 6 in 0,01 mm.

*M. apiculata* W. Sm. (Syn. II, pag. 65, Pl. LXII, fig. 387).

*M. minuta* Grev. — var. with 16 striæ and 8 loculi in 0,01 mm. Length 0,03—0,04 mm. Breadth 0,014 mm. — According to Grunow (T. M. S. 1877, pag. 176) *M. minuta* has closer striæ, 25 in 0,01 mm.

*M. Jelineckii* Grun. (T. M. S. 1877, pag. 174, Pl. CXCIV, fig. 1) var. Length 0,06 mm. Breadth 0,015 mm. Striæ 18 in 0,01 mm. Loculi 5 in 0,01 mm.

*M. quinque-costata* Grun. (Verh. 1860, pag. 578, Pl. VII, fig. 8) Several varieties. On a small specimen, 0,03 mm. in length and 0,018 mm. in breadth, I counted 26 striæ and 4 loculi in

0,01 mm. Specimens from the Balearic Islets and from the Cape of Good Hope have 16 striæ in 0,01 mm.

*M. (acutiuscula* Grun. Mpt. var.?) *Labuensis* Cl. — Valve elongate, with almost parallel margins and subcuneate ends. Median line straight with approximate accompanying lines. Striæ 16—17 in 0,01 mm. parallel or a little radiant near the ends, composed of puncta, forming longitudinal striæ. Loculi of equal size, 7—8 in 0,01 mm. — Length 0,064 mm. Breadth 0,016 mm. — Pl. 35, fig. 5.

Mr. Grunow has kindly sent me a sketch of his not yet published *M. acutiuscula* from the Seychells, which differs by regular elliptic outline and has 16—21 striæ in 0,01 mm.

*M. (baltica* Grun. var.?) *Citrus* Cl. — Broadly oval, with apiculate ends. Striæ 18—19 in 0,01 mm., more close near the ends, about 23 in 0,01 mm., composed of puncta, which form longitudinal lines, at a right angle to the striæ. Loculi marginal of equal size 8—10 in 0,01 mm. Median line straight, with very approximate accompanying lines or furrows. Length 0,035—0,04 mm., breadth 0,02—0,024 mm. — Pl. 35, fig. 7.

This well defined form has very little resemblance to *M. baltica* Grun. in Van Heurck Syn. Pl. IV, fig. 24, but Mr. Grunow thinks nevertheless that it may be a variety of the latter species. According to Grunow, it comes very near to *Phlyctænia minuta* Kütz. I have seen the same form in samples from Honolulu.

*M. Kjellmanii* Cl. N. Sp. — Elongate, with apiculate ends, loculi marginal of almost equal size, 4 in 0,01 mm. Striæ fine, 22 in 0,01 mm., parallel, or a little radiant in the middle, punctate, puncta forming oblique lines. Median line straight. Central nodule elongated. Length 0,06 mm. Breadth 0,014 mm. — Pl. 35, fig. 6.

*Rhoikoneis genuflexa* Grun. (Verh. 1863 pap. 147) Striæ on the convex valve 23 on the concave 20 in 0,01 mm.

*Navicula rectangulata* Greg. (Donk. Brit. Diat. Pl. X, fig. 5. Cl. & M. Diat. No 301).

*N. Pandura* Ehb. (A. Schm. Atl. Pl. XI, fig. 1).

*N. diplosticta* Grun. (A. Schm. Atl. Pl. XIII, fig. 29).

*N. multicostata* Grun. (A. Schm. Atl. Pl. XI, fig. 18).

*N. Apis* Donk. (A. Schm. Atl. Pl. XII, fig. 23 and Pl. LXIX, fig. 43).

*N. futilis* A. Schm. var.? (Atl. Pl. XIII, fig. 18).

*N. lacrimans* A. Schm. (Atl. Pl. XII, fig. 61).

*N. Lyra* Ehb.



- N. abrupta* Greg. var.  
*N. bullata* Norm. (T. M. S. I, pag. 8, Pl. II, fig. 6).  
*N. clavata* Greg. (T. M. S. IV, pag. 46, Pl. V, fig. 17).  
*N. exul* A. Schm. (Atl. Pl. II, fig. 13).  
*N. Græffii* Grun. (A. Schm. Atl. Pl. VII, fig. 5—6).  
*N. Smithii* Bréb. (A. Schm. Atl. Pl. VII, fig. 14—18).  
*N. nitescens* Greg. (A. Schm. Atl. Pl. VII, fig. 38).  
*N. suborbicularis* Greg. (A. Schm. Atl. Pl. VIII, fig. 1, 2, 5).  
*N. Campylodiscus* Grun. (A. Schm. Atl. Pl. VIII, fig. 9).  
*N. notabilis* Grev. (A. Schm. Atl. Pl. VIII, fig. 46).  
*N. latissima* Greg. (T. M. S. IV, pag. 40, Pl. V, fig. 4. A. Schm. Atl. Pl. VI, fig. 7).  
 var. *kamorthensis* Grun. (A. Schm. Atl. Pl. VI, fig. 8).  
*N. humerosa* Bréb. (A. Schm. Atl. Pl. VI, fig. 4).  
*N. caribæa* Cl. (A. Schm. Atl. Pl. VI, fig. 10—12).  
*N. brasiliensis* Grun. (A. Schm. Atl. Pl. VI, fig. 21 and 32).

*N. sublyrata* Grun. — Valve constricted in the middle, covered with parallel or sub-parallel striæ, composed of distinct puncta, 12 in 0,01 mm., reaching to the median line. Length 0,046 mm. Br. 0,01 mm. at the constriction 0,007 mm. — Pl. 35, fig. 17.

Mr. Grunow has sent me a sketch of his *N. sublyrata*, which lives in brackish water in North America. The American species is not so strongly constricted in the middle as my specimen from Labuan. *N. Ceylanensis* Leud. Fortm. (Diat. Ceyl. Pl. II, fig. 25) seems to be nearly related to this species.

*N. scopulorum* Bréb. (Donk. B. D. Pl. XII, fig. 5).

*N. O'Mearii* Grun. Mpt. — Elongate, with more or less rounded ends; median line straight, terminal nodules in the ends, central nodule small. Striæ transverse and longitudinal covering the whole valve. Transverse striæ almost parallel, or very little radiant, 16 to 17 in 0,01 mm., longitudinal 18—21 in 0,01 mm.

*forma typica* Grun. Mpt. — Length 0,066 mm. Breadth 0,009 mm. Transv. str. 17, longit. 20 in 0,01 mm. Outline lanceolate, equally tapering from the middle to the somewhat acute ends. — Seychells, Grun.

var. *labuensis* Cl. Length 0,072 mm. Breadth 0,015 mm. Transv. striæ 17 in 0,01 mm. longit. striæ 21 in 0,01 mm. Outline elliptic with rounded ends. — Labuan, rare.

var. *minor* Cl. Length 0,05 mm. Breadth 0,011 mm. Trans-



verse striæ 16, slightly radiant, longitudinal 18 in 0,01 mm. — Port Jackson, rare.

This species comes near to *Navicula Vegæ* Cl. (= *Pleurosigma Kjellmanii* Cl. Arct. Diat. Pl. IV, fig. 80).

*N. cancellata* var. *impressa* Ldt. (Bih. t. K. Sv. Vet. Ak. Handl. 3 No 15, fig. 3).

*N. Zostereti* Grun. (A. Schm. Atl. Pl. XLVII, fig. 44).

The specimens from Labuan resemble exactly the figure quoted. The striæ are very finely transversely lineate as in all species of the *directa*-group.

*N. Bruchii* Grun. (K. Sv. Vet. Ak. Handl. 18, No 5, pag. 13, Pl. III, fig. 35). This species, classed among the *quadrin-seriata*-group, is beyond doubt very nearly related to *N. directa*, and has transversely lineate striæ.

*N. velata* A. Schm. (Atl. Pl. XLVIII, fig. 33—34).

*N. aspera* Ehb. (A. Schm. Atl. Pl. XLVIII, fig. 2—5).

*N. liber* W. Sm. (A. Schm. Atl. Pl. L, fig. 16—18).

*N. maxima* Greg. (T. M. S. IV, pag. 39, Pl. V, fig. 2). In the Labuan material were found both the typical form (A. S. Northsea Diat. Pl. II, fig. 44) and a variety with finer striæ 25 in 0,01 mm. Length 0,065. Breadth 0,015 mm.

*N. samoensis* Grun. (A. Schm. Atl. Pl. L, fig. 43—44). Striæ 10—13 in 0,01 mm. Length 0,054 mm. to 0,085 mm. Breadth 0,015—0,018 mm.

*N. blanda* A. Schm. (N. Sea Diat. Pl. II, fig. 27).

*N. triundulata* Grun. (T. M. S. 1877, pag. 178, Pl. CXCIV, fig. 10).

*N. quadrisulcata* Grun. (Novara Exp. Alg. pag. 101, Pl. I, fig. 14).

*Pleurosigma formosum* W. Sm. (Van Heurck Syn. Pl. XIX, fig. 4).

*P. decorum* W. Sm. (Van Heurck Syn. Pl. XIX, fig. 1).

*Pl. angulatum* W. Sm. — Oblique and transverse striæ 20—21.

*Pl. strigosum* W. Sm. (Van Heurck Syn. Pl. XIX, fig. 2).

*P. rigidum* W. Sm. (Van Heurck Syn. Pl. XIX, fig. 3).

*P. australe* Grun. (Novara pag. 21, Pl. I, fig. 18).

*P. marinum* Donk. (T. M. S. VI, pag. 22, Pl. III, fig. 3). Transverse striæ 20 oblique 19 in 0,01 mm.

*Donkinia carinata* Donk. (Pleur. car. Donk. T. M. S. VI, pag. 23, Pl. III, fig. 5). Length of the valve 0,065 mm.; breadth 0,014 mm. Transverse striæ 22, oblique 21—22 in 0,01 mm.

*D. recta* Donk. (Pleur. r. D. l. c. fig. 6). Length 0,093; breadth 0,012 mm. Longitudinal striæ 20, transverse striæ 21 in 0,01 mm.

*Amphiprora delicatula* Grev. (Edinb. N. Phil. J. XVIII, pag. 39, fig. 15—16). Length 0,075 mm. Breadth 0,015 mm. Striæ 26 in 0,01 mm.

*Achnanthes javanica* Grun. (Arct. Diat. pag. 18).

*A. seriata* Grun. (Arct. Diat. pag. 19).

*Orthonais fimbriata* (Btw.) Grun. (Van Heurck Syn. Pl. XXVIII, fig. 3).

*O. Clevei* Grun. (l. c. f. 4).

*O. binotata* Grun. (l. c. fig. 7).

*Cocconeis Scutellum* Ehb. (Van Heurck Syn. Pl. XXIX, fig. 1—12).

*C. heteroidea* Hantzsch (Ost Ind. Arch. Diat. pag. 21, fig. 10).

*C. pseudomarginata* Greg. (Van Heurck Syn. Pl. XXIX, fig. 20—21).

*C. dirupta* var. *flexella* Grun. (Van Heurck Syn. Pl. XXIX, fig. 16).

*Epithemia Musculus* Kütz. (W. Sm. Syn. I, pag. 14, Pl. I, fig. 10).

*Plagiogramma* (caribæum var.?) *Labuense* Cl. N. Sp. — Valve constricted in the middle, where there is a large annulus. Transverse septa in the ends not distinct. Median raphe distinct. Striæ, composed of separate puncta, 11 in 0,01 mm. Length 0,05 mm. Breadth 0,011 mm., at the constriction 0,007 mm. — Pl. 37, fig. 62.

*P. Seychellarum* Grun. in litt. — Valve elliptic with rounded ends. Centre with a large annulus, ends without costæ. Striæ fine, transverse, absent in the middle and at the ends, 18 in 0,01 mm., composed of fine puncta forming oblique lines (16 in 0,01 mm.). There is a distinct median raphe. Length 0,075. Breadth 0,013 mm. — Pl. 37, fig. 59 a, b.

*P. interruptum* var. *adriatica* Grun. (Van Heurck Syn. Pl. XXXVI, fig. 1)? Transverse striæ 26 in 0,01 mm. composed of puncta forming longitudinal striæ, 26 in 0,01 mm. Median raphe distinct. Length 0,056 mm. Breadth 0,008 mm. — Pl. 37, fig. 61 a, b.

*P. decussatum* Grev. (T. M. S. XIV, pag. 1, Pl. I, fig. 22).

*P. obesum* Grev. (M. J. VII, pag. 211, Pl. X, fig. 12—13).

*P. tenuistriatum* Cl. N. Sp. — Elliptic with rounded ends. Central annulus large; no costæ at the ends. Striæ transverse, 18 in 0,01 mm., composed of distinct puncta, which also form longitudinal lines. Length 0,032. Breadth 0,01 mm. — Pl. 37, fig. 63.

*P. pygmæum* Grev. (M. J. VII, pag. 211, fig. 11).



*P. orientale* Grev. (T. M. S. XIV, pag. 77, Pl. VIII, fig. 1).

*P. tessellatum* Grev. (M. J. Vol. VII, pag. 208, Pl. X, fig. 7).

*P. pulchellum* Grev. (M. J. VII, pag. 209, fig. 4—6).

*P. costatum* Grev. (Ed. N. Phil. Journ. XVIII, 1863, pag. 35, fig. 5—6). The structure of the valve consists of numerous, strong, transverse costæ and fine striæ, composed of puncta, 2 to 3 between each pair of costæ.

*Dimerogramma minus* Greg. (Diat. of Cl. pag. 495, Pl. X, fig. 35).

var. *nana* (Greg.).

*Raphoneis amphiceros* Ehr. — In the Labuan material I have seen this species in an almost incredible number of varieties, of which some are described as distinct species,

a. *forma typica* Pl. 37, fig. 52 a. Van Heurck Syn. Pl. XXXVI, fig. 20—23.

b. var. *major* *Raphoneis lanceolata* Ehb.? Length 0,075 mm. Breadth 0,023 mm. Rows of puncta 7 in 0,01 mm.

c. var. *triangularis*.

d. var. *cruciata* = *Amphitetras cruciata* Jan & Rab. Hond. Diat. pag. 4, Pl. I, fig. 5. — Intermediate forms between a. and d. are common in the Labuan material. Pl. 37, fig. 52 b. Such an intermediate variety is *Raph. amph. var. californica* Grun. in Van Heurck Syn. XXXVI, fig. 24.

e. var. *pentagona*. Pl. 37, fig. 52. c intermediate between d. and e.

f. var. *Castracanei* Grun. (Van Heurck Syn. Pl. XXXVI, fig. 28) Labuan.

*R.?* *bilineata* Gr. & Cl. — Valve variable in the outline, generally lanceolate. Sculpture strong, parallel costæ 7 in 0,01 mm., which, according to Grunow, are delicately punctate. The costæ are interrupted by strongly marked lines on both sides of the raphe. Length 0,025—0,054 mm. Breadth 0,008—0,012 mm.

forma a. *lancettula* Gr. & Cl. valve lanceolate — Pl. 37, fig. 55, b. Labuan, Seychelles (Grun.).

forma b. *protracta* Cl. valve with protracted ends, median raphe expanded to an area. Length 0,048. Br. 0,012 mm. — Pl. 37, fig. 55 a. — Labuan, Seychells (Grun.).

forma c. *elliptica* Grun. Valve elliptic — Seychells (Grun.)

forma d. *contracta* Grun. Valve contracted in the middle. Seychells (Grun.).

*R. maculata* Cl. N. Sp. — Rhombic or lanceolate, covered with pearl-like puncta, arranged in rows, crossing each other



at right angles, about 10 in 0,01 mm. In the centre of the valve is a large blank area, where the puncta are absent or as erased. Length 0,03—0,05 mm. Breadth 0,012—0,014 mm. — Pl. 37, fig. 56.

*R. quarnerensis* Grun. (Verh. 1862, Pl. IV, fig. 24)? It is with great hesitation I have determined the form Pl. 37, fig. 53 as the above species. There is in the middle of the area a faint trace of a median line and of a very indistinct central nodule, from which characters the form may approach the genus *Glyphodesmus*. The forme of the valve is sometimes a little cuneate (a).

*R.? marginulata* Cl. & Grun. — Lanceolate with marginal striæ, 15 in 0,01 mm., surrounding an apparently structure-less large area. Length 0,042 mm. Breadth 0,009 mm. — Pl. 37, fig. 57.

Mr. Grunow found the same species in gatherings from the Seychells. According to Mr. Grunow the large area is pervaded by the shallow continuation of the marginal striæ and has in the middle a median line, which I could not see with my lenses.

*Trachysphenia australis* H. L. Smith. (*Raphoneis australis* H. L. Sm. Am. Quarterl. M. J. 1878, pag. 14, Pl. III, fig. 6. *Tr. australis* var.? *Aucklandica* Grun. in Van Heurck Syn. Pl. XXXVII, fig. 1). The genus *Trachysphenia* was established by Mr. Petit in 1877 (*Diat. de Campbell* pag. 32). The *Tr. australis* Petit l. c. Pl. V, fig 19, is large and has 6 puncta in 0,01 mm. It seems then to be different from *Raphoneis australis* H. L. Smith, which is 0,0128—0,0218 mm. in length and has 12 puncta in 0,01 mm. The specimens from Labuan are about 0,022 mm. in length and have 11 rows of puncta on 0,01 mm. Similar forms have I seen in gatherings from Port Jackson. The cuneate form of the valve does not seem to be a constant characteristic, as I have found elliptic valves, to the sculpture agreeing with the cuneate ones. Such a specimen, var. *elliptica* Cl., has been figured on Pl. 37, fig. 54.

*Synedra commutata* var. *septentrionalis* Grun. (Van Heurck Syn. Pl. XL, fig. 5) Length 0,054 mm. Striæ 13 in 0,01 mm.

*S. affinis* Kütz. — Striæ 13 in 0,01 mm., area tolerably narrow.

*S. Henedyana* Greg. (*Diat. of Clyde* pag. 532, Pl. XIV, fig. 108).

*S. crystallina* var. *Smithii* Grun. (Van Heurck Syn. Pl. XLII, fig. 10).

*S. fulgens* Grev. (*Sm. Syn.* 1, pag. 74, Pl. XII, fig. 103).

*S. formosa* Hantzsch (Ost. Ind. Arch. Diat. pag. 19, Pl. V, fig. 3).

*Fragilaria? pacifica* Grun. (Van Heurck Syn. Pl. XLIV, fig. 21—22).

*Fr.? Schwarzii* Grun. (Van Heurck. l. c. fig. 24).

*Licmophora Lyngbyei* (Kütz) Grun. (Van Heurck Syn. Pl. XLVII, fig. 16) Length of the valve 0,065, breadth 0,008 mm. Striæ at the base 12, in the summit 15 in 0,01 mm.

*Grammatophora oceanica* Ehb. Several varieties were found in the Labuan material, among them the var. *intermedia* Grun. (Van Heurck Syn. Pl. LIII, fig. 15) with 26 striæ in 0,01 mm.

*Gr. maxima* var. *Trinitatis* Grun. (Bot. Centr. Bl. 1881, Bd VII, Beil. pag. 8) Length 0,075, breadth 0,008 mm. Striæ 30 in 0,01 mm.

*G. undulata* var. *gibba* Grun. (Van Heurck Syn. XIII B, fig. 17).

*Striatella interrupta* Ehb. (Van Heurck Syn. Pl. LIV, fig. 8).

*Rhabdonema adriaticum* Kütz.

*Climacosphenia elongata* Bail (Smith's Contr. VII, fig. 10—11) Striæ 21 in 0,01 mm.

*Hantzschia amphioxys* var. *borneensis* Cl. Length 0,1 mm. Striæ 9 in 0,01 mm., composed of distinct puncta; carinal puncta 3 in 0,01 mm.

*H. virgata* Roper. (Van Heurck Syn. Pl. LVI, fig. 12).

*Nitzschia (punctata var.?) diluviana* Cl. (Schr. der phys. Oek. Ges. zu Königsb. Bd XXII, pag. 139) Lanceolate (of the same outline as *Nitz. lanceola* Grun.) one half of the valve not on the same plane as the other. Striæ, composed of distinct and separate puncta, 11 in 0,01 mm. carinal puncta indistinct. Length 0,035 mm. Breadth 0,008 mm. Pl. III, fig. 67.

I found this form first in diluvial clay from East Prussia.

*N. panduriformis* Greg. (Grun. Arct. Diat. pag. 71). Length 0,075 mm. Breadth 0,02 mm. Striæ 17 in 0,01 mm.

*N. Jelineckii* Grun. (Arct. Diat. pag. 74).

*N. marginulata* Grun. (Arct. Diat. pag. 72). Puncta 10—13 in 0,01 mm. Striæ 20—25 in 0,01 mm. Length 0,066 mm. Breadth 0,016 mm. Sides of the valve almost parallel.

*N. (vivax var.?) fluminensis* Grun. (Arct. Diat. pag. 86. Van Heurck Syn. Pl. LXII, fig. 3).

*N. (sigma var.?) valida* Cl. & Grun. (Van Heurck Syn. Pl. LXV, fig. 5).

*N. labuensis* Cl. N. Sp. — Valve elongate; keel eccentric with large and distant puncta, 4—5 in 0,01 mm., of which the

central is much larger than the others. Striæ extremely fine, about 36 in 0,01 mm. (sec Grunow) marginal. Length 0,083 mm. Breadth 0,006 mm. Very rare in the Labuan material. — Pl. 37, fig. 66.

*N. Sigma* var. *intercedens* Grun. (Casp. Sea. Alg. pag. 22). Puncta 7, striæ 30 in 0,01 mm.

*N. obtusa* W. Sm. Very long and slender form with 10 puncta and 27 striæ in 0,01 mm.

*N. (Homoeocladia) Vidovichi* Grun. (Van Heurck Syn. Pl. LXVII, fig. 7)

*N. vitrea* Norm. (Grun. Arct. Diat. pag. 93). Puncta 7, striæ 24 in 0,01 mm. Length 0,1 mm. Breadth 0,008 mm.

*N. lanceolata* W. Sm. var. with 10 puncta and 26 striæ in 0,01 mm. Length 0,08 mm. Breadth 0,01 mm.

*N. longissima* (Bréb.) Ralfs. (Van Heurck Syn. Pl. LXX, fig. 1—2).

*N. ventricosa* Kitton (M. M. Jour. Nov. 1873, pag. 206, Pl. XXXVIII, fig. 5).

*Surirella fastuosa* Ehb. (A. Schm. Atl. Pl. V, fig. 10—13).

*S. cuneata* O. Witt (A. Schm. Atl. Pl. IV, fig. 1).

*Campylodiscus ambiguus* Grev. (A. Schm. Atl. Pl. XVIII, fig. 23).

*C. undulatus* Grev. (A. Schm. Atl. Pl. XVIII, fig. 11).

var. *biangulatus* Grev. (A. Schm. Atl. Pl. XIV, fig. 18).

*C. Thuretii* Bréb. a very small variety.

*C. parvulus* (W. Sm.?) Van Heurck (Syn. Pl. LXXVII, fig. 2).

*C. Ralfsii* Sm. (A. Schm. Atl. Pl. XIV, fig. 3).

*Campylodiscus(?) cocconeiformis* Grun (Cl. & Möll. Diat. No 178 and 214). Length 0,02—0,036 mm. Breadth 0,018—0,028 mm. — Pl. 38, fig. 78.

*Plagiodiscus nervatus* Grun. (M. J. 1877, pag. 172, Pl. CXCIV, fig. 9).

*Bacteriastrum varians* Laud. (Van Heurck Syn. Pl. LXXX, fig. 3—5).

*Chaetoceros diversus* Cl. (Van Heurck Syn. Pl. LXXXI, fig. 5).

*Ch. peruvianus* Btw. (M. J. IV, pag. 107, Pl. VII, fig. 16—18).

*Podosira hormoides* Mont. (Van Heurck Syn. Pl. LXXXIV, fig. 3).

*Melosira sulcata* Ehb.

*Melosira labuensis* Cl. N. Sp. — Valve as high as broad, rounded at the end, covered by puncta arranged in straight lines, radiating from the apex to the suture, 18 in 0,01 mm. Height of valve 0,008 mm. Breadth 0,012 mm. — Pl. 38, fig. 84.



*Cyclotella striata* Kütz var. *stylorum* Btw. (Van Heurck Syn. Pl. XCII, fig. 2—5).

*Coscinodiscus* (*Hauckii* Grun. var.?) *mesoleius* Cl. — Very thin and transparent. Striæ marginal, composed of fine puncta, 28 in 0,01 mm., surrounding a large structure-less centre. Diam. 0,03 mm. — Pl. 38, fig. 82.

This form differs from *Cos. Hauckii* Grun. (Van Heurck Syn. Pl. XCIV, fig. 29) by its structure-less central area, which in the Grunowian species is covered with large scattered puncta.

*C. excentricus* Ehb. (A. Schm. Atl. Pl. LVIII, fig. 46, 47, 48).

*C. nitidulus* Grun. (A. Schm. l. c. fig. 20).

*C. lineatus* Ehb. (A. Schm. Atl. Pl. LIX, fig. 29—30).

*C. radiatus* Ehb. (A. Schm. Atl. Pl. LX).

*Biddulphia reticulata* Roper var. A. Schm. Atl. Pl. LXXVIII, fig. 21.

var.? *dubia* (Btw.) — *Triceratium* dub. Btw. M. J. VII, pag. 180, Pl. IX, fig. 12 *T. bicornis* Cl.

*B. Roperiana* Grev. (Van Heurck. Syn. Pl. XCIX, fig. 6).

*Triceratium punctatum* Btw. (Pritch. Inf. Pl. VI, fig. 20).

*T. parvulum* Jan. & Rab. (Hond. pag. 4, Pl. I, fig. 4, Amphitetras).

*T. Favus* Ehb. a small form.

*Eunotogramma lævis* Grun. (Cl. & Möll. Diat. No 257 —? Leudug. Fortm. Diat. Ceyl. Pl. IX, fig. 93, 94, 95, *Biddulphia lunaris* Ehb.?)

*Anaulus minutus* Grun. (Van Heurck Pl. CIII, fig. 4—5).

*Cerataulus labuensis* Cl. N. Sp. — Hyaline; valve broadly ovale with rounded ends. Surface covered with extremely fine striæ, 28 in 0,01 mm., almost parallel, near the ends radiating, passing from the longitudinal axis of the valve to the margin. Both valves of the frustle at an angle to each other. F. W. trapeziform or irregularly quadratic; in the corners of the valves are ocelli visible. Connecting membrane  $\infty$  shaped. Length of the valve 0,025—0,04 mm. — Pl. 38, fig. 80.

Both valves are not opposite to each other, for which reason the connecting membrane forms a somewhat twisted tubus.

*Auliscus cœlatus* Bail (A. S. Atl. Pl. XXXII, fig. 13).

*A. Stöckhardtii* Jan. (Guan. Pl. I, fig. 4).

*Aulacodiscus margaritaceus* Ralfs (A. Schm. Atl. Pl. XXXVII, fig. 7).

*Actinoptychus hexagonus* Grun. (A. Schm. Atl. Pl. I, fig. 15).

*A. splendens* Shadb. (*Halionyx undenarius* Jan. Guan. Pl. I, fig. 1).

*Actinocyclus Ehrenbergii* Ralfs (Pritch. Inf. pag. 834) large and fine specimens.

*Asteromphalus flabellatus* Bréb. (A. Schm. Atl. Pl. XXXVIII, fig. 10—12).

*A. impar* Shadb. (T. M. S. 154, pag. 17, Pl. I, fig. 17).

## V. Diatoms from Ceylon.

During the stay of the Vega at Point de Galle Dr. Kjellman made some collections of marine algæ. On cleaning them he collected the washing a water deposits, which were given to me for examination. Also some samples of marine coarse mud were taken and sent to me. The latter were very poor in diatoms, but the first named deposit tolerably rich. On the marine diatoms of Ceylon we have by Dr. Leuduger-Fortmorel an elaborate paper, containing descriptions of many new forms<sup>1</sup>. The samples collected by Dr. Kjellman contained scarcely any of the species described by Dr. Leuduger-Fortmorel, but a lot of forms not recorded in the named paper. The collection of Dr. Kjellman completes in a welcome manner the number of marine species, known from Ceylon. I think it will be most convenient to enumerate the forms, contained in the samples from the Vega-Expedition, in the same order as in the paper of Dr. Leuduger-Fortmorel. I have added a \* to each species not found by Dr. Leuduger-Fortmorel.

*Cocconeis Scutellum* Ehb. (Van Heurck Syn. Pl. XXIX, fig. 1—12).

\* *C. heteroidea* Hantzsch (Ost. Ind. Arch. pag. 21, fig. 10).

\* *C. pseudomarginata* Greg. (D. of Cl. pag. 492, Pl. IX, fig. 29, *C. major* l. c. pag. 28).

\* *C. pellucida* Grun. (Hantzsch Ost. Arch. D. pag. 21, fig. 11).

\* *Orthoneis fimbriata* (Btw.) Grun. (*Mastogloia cribrosa* Grun. p. p. Trans. M. S. VII, pag. 179, Pl. IX, fig. 3).

\* *Campyloneis Grevillei* (W. Sm.) Grun. V. H. Syn. Pl. XXVIII, fig. 10—12).

\* *Achnanthes javanica* Grun. (A. D. pag. 18).

\* *A. bengalensis* Grun. (l. c.).

*A. pennata* Grev. — One single valve of an *Achnanthes*, which I believe belongs to *A. pennata*, was found in the Ceylon-material, but having had no occasion to see the fig.

<sup>1</sup> Catalogue des Diatomées de l'île de Ceylan. Mémoires de la Société d'Émulation des Côtes du Nord. 1879.

published by Greville I cannot be sure of the identity. The valve was 0,072 mm. in length and 0,005 mm. in breadth. Striæ 13 1/2 in 0,01 mm. — Pl. 35, fig. 2.

*Amphora ostrearua* Bréb. (A. S. Atl. Pl. XXVI, fig. 23).

*A. crassa* Greg. (A. S. Atl. Pl. XXXIX, fig. 30).

\* *A. cymbelloides* Grun. (Hedw. 1867, VI p. 24, Cl. & M. D. No 147).

\* *Navicula Apis* Donk. (A. S. Atl. XII, fig. 23).

\* *N. Advena* A. S. Atl. (Pl. VIII, fig. 29).

*N. aspera* Ehb. (A. S. Atl. XLII, fig. 26).

*N. brasiliensis* Grun. var.? — L. 0,065. Br. 0,03 mm. Str. 14 in 0,01 mm.

\* *N. consors* A. S. (Atl. Pl. XLVIII, fig. 24—27).

*N. circumsecta* Grun. (A. S. Atl. Pl. III, fig. 27).

*N. directa* Sm. var.? (A. S. Atl. Pl. XLVII, fig. 12 and l. c. fig. 13.)

\* *N. Leudugeri* Cl. N. S. — Elliptic; med. line straight. Striæ radiant, coarse, 8 in 0,01 mm., composed of 3 to 4 large elongate and transversely lineate puncta, reaching to the med. line, except in the middle, where they are shortened. L. 0,07 mm. B. 0,016 mm. This species resembles *N. guttata* Grun (A. S. Atl. Pl. XLVI, fig. 10) but is not so convex and has different end-pores. — Pl. 36, fig. 22.

*N. futilis* A. S. (Atl. Pl. XIII, fig. 17, 19).

\* *N. formosa* Greg. (A. S. Atl. Pl. L, fig. 9—10). Str. 15 in 0,01 mm. L. 0,085 mm. Br. 0,018 mm.

\* *N. fluminensis* Grun. (A. D. p. 28). L. 0,07 mm. Br. 0,01 mm. Str. 15 in 0,01 mm.

*N. gemmatula* Grun. (A. S. Atl. Pl. XIII, fig. 21).

*N. Henedyi* W. Sm. (A. S. Atl. Pl. III, fig. 17—18).

*N. indica* Grev. (T. M. S. II, pag. 95, Pl. IX fig. 13).

*N. lacrimans* A. S. Atl. (Pl. XII, fig. 61).

*N. Lyra* Ehb. var.

*N. Musca* Greg. (A. S. N. D. Pl. I, fig. 15).

*N. maxima* Greg. var. — A very large form with somewhat inflated middle and subcuneate ends. Length 0,16, breadth 0,017 mm. Striæ 20 in 0,01 mm. at the ends and in the middle.

*N. multicostata* Grun. (A. S. Atl. Pl. XI, fig. 14—20).

*N. nitescens* Greg. (A. S. Atl. Pl. VII, fig. 37—41).

*N. notabilis* Grev. (A. S. Atl. Pl. VIII, fig. 46).

\* *N. nicobarica* Grun. — Only one specimen, perfectly agreeing with a figure sent by Mr. Grunow but not with the fig. given in A. Schm. Atl. Pl. VIII, fig. 57 and LXX, fig. 35, 36. The



striae are costate and smooth, not punctate as in the fig. of A. S. Atl. — Pl. 35, fig. 16.

*N. Pandura* Ehb. (A. S. Atl. Pl. XI, fig. 1).

\* *N. pygmæa* Kütz (A. S. N. S. D. Pl. I, fig. 43).

*N. prætexta* Ehb. (A. S. Atl. Pl. III, fig. 32).

\* *N. quadrisulcata* Grun. (Nov. pag. 101, Pl. I, fig. 14).

\* *N. rhombica* Greg. (T. M. S. IV, pag. 38, Pl. V, fig. 1).

L. 0,07. Br. 0,02. Str. 17 in 0,01 mm.

*N. splendida* Greg. (T. M. S. IV, pag. 44, fig. 14).

*N. Smithii* Bréb. (A. S. Atl. Pl. VII, fig. 14—18).

\* *N. separabilis* A. S. (Atl. Pl. XI, fig. 3).

*N. Weissflogii* A. S. (Atl. Pl. XII, fig. 26—31).

\* *N. velata* A. S. (Atl. Pl. XLVIII, fig. 33—34).

\* *N. Yarrensii* Grun. (A. S. Atl. Pl. XLVI, fig. 3).

\* *N. sp.* A. S. Atl. Pl. XLVII, fig. 12 et 13.

\* *Rhoikoneis genuflexa* (Kütz?) Grun. (Verh. 1863, pag. 147).

Striæ on the convex valve 18, on the concave 17 in 0,01 mm.

\* *Pleurosigma decorum* W. Sm. (Van Heurck Syn. Pl. XIX, fig. 1).

\* *P. giganteum* Grun. (Verh. 1860, Pl. VI, fig. 1).

*P. australe* Grun. (Nov. p. 21, Pl. I, fig. 18).

\* *P. strigosum* W. Sm. Length 0,11 mm. Br. 0,02 mm.

Trans. and obl. str. 20 in 0,01 mm.

\* *Rhoicosigma robustum* Grun. (A. D. p. 58) Length 0,4. Br. 0,06 mm. Long. striae 13 1/2, trans. 11 1/2 in 0,01 mm.

\* *R. antillarum* Cl. (West. Ind. D. pag. 9, Pl. II, fig. 14).

Longit. striae 24, transverse 18 in 0,01 mm.

\* *Amphiprora lepidoptera* Greg. (Van Heurck Syn. Pl. XXII, fig. 2).

\* *A. balearica* Cl. & Grun. (A. D. p. 63).

*Nitzschia panduriformis* Greg. (Van Heurck Syn. Pl. LVIII, fig. 1).

var. *continua* Grun. (l. c. fig. 6).

*N. pand. v. lata* (O. W.) Grun, A. D. pag. 71.

*N. Jelinecki* Grun. (A. D. pag. 74).

\* *N. granulata* Grun. (M. J. III, Pl. XII, fig. 7, 1880).

*N. Sigma* W. Sm. (Van Heurck Syn. Pl. LXV, fig. 7—8).

\* *N. cursoria* (Donk.) Grun. (Van Heurck Syn. Pl. LXII, fig. 19).

\* *N. angularis* W. Sm. (Van Heurck Syn. l. c. fig. 11—14).

\* *N. vivax* (W. Sm.) Grun. — Puncta 6—7. Str. 13 in 0,01 mm. punctate. L. 0,135 mm. Keel unusually eccentric.

\* *N. affinis* Grun. (Van Heurck Syn. Pl. LXII, fig. 16).

\* *N. fluminensis* Grun. (Van Heurck Syn. Pl. LXII, fig. 3 a. 4) L. 0,1 mm. Puncta 5—6. Str.  $19\frac{1}{2}$  in 0,01 mm.

\* *N. (Homoeocladia) Vidovichii* Grun. (Van Heurck Syn. Pl. LXVII, fig. 7).

\* *N. ventricosa* Kitton. (M. J. 1873, Pl. XXXVIII, fig. 5).

*N. nicobarica* Grun. (M. J. III 1880, Pl. XII, fig. 2).

*N. marina* Grun. (Van Heurck Syn. Pl. LVII, fig. 26,27) Str. 11, oblique striae 16 in 0,01 mm. Length 0,23. Br. 0,008 mm.

*Surirella fastuosa* W. Sm. (Grev. T. M. S. X, Pl. III, fig. 1, A. S. Atl. Pl. V, fig. 13, 15).

\* *S. manca* Janish (A. S. Atl. LVI, fig. 9).

\* *Campylodiscus Ralfsii* Sm. (A. S. Atl. Pl. XIV, fig. 1).

*C. undulatus* Grev. (A. S. Atl. XVIII, fig. 11, C. Grevillei Leuduger p. 47, Pl. V, fig. 54—56).

*C. biangulatus* Grev. (A. S. Atl. XIV, fig. 18) scarcely more than a variety of *C. undulatus*.

*C. ornatus* Grev.

\* *C. sp.* A. S. Atl. Pl. XIV, fig. 27.

\* *C. Dæmelianus* Grun. (A. S. Atl. Pl. LIV, fig. 1 a. 2).

\* *C. Thuretii* Bréb. (Van Heurck Syn. Pl. LXXVII, fig. 1).

*C. ambiguus* Grev. (A. S. Atl. XVIII, fig. 23—26).

\* *Synedra Baculus* v. *minor* Grun. (T. M. S. 1877, p. 168. Pl. CXCIV, fig. 1).

\* *S. formosa* Hantzsch. var. — Str. 12 in 0,01 mm.

\* *S. crystallina* var. — Med. line indistinct, lateral very strong. Striae  $10\frac{1}{2}$  in 0,01 mm.

\* *S. lævigata* Grun. (T. M. S. 1877, p. 166, Pl. CXCIII, fig. 3).

*S. Henedyana* Greg. (Van Heurck Syn. Pl. XLII, fig. 3).

*S. undulata* (Bail) Greg. (Van Heurck Syn. Pl. XLII, fig. 2).

*Sceptroneis cuneata* Grun. — var. with 16 striae in 0,01 mm. and indiscernible longitudinal furrows.

*S. intermedia* C. N. Sp. — Linear with very little dissimilar ends. Length 0,3 mm. Br. 0,018 mm. Median line not visible, lateral strong. Striae  $16\frac{1}{2}$  in 0,01 mm., finely punctate. Ends with radiant lines of small puncta. — Pl. 37, fig. 60.

*Raphoneis Surirella* (Ehb.?) Grun. (Van Heurck Syn. Pl. XXXVI, fig. 26—27).

\* *R. bilineata* Cl. & Grun. pag. 499.

*R. amphiceros* Ehb. var. *cruciata* (Amphitetras *cruciata* Jan & Rabh. conf. pag. 499).

\* *Dimerogramma ceylanica* Cl. N. S. — Linear with rounded ends. Striae punctate 16 in 0,01 mm., marginal. Length 0,08. Br. 0,01 mm. — Pl. 37, fig. 58.

- Plagiogramma pulchella* Grev. (M. J. VII, p. 209, fig. 4—6).  
*P. decussata* Grev. (T. M. S. XIV, p. 1, Pl. I, fig. 1 a. 2).  
 \* *Pl. attenuata* Cl. (West. Ind. Diat. pag. 10, Pl. III, fig. 18).  
*P. staurophora* (Greg.) Heib. (Van Heurck Syn. Pl. XXXVI, fig. 2).  
 \* *Cyclophora tenuis* Castr. (Van Heurck Syn. Pl. XXXVI, fig. 5).  
 \* *Licmophora Lyngbyei* v. *Pappeana* Grun. (Van Heurck Syn. XLVII, fig. 15). Upper striæ 13 in 0,01 mm. Lower 12 in 0,01 mm. Length of valve 0,05—0,06. Br. 0,08 mm.  
 \* *L. flabellata* C. Ag. (Van Heurck Syn. Pl. XLVI, fig. 2).  
*Euphyllodium spathulatum* Shadb. (M. J. II, Pl. I, fig. 3).  
*Climacosphenia elongata* Bail.  
*Grammatophora hamulifera* Kütz. (*G. uncina* Leuduger pag. 55, Pl. V, fig. 60?).  
*G. oceanica* Ehb.  
*G. undulata* Ehb. forma *genuina* Grun. (Beil. z. Bot. Centralbl. Vol. VII, fig. 11).  
 \* *G. maxima* Grun.  
 \* *Rhabdonema adriaticum* Kütz.  
 \* *Climacosira mirifica* (W. Sm.) Grun. (Verh. 1862, pag. 424, Pl. IX, fig. 3).  
 \* *Striatella delicatula* (Kütz.) Grun. (Van Heurck. Syn. Pl. LIV, fig. 2).  
 \* *Isthmia Lindigiana* Grun. (Mier. Journ. 1877, Pl. CXCVI, fig. 1).  
*Biddulphia pulchella* Gray.  
 var. T. M. S. X, pag. 25, Pl. III, fig. 3—4.  
*B. Tuomeyi* Roper.  
*B. Edwardsii* Febig (Van Heurck Syn. Pl. C, fig. 10).  
 \* *B. Roperiana* Grev. (T. M. S. VII, pag. 163, Pl. VIII, fig. 11—13).  
*B. reticulata* Roper (Van Heurck Syn. Pl. CII, fig. 1—2).  
 var. *trigona* Grun. (Van Heurck l. c. fig. 3).  
*B. dubia* (Btw.) (*Tric. dubium* Btw. T. M. S. VII, pag. 180, Pl. IX, fig. 12. *Tric. bicornis* Cl. West. Ind. Diat. Pl. V, fig. 30).  
*B. mobiliensis* Bail. (Van Heurck Syn. Pl. CI, fig. 6).  
 \* *B. turgida* Ehb. (*B. granulata* Roper T. M. S. Vol. VII, pag. 13, Pl. I, fig. 10—11, Van Heurck Syn. Pl. XCIX, fig. 7—8).  
 \* *Cerataulus Titianus* Grun. (Verh. 1863, pag. 158, Pl. XIII, fig. 25, Bidd. membranacea Cl. West. Ind. Diat. pag. 20, Pl. V, fig. 33).  
 \* *C. levis* Ehb. (Roper. T. M. S. Vol. VII, Pl. II, fig. 25—26).  
 \* *C. turgidus* W. Sm. (Syn. II, pag. 50, Pl. LVI, fig. 323).



\* *Hydrocera compressa* Wallich (M. J. Vol. VI, pag. 252, Pl. XIII, fig. 7—12). The structure of the valve consists of a coarse reticulation of large 5—7-gonal cells, 6 in 0,01 mm., and a finer decoration of small puncta arranged in lines radiating from the centre. Ends of the valve (in S. V.) destitute of the coarse reticulation.

*Anaulus birostratus* Grun. (Van Heurck Syn. Pl. CIII, fig. 1—2).

\* *Triceratum (arcticum var.?) formosum* Btw. (A. Schm. Atl. Pl. LXXIX, fig. 2) 3—6-gonal varieties.

*T. punctatum* Btw. (M. J. Vol. IV, pag. 275, Pl. XVII, fig. 18).

\* *T. cinnamomeum* Grev. (M. J. N. S. III, pag. 232, Pl. X, fig. 12).

*T. Farus* Ehb.

*T. Pentacrinus* Wallich (M. J. VI, pag. 249, Pl. XII, fig. 10—19).

\* *T. elongatum* Grun. (A. Schm. Atl. Pl. LXXX, fig. 12).

\* *T. armatum* Roper (M. J. II, pag. 283).

*Hemidiscus cuneiformis* Wallich (Pritch. Inf. Pl. VI, fig. 14 and probably *Euodia Ceylanensis* Leuduger pag. 62, Pl. VI, fig. 65).

\* *Aulacodiscus orientalis* Grev. (T. M. S. XII, pag. 12, Pl. II, fig. 6. A. Schm. Atl. Pl. XXXIV, fig. 2).

\* *B. Beeveriae* Johns. (Pritch. Inf. pag. 844, Pl. VI, fig. 5). This form has been distributed in Cl. and Möll. Diat. No 278 as *A. Comberi* var. *ceylanica* Grun., according to the determination of Grunow. I think nevertheless that it may be the *A. Beeveriae* of Johns.

\* *A. Macraeanus* Grev. (T. M. S. X, pag. 23, Pl. II, fig. 4).

*Coscinodiscus radiatus* Ehb. (A. S. Atl. Pl. LX, fig. 6—7).

*C. excentricus* Ehb. (A. S. Atl. LVIII, fig. 46).

\* *C. denarius* A. S. (Atl. Pl. LVII, fig. 20—21).

\* *C. cocconeiformis* A. S. (Atl. Pl. LVIII, fig. 25—28).

*C. nitidus* Greg. (A. S. Atl. Pl. LVIII, fig. 18).

\* *C. sp.* A. S. Atl. LVII, fig. 32.

\* *C. subtilis* Ehb. (A. S. Atl. Pl. LVII, fig. 14).

\* *C. symmetricus* (Grev.?) A. S. (Atl. Pl. LVII, fig. 27).

\* *Actinocyclus Ehrenbergii* Ralfs (Prit. Inf. p. 834).

\* *A. tenellus* Bréb. (Donkin M. J. I, pag. 7, Pl. I, fig. 16. *A. moniliformis* Ralfs? A. S. N. S. D. III, fig. 31).

\* *A. subtilis* Greg.

\* *Actinoptychus hexagonus* Grun. (A. S. Atl. Pl. I, fig. 15).

v. *tenella* A. S. l. c. fig. 16.

*A. quaternatus* Ehb. (Jan. Guan Pl. I, A., fig. 8).

*A. splendens* (Shadb.) Ralfs (*Halionyx undenarius* Jan. Guan. Pl. I, fig. 1).

\* *Asteromphalus flabellatus* Bréb. (Grev. M. J. VII, p. 160, Pl. VII, fig. 4 et 5).

*Melosira sulcata* Ehb.

*M. (Endictya) oceanica* Btw. (A. S. Atl. Pl. LXV, fig. 10, 12, 13).

\* *Podosira Argus* Grun. (M. J. 1879, Pl. XXI, fig. 6). Diameter 0,08 mm. Striæ on the rim about 20 in 0,01 mm. The puncta which compose these striæ are arranged in quincunx as in many species of *Pleurosigma*.

*P. maculata* W. Sm. (Lagerst. Bih. t. K. Sv. Vet. Ak. Handl. III, No 15, fig. 1).

\* *P. Montagnei* Kütz. (Van Heurck Syn. Pl. LXXXIV, fig. 11).

\* *P. ambigua* Grun. (A. D. p. 118, M. J. 1879, Pl. XXI, fig. 7).

\* *P. maxima* (Kütz.) Grun. (A. D. p. 118). Diam. 0,065 mm. Umbilic. 0,01 mm. Rows of puncta 16 in 0,01 mm. near the umbilicus, 20 near the margin.

## VI. Diatoms from Bab-el-Mandeb.

Between Aden and Bab-el-Mandeb were taken samples of bottom-mud, which contained, sparsely, some diatoms, among which I have determined the following:

*Amphora zebrina* Jan (A. Schm. Atl. Pl. XXV, fig. 11).

*A. robusta* Greg. (Diat. of Cl. pag. 516, Pl. XIII, fig. 79).

*A. Proteus* Greg. var.

*A. crassa* Greg. (Diat. of Cl. pag. 525, Pl. XIV, fig. 94).

*A. furcata* Leuduger-Fortm. (Diat. de Ceylan pag. 20, Pl. I, fig. 11).

*A. mexicana* A. Schm. (Atl. Pl. XXVII, fig. 47—48).

*A. cymbifera* Greg. — Length of valve 0,085 mm., breadth 0,011. Striæ 8 in 0,01 mm. composed of distinct granules.

*Navicula aspera* Ehb.

*N. directa* W. Sm. — Length 0,11 mm. Breadth 0,013 mm. Striæ 6 in 0,01 mm.

*N. maxima* Greg. var. *Bleischii* Jan (A. Schm. Atl. Pl. L, fig. 22—25) Length 0,13 mm. Striæ 17 in 0,01 mm.

*N. maxima* Greg. var. *umbilicata* Grun. (A. Schm. Atl. Pl. L, fig. 32—33) Length 0,13 mm. Striæ 12 in 0,01 mm. in the middle, 15 in 0,01 mm. near the ends.

*N. elongata* Grun. (A. Schm. Atl. Pl. L, fig. 27—29).

*N. cancellata* Donk. — Length 0,037. Striæ 8 in 0,01 mm.

*N. Lyra* Ehb.

*N. Hennedyi* W. Sm.

*N. spectabilis* Greg. — In the sample from Bab-el-Mandeb there occur many intermediate varieties of the three last species, so that no limit between them can be established.

*N. circumsecta* Grun. (A. Schm. Atl. Pl. XIII, fig. 27).

*N. abrupta* Greg. (A. Schm. Atl. Pl. III, fig. 1—2).

*N. forcipata* Grev. (A. Schm. Nord. See Diat. Pl. I, fig. 45).

*N. splendida* var. *diplosticta* Grun. (A. Schm. Atl. Pl. XIII, fig. 28).

*N. Apis* Donk. (A. Schm. Atl. Pl. XIII, fig. 21).

*N. Weissflogii* A. Schm. (Atl. Pl. XII, fig. 27).

*N. Gründleri* A. Schm. (Atl. Pl. XII, fig. 35—36).

*N. dalmatica* Grun. (A. Schm. Atl. Pl. VIII, fig. 58).

*N. clavata* var. *elliptica* A. Schm. Atl. Pl. III, fig. 13.

*N. circumsecta* Grun. (A. Schm. Atl. Pl. III, fig. 27—28).

*N. transfuga* Grun. Mpt. — Oval, with somewhat protracted ends. Valve with a depression on each side of the median line, covered with puncta, arranged in somewhat radiant lines, 10 in 0,01 mm., reaching the median line, except around the central nodule, where these are some wedge-shaped areas. Length 0,07 mm. Breadth 0,038 mm. — Pl. 35, fig. 15. — This species has been found by Mr. Grunow in gatherings from the Seyschells.

*N. prætexta* Ehb. (A. Schm. Atl. Pl. III, fig. 30—34).

*N. brasiliensis* Grun. (A. Schm. Atl. Pl. VI, fig. 25).

*N. Baileyana* Grun. (A. Schm. Atl. Pl. VI, fig. 26—27).

*N. lacrimans* A. Schm. (Atl. Pl. XII, fig. 59—61).

*N. Smithii* Bréb. (A. Schm. Atl. Pl. VII, fig. 18—19).

*N. nitescens* Greg. (A. Schm. Atl. Pl. VII, fig. 38—39).

*N. nummularia* Grev. (A. Schm. Atl. Pl. LXX, fig. 38—40).

*N. Campylodiscus* Grun. (A. Schm. Atl. Pl. LXX, fig. 64).

*N. Eudoxia* A. Schm. (Atl. Pl. LXX, fig. 71).

*N. serrulata* A. Schm. (Atl. Pl. VII, fig. 42—43).

*N. Græffii* Grun. (A. Schm. Atl. Pl. VII, fig. 5—6).

*N. Musca* Greg. (A. Schm. Nord Sea Diat. Pl. I, fig. 15).

*Alloioneis antillarum* Cl. & Grun. (Bih. t. Kongl. Sv. Vet. Ak. Handl. T. V. No 8, pag. 8, Pl. II, fig. 11).

*Pleurosigma formosum* W. Sm.

*P. australe* Grun. (Novara. pag. 21, Pl. I, fig. 18).



*P. elongatum* var. *fallax* Grun. (Arct. Diat. pag. 50, Pl. III, fig. 36). Transverse striæ 22, oblique 20 in 0,01 mm.

*P. strigosum* W. Sm. var. *convexum* Grun. (Arct. Diat. pag. 50). Transv. striæ 20 oblique 18 in 0,01 mm.

*Amphiprora* (*Plogiotraxis*) *elegans* W. Sm. (Van Heurck Syn. Pl. XXII, fig. 1—2).

*A. Lepidoptera* Greg.

*Amphiprora rimosa* O'Meara (M. J. XI, pag. 22, Pl. III, fig. 1). This curious form, found by O'Meara in gatherings from Seychells, can scarcely belong to *Amphiprora* or to any known genus of diatoms.

*Achnanthes danica* (Flögel) Grun. (Arct. Diat. pag. 21, *Stauroneis cornuta* Leuduger-Fortm. Ceyl. Pl. III, fig. 36).

*Cocconeis?* (*Achnanthes?*) *producta* Grun.

*Plagiogramma tessellatum* Grev. (M. Journ. VII, pag. 208, Pl. X, fig. 7).

*P. nankoorensis* Grun. (*P. constrictum* v. *nankoorensis* Grun. Nov. pag. 95, Pl. I A., fig. 8. *P. ceylanense* Leuduger-Fortm. Ceyl. pag. 52, Pl. V, fig. 59). This species cannot be a variety of *P. constrictum* Grev., which has transverse costæ at the ends. It occurs fossil in Nankoori and Monterey deposits, living near Madagascar. Rows of puncta 7 in 0,01 mm. In a sample from Port Jackson I have seen a small variety, only 0,035 mm. in length and with 12 rows of puncta in 0,01 mm., var. *minuta* Cl.

*Raphoneis?* *fluminensis* Grun. (Van Heurck Syn. Pl. XXXVI, fig. 34).

*Nitzschia marina* Grun. (Arct. Diat. p. 70).

*N. Gründleri* Grun. var. — Frustle slightly constricted in the middle. Length 0,11. Striæ, composed of elongate puncta, 13 in 0,01 mm. Carinal puncta elongate, 3 in 0,01 mm.

*N. distans* Greg. var. *quarnerensis* Grun. (Verh. 1862, pag. 580, Pl. XVIII, fig. 6. Arct. Diat. pag. 87).

*N. socialis* Greg. var. *seychellensis* Grun. (Arct. Diat. pag. 85). Length 0,24 mm. Breadth 0,008 mm. Carinal puncta 7, striæ 16 in 0,01 mm.

*N. fluminensis* Grun. (Verh. 1862, pag. 37, Pl. XVIII, fig. 35. Arct. Diat. pag. 86).

*N. Sigma* var. *valida* Cl. & Grun. (Van Heurck Syn. Pl. LXV, fig. 5), Puncta 4, str. 21 in 0,01 mm.

*N. Sigma* var. *subrecta* Grun. (Casp. Sea Alg. pag. 22). Carinal puncta 8, striæ 30 in 0,01 mm.

*N. Sigma* var. *Habirshawii* Febiger (Cl. & Möll. Diat. No 223) Puncta 6, striæ 28 in 0,01 mm.

*N. insignis* Greg. var. *genuina* Grun. (Arct. Diat. pag. 84). Length 0,17 mm. Breadth 0,011 mm. Striæ 10, carinal puncta 6 in 0,01 mm.

*N. campechiana* Grun. (M. J. III, 1880, Pl. XIII, fig. 16). Length 0,065 mm. Breadth 0,023 at the constriction 0,019 mm. Carinal puncta 3, striæ 24 in 0,01 mm.

*N. marginulata* Grun. (Arct. Diat. pag. 72, Pl. IV, fig. 93). Length 0,093 mm. Breadth 0,013 mm. Carinal puncta 12—14, striæ 25 in 0,01 mm.

*N. Jelineckii* Grun. (Arct. Diat. pag. 74).

*N. panduriformis* Greg. var.

*N. diluvialis* Cl. conf. pag. 150.

*Pseudoeunotia Doliolus* (Wallich) Grun. (Van Heurck Syn. Pl. XXXV, fig. 22).

*Climacosphenia elongata* -Bail.

*Surirella fluminensis* Grun. (A. Schm. Atl. Pl. V, fig. 6).

*S. Lorenziana* Grun. (A. Schm. Atl. Pl. V, fig. 5).

*S. patens* A. Schm. (Atl. Pl. VI, fig. 16—17).

*S. mexicana* A. Schm. (Atl. Pl. VI, fig. 10—12).

*S. lepida* A. Schm. (Atl. Pl. IV, fig. 3—5).

*S. cuneata* A. Schm. (Atl. Pl. IV, fig. 1).

*S. orbicularis* Cl. N. Sp. — Valve orbicular, 0,075 mm. in diameter. Canaliculi distant 1—1½ in 0,01 mm., a little more than half of the radius in length, encircling a depressed central area, which is almost smooth. Margin striate with 18 striæ in 0,01 mm. — This beautiful species should perhaps be more correctly arranged in the genus *Campylodiscus*, where it seems to come near to *C. Helianthus*, but I think nevertheless it is most nearly related to *Surirella fastuosa*. — Pl. 38, fig. 79,  $\frac{500}{1}$ .

*Campylodiscus undulatus* Grev. (A. Schm. Atl. Pl. XVIII, fig. 11).

*C. decorus* Bréb. (A. Schm. Atl. Pl. XIV, fig. 4—5).

*C. Ralfsii* W. Sm. (A. Schm. Atl. Pl. XIV, fig. 1).

*C. crebrecoatus* Grev. (A. Schm. Atl. Pl. XV, fig. 16—17).

*C. subangularis* Grun. (A. Schm. Atl. Pl. XVIII, fig. 5—6).

*C. densecoatus* Cl. — Diam. 0,084 mm. Canaliculi numerous, 6 in 0,01 mm., reaching to the median raphe and interrupted by a circular furrow,  $\frac{1}{4}$  of the radius distant from the margin. — Pl. 38, fig. 76.

*C. limbatus* var. *minuta* Cl. — Diam. 0,027—0,035 mm. Canaliculi about 9 in 0,01 mm. — Pl. 38, fig. 77.

*Rhizosolenia ornithoglossa* Ehb.? — Some fragments, probably belonging to this species.

*Chætoceros coarctatus* Laud.? — Some fragments, which seem to belong to this species.

*Biddulphia pulchella* Gray.

*B. Tuomeyi* Roper (T. M. S. VII, Pl. I, fig. 1—2).

*B. dubia* (Btw.) Cl. (Tricerat. dubium Btw. T. bicorne Cl.).

*Triceratium Favus* Ehb.

*T. cinnamomeum* Grev. (T. M. S. III, Pl. IX, fig. 12).

*T. Pentacrinus* Wallich.

*T. punctatum* Btw. (A. Schm. Atl. Pl. LXXVI, fig. 19—20).

*T. sculptum* Shadb. A. Schm. Atl. l. c. fig. 9—10).

*Hemidiscus cuneiformis* Wallich.

*Palmeria Hardmaniana* Grev.

*Coscinodiscus africanus* Jan. (A. Schm. Atl. Pl. LIX, fig. 24—25).

*C. subtilis* Ehb. (A. Schm. Atl. LVII, fig. 13—14).

*C. denarius* A. Schm. (Atl. Pl. LVII, fig. 20—21).

*C. radiatus* Ehb. (A. Schm. Atl. Pl. LX, fig. 57).

*C. excentricus* Ehb.

*C. nodulifer* A. Schm. (Atl. Pl. LIX, fig. 21).

*C. concavus* Greg. (Diat. of Cl. Pl. II, fig. 47).

*C. lineatus* Ehb. (A. Schm. Atl. Pl. LIX, fig. 26).

*Podosira maxima* (Kg.) Grun. (Arct. Diat. pag. 118).

*Melosira (Paralia) marina* Ehb.

*Actinoptychus undulatus* Ehb.

*Asteromphalus Arachne* Bréb. (A. Schm. Atl. Pl. XXXVIII, fig. 3—4).

*A. elegans* Ralfs (A. Schm. Atl. XXXVIII, fig. 1—2).



## Explication of the Plates.

## Pl. 35.

1. *Amphora Labuensis* Cl. Labuan  $1000_I$ .
2. *Achnanthes pennata* Grev. Ceylon  $1000_I$ .
3. *A. grönlandica* Cl. Bessel's Bay  $1000_I$ .
4. *Cocconeis arctica* Cl. Bessel's Bay  $1000_I$ .
5. *Mastogloia* (*acutiuscula* var.?) *Labuensis* Cl. Labuan  $1000_I$ .
6. *M. Kjellmanii* Cl. Labuan  $1000_I$ .
7. *M.* (*baltica* var?) *Citrus* Cl. Labuan  $1000_I$ .
8. *M. acuta* Grun. var.? Labuan  $1000_I$ .
9. *M. rhombica* Cl. Labuan  $1000_I$ .
10. *Stauroneis pellucida* Cl. Cape Wankarema  $1000_I$ .
11. *Amphiprora kryophila* Cl. Cape Wankarema  $1000_I$  a F. V., b. S. V.
12. *A. glacialis* Cl. Cape Wankarema  $1000_I$ .
13. *Pleurosigma glaciale* Cl. Cape Wankarema a  $475_I$ , b *structare*  $2000_I$ .
14. *P. Clevei* Grun. var. *siberica* Grun. Cape Wankarema  $900_I$ .
15. *Navicula transfuga* Grun. Bab-el-Mandeb  $1000_I$ .
16. *N. nicobarica* Grun. Ceylon  $1000_I$ .
17. *N. syblyrata* Grun. var. Labuan  $1000_I$ .
18. *N. cruciformis* var. *brevior* Cl. Cape Deschnew (East Cape)  $1000_I$ .
19. *N. megastauros* Cl. Cape Deschnew (East Cape)  $1000_I$ .

## Pl. 36.

20. *Navicula decurrens* (Ehb.) Grun. Cape Deschnew (East Cape)  $1000_I$ .
21. *N. Pinnularia* Cl. var. *interrupta* Cl. Cape Wankarema  $1000_I$ .
22. *N. Leudugeri* Cl. Ceylon  $1000_I$ .
23. *N.* (*Rhoikoneis*) *superba* Cl. Cape Wankarema  $1000_I$ . Both valves of the same frustle.
24. *N.* (*Rhoikoneis*) *superba* var. *elliptica* Cl. Cape Wankarema  $1000_I$ .
25. *N.* (*Rhoikoneis*) *obtusa* Cl. Cape Wankarema  $1000_I$ .
26. *N. incudiformis* Grun. Cape Wankarema  $1000_I$ .
27. *N. asymmetrica* Cl. Cape Wankarema  $1000_I$ .
28. *N. erosa* Cl. Cape Wankarema  $1000_I$ .

29. *N. trigonocephala* Cl. Cape Wankarema  $1000$ .  
 30. *N. incudiformis* Grun. var. Cape Wankarema  $1000$ .  
 31. *N. transitans* Cl. Cape Wankarema  $1000$ .  
 32. *N. (transitans* Cl. var.) *derasa* Grun. Cape Wankarema  $1000$ .  
 33. *N. transitans* Cl. type. Cape Wankarema  $1000$ .  
 34. *N. imperfecta* Cl. Cape Wankarema  $1000$ .  
 35. *N. retusa* Bréb. Cape Wankarema  $1000$ .  
 36. *N. detera* Grun. Cape Wankarema  $1000$ .  
 37. *N. transitans* Cl. forma minuta. Cape Deschnew (East Cape)  $1000$ .

## Pl. 37.

38. *Navicula (Rhoikoneis) Bolleana* var.? *siberica* Grun. Cape Wankarema  $1000$ .  
 39. *N. (Rhoikoneis) Bolleana* var. *asymmetrica* Cl. Cape Wankarema  $1000$ .  
 40. *N. Kariana* Grun. var. *minor*, f. *curta*. Cape Wankarema  $1000$ .  
 41. *N. glacialis* Cl. var. Cape Wankarema  $1000$ .  
 42. *N. gelida* Cl. Cape Wankarema  $1000$ .  
 43. *N. kryophila* Cl. Cape Wankarema  $1000$ .  
 44. *N. kryokonites* Cl. Cape Wankarema  $1000$ .  
 45. *N. kryokonites* Cl. var. *semiperfecta* Cl. Cape Wankarema  $1000$ .  
 46. *N. kryokonites* Cl. var. *subprotracta* Cl. Cape Wankarema  $1000$ .  
 47. *N. (kryokonites* var.?) *Wankaremæ* Cl. Cape Wankarema  $1000$ .  
 48. *N. Tschuktschorum* Cl. Cape Deschnew (East Cape)  $1000$ .  
 49. *N. subimpressa* var. *tenuior* Cl. Cape Deschnew (East Cape)  $1000$ .  
 50. *N. subinflata* Grun. Cape Wankarema  $1000$ .  
 51. *N. Baculus* Cl. Cape Wankarema  $1000$ .  
 52. *Raphoneis amphiceros* Ehb. Labuan  $1000$  a. typical b. form intermediate between *Rh. amph.* var. *californica* and var. *cruciata* c. intermediate between var. *cruciata* and *pentagona*.  
 53. a. b. *Raphoneis quarnerensis* Grun. var.? Labuan  $1000$ .  
 54. *Trachyspenia australis* H. L. Sm. var. *elliptica* Cl. Labuan  $1000$ .  
 55. *Raphoneis?* *bilineata* Cl. & Grun. Labuan  $1000$ .  
 56. *R. maculata* Cl. Labuan  $1000$ .  
 57. *R.?* *marginata* Cl. & Grun. Labuan  $1000$ .  
 58. *Dimerogramma ceylanica* Cl. Ceylon  $1000$ .  
 59. a. b. *Plagiogramma Seychellarum* Grun. Labuan  $1000$ .  
 60. *Sceptroneis intermedia* Cl. Ceylon a  $300$  b  $1000$ .  
 61. a. b. *Plagiogramma interruptum* var. *adriatica* Labuan Grun.  $1000$ .  
 62. Pl. (*caribæum* Cl. var.?) *Labuense* Cl. Labuan  $1000$ .  
 63. Pl. *tenuistriatum* Cl. Labuan  $1000$ .  
 64. a. b. c. *Fragilaria (?) Cylindrus* Grun. Cape Wankarema  $1000$ .

65. *Nitzschia hybrida* var. *kryokonites* Cl. Cape Wankarema  $1000_I$ .  
 66. *N. labuensis* Cl. Labuan  $1000_I$ .  
 67. *N.* (*punctata* var?) *diluviana* Cl. Labuan  $1000_I$ .  
 68. *N. Denticula* var. Japan  $1000_I$ .

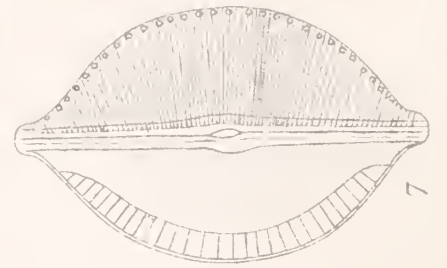
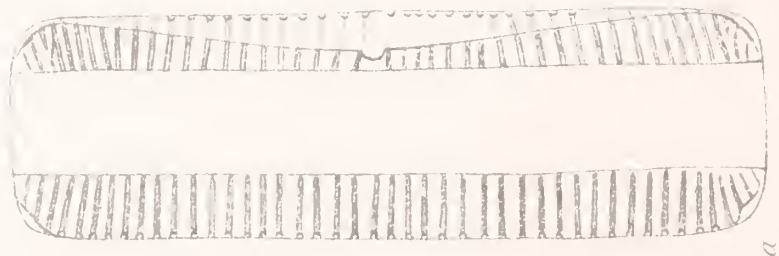
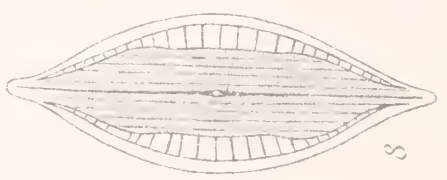
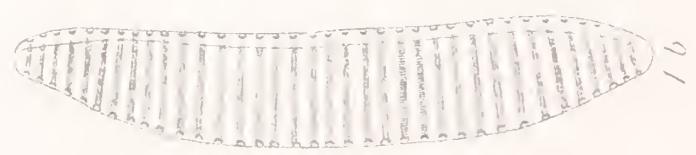
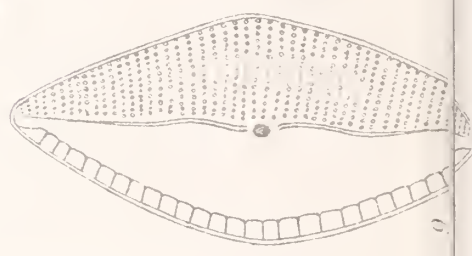
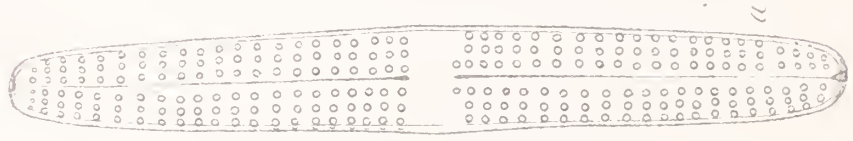
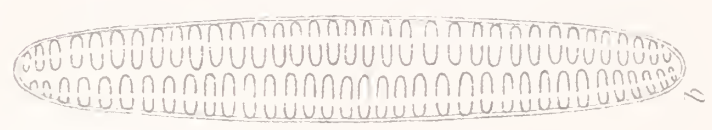
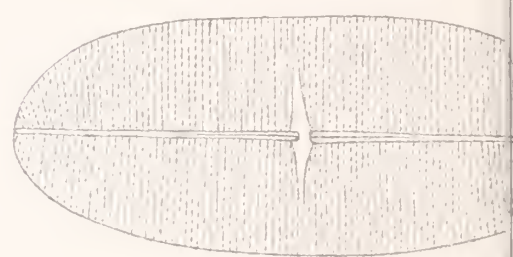
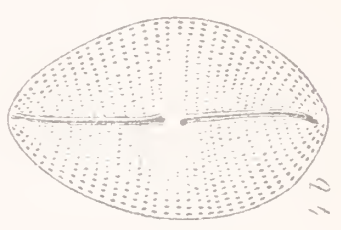
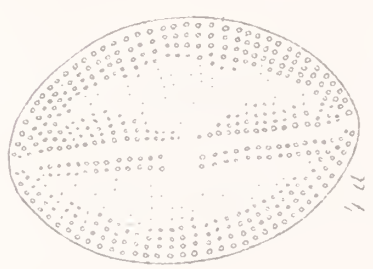
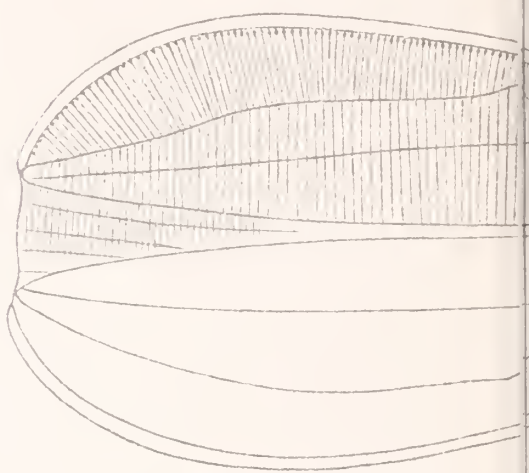
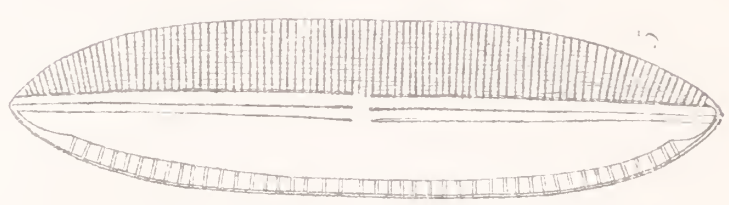
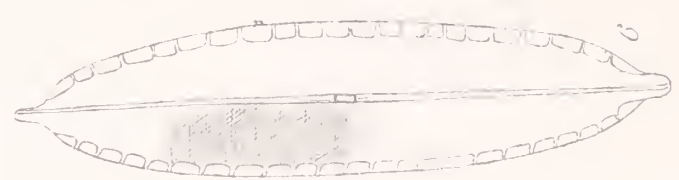
## Pl. 38.

69. *Rhizosolenia hebeta* Bail. Sea of Behring a. b. d. e. f.  $300_I$  c.  $1000_I$ .  
 70. *Nitzschia gelida* Cl. & Grun. Cape Wankarema a.  $480_I$  b. c  $1000_I$ .  
 71. *N. wankaremæ* Cl. Cape Wankarema  $1000_I$ .  
 72. a. b. *N. polaris* Grun. Cape Wankarema  $1000_I$ .  
 73. a. b. *N.* (*Sigma* var.?) *scabra* Cl. Cape Wankarema  $1000_I$ .  
 74. *N.* (*obtusa* var.??) *kryophila* Cl. Cape Wankarema  $1000_I$ .  
 75. *N.* (?) *seriata* Cl. Greenland  $1000_I$ .  
 76. *Campylodiscus densecostatus* Cl. Bab-el-Mandeb  $500_I$ .  
 77. *C. limbatus* var. *minuta* Cl. Bab-el-Mandeb  $1000_I$ .  
 78. *C.?* *cocconeiformis* Grun. Labuan  $1000_I$ .  
 79. *Surirella orbicularis* Cl. Bab-el-Mandeb  $500_I$ .  
 80. a. b. *Cerataulus labuensis* Cl. Labuan  $1000_I$ .  
 81. *Coscinodiscus bathyomphalus* Cl.  $1000_I$  a. Spitsbergen, b. Cape Wankarema.  
 82. *Coscinodiscus* (*Hauchii* Grun var.? *mesoleins*) Cl. Labuan  $1000_I$ .  
 83. *Melosira* (*mediterranea* Grun. var.?) *gelida* Cl. Mushroom Point  $1000_I$ .  
 84. *Melosira labuensis* Cl. Labuan  $1000_I$ .

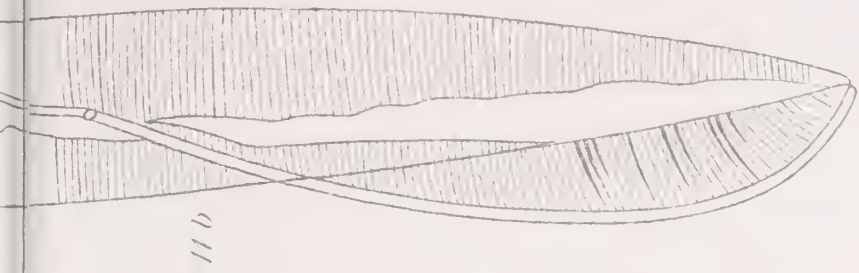




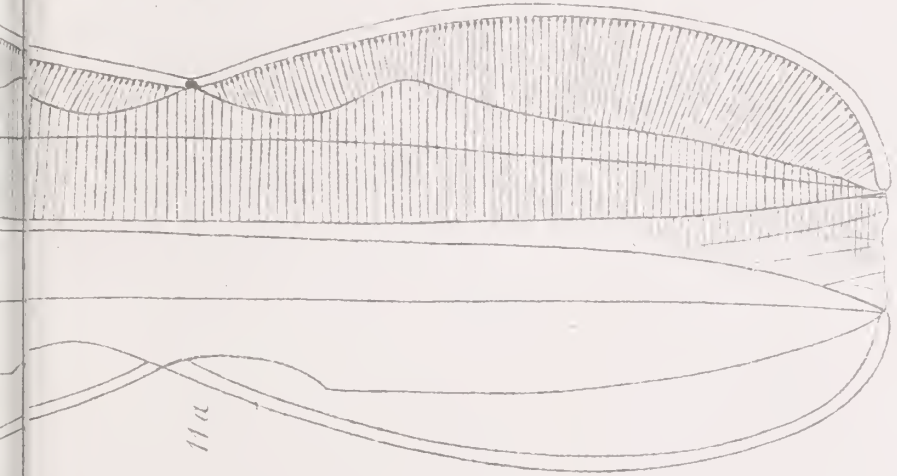




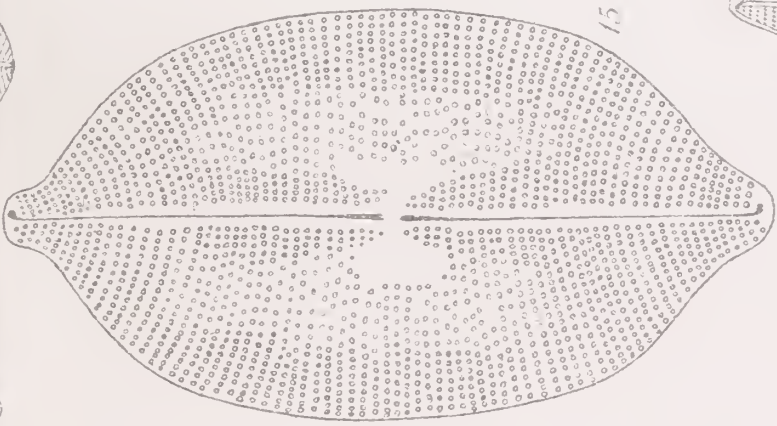




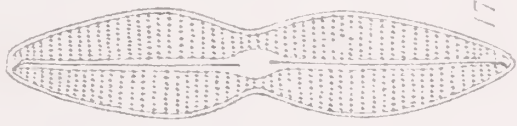
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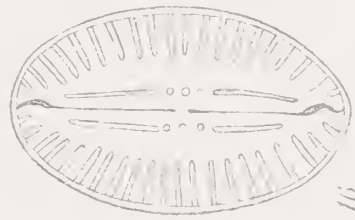
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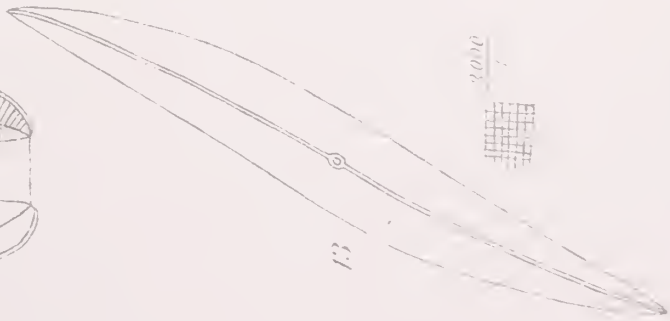
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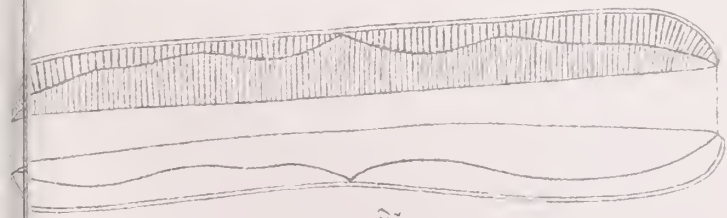
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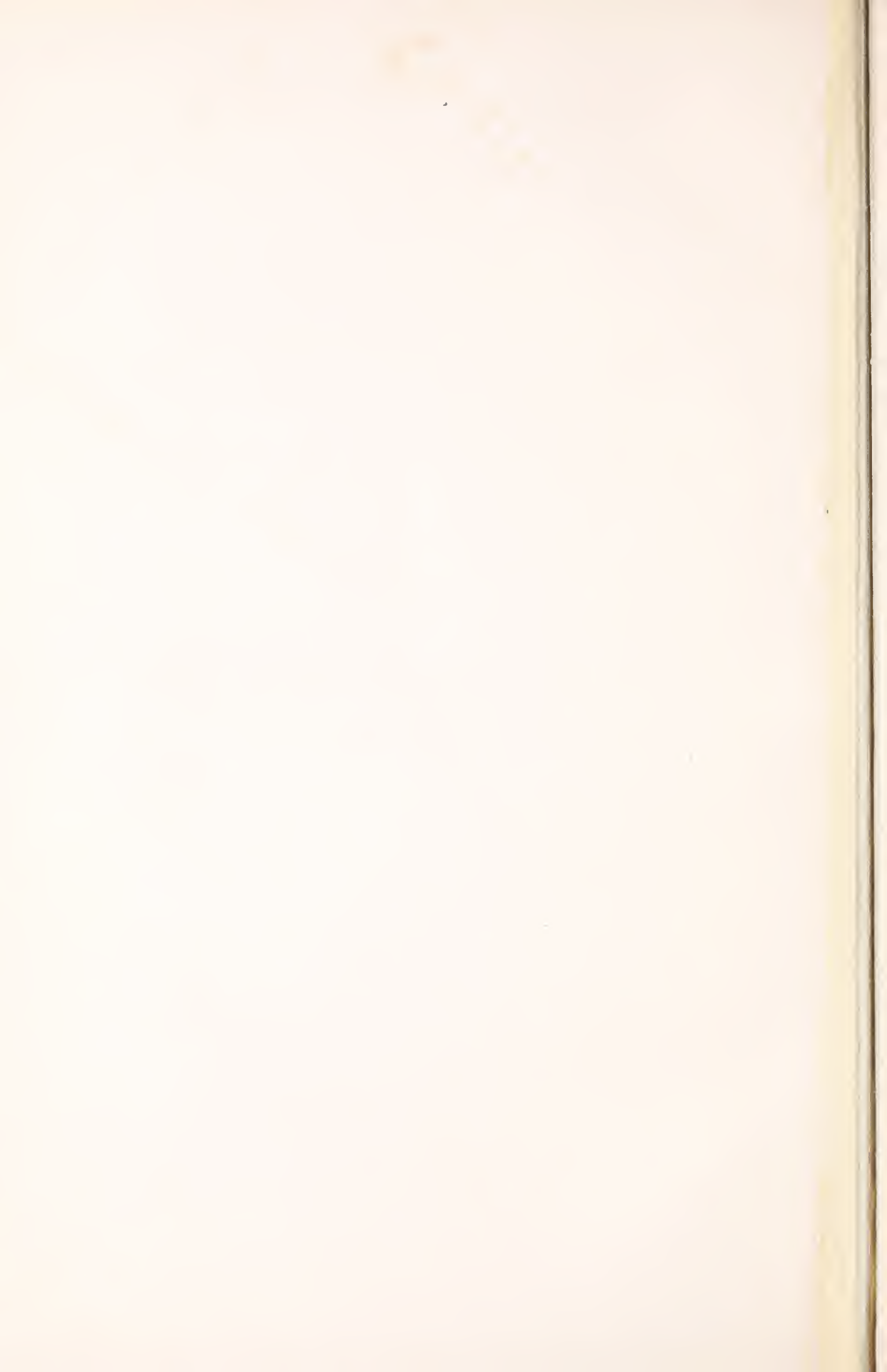
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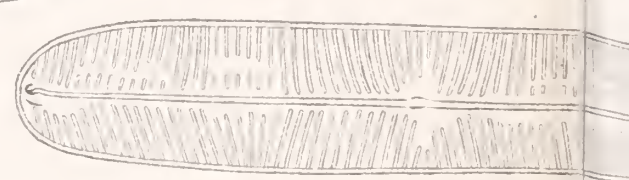
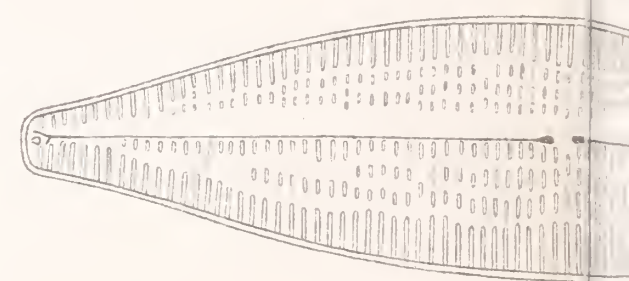
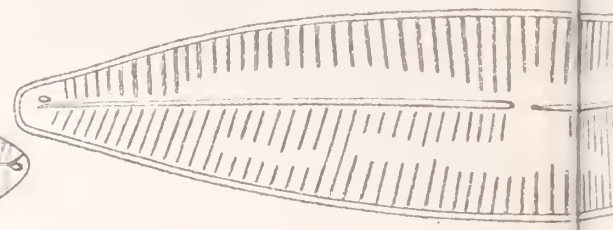
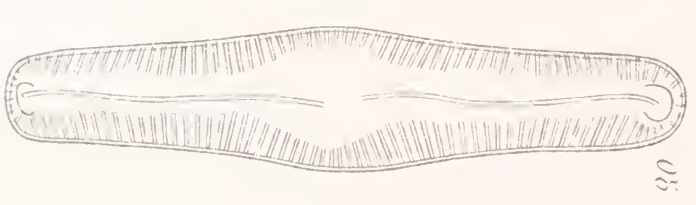
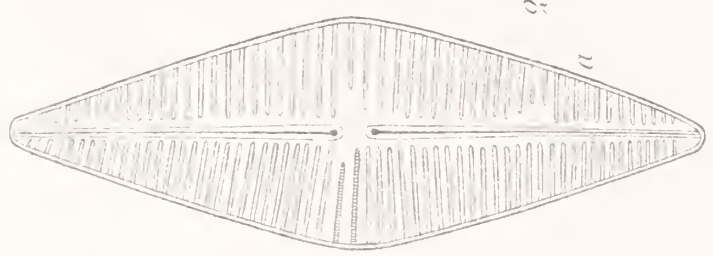
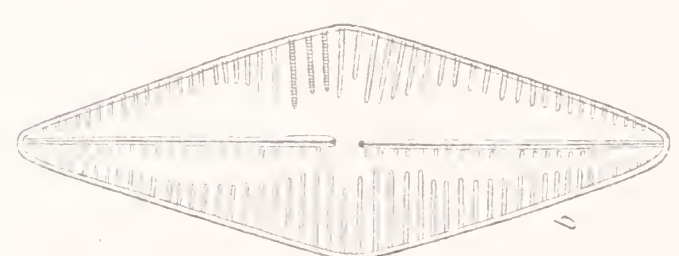
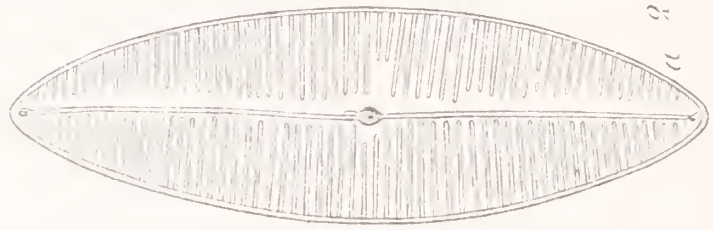
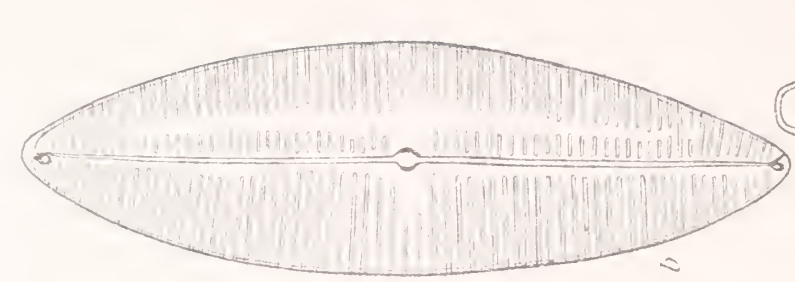
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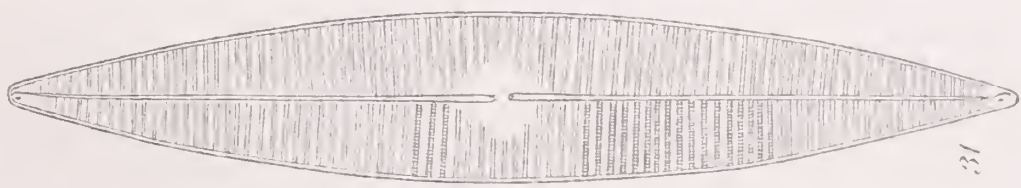
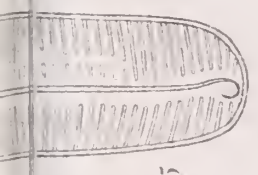
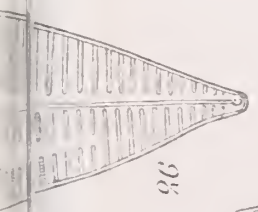
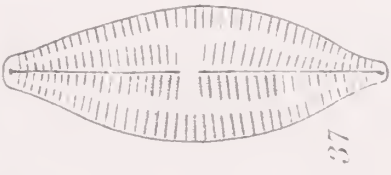
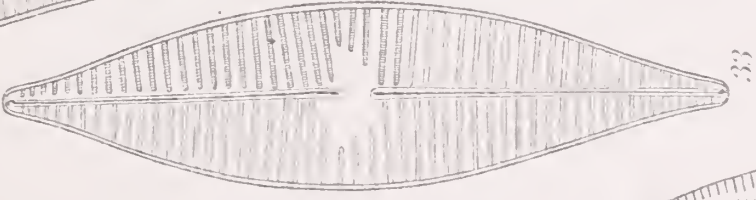
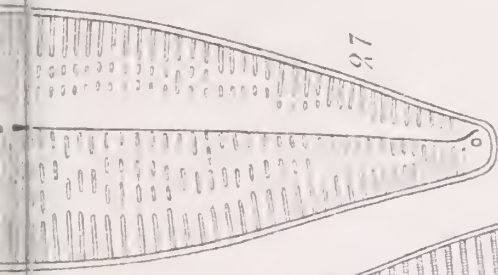
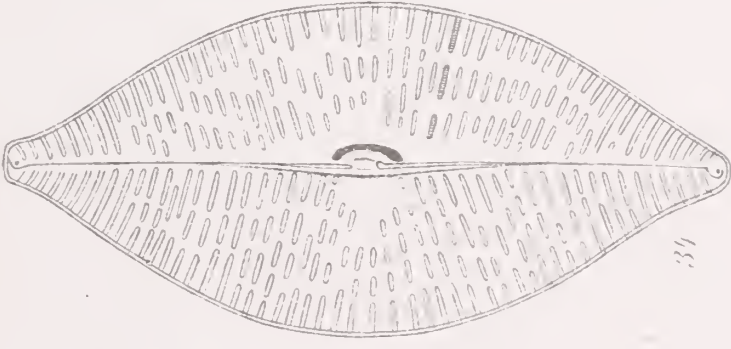
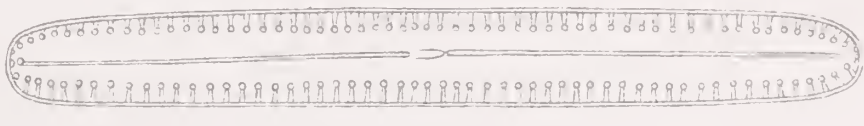
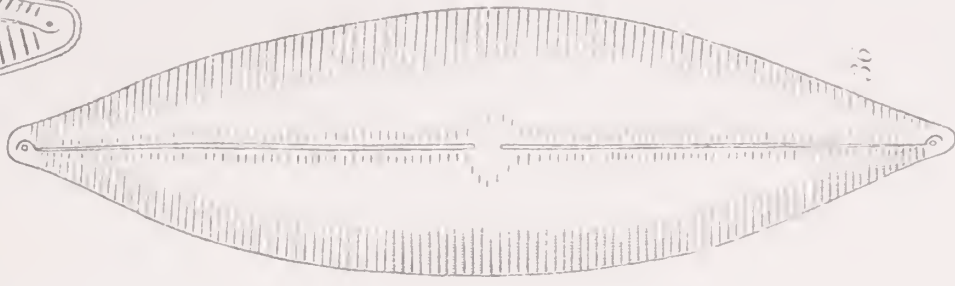
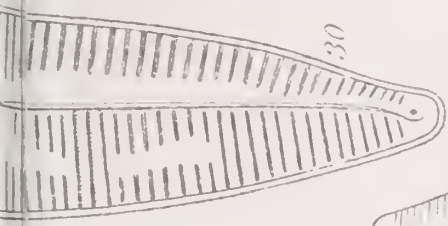
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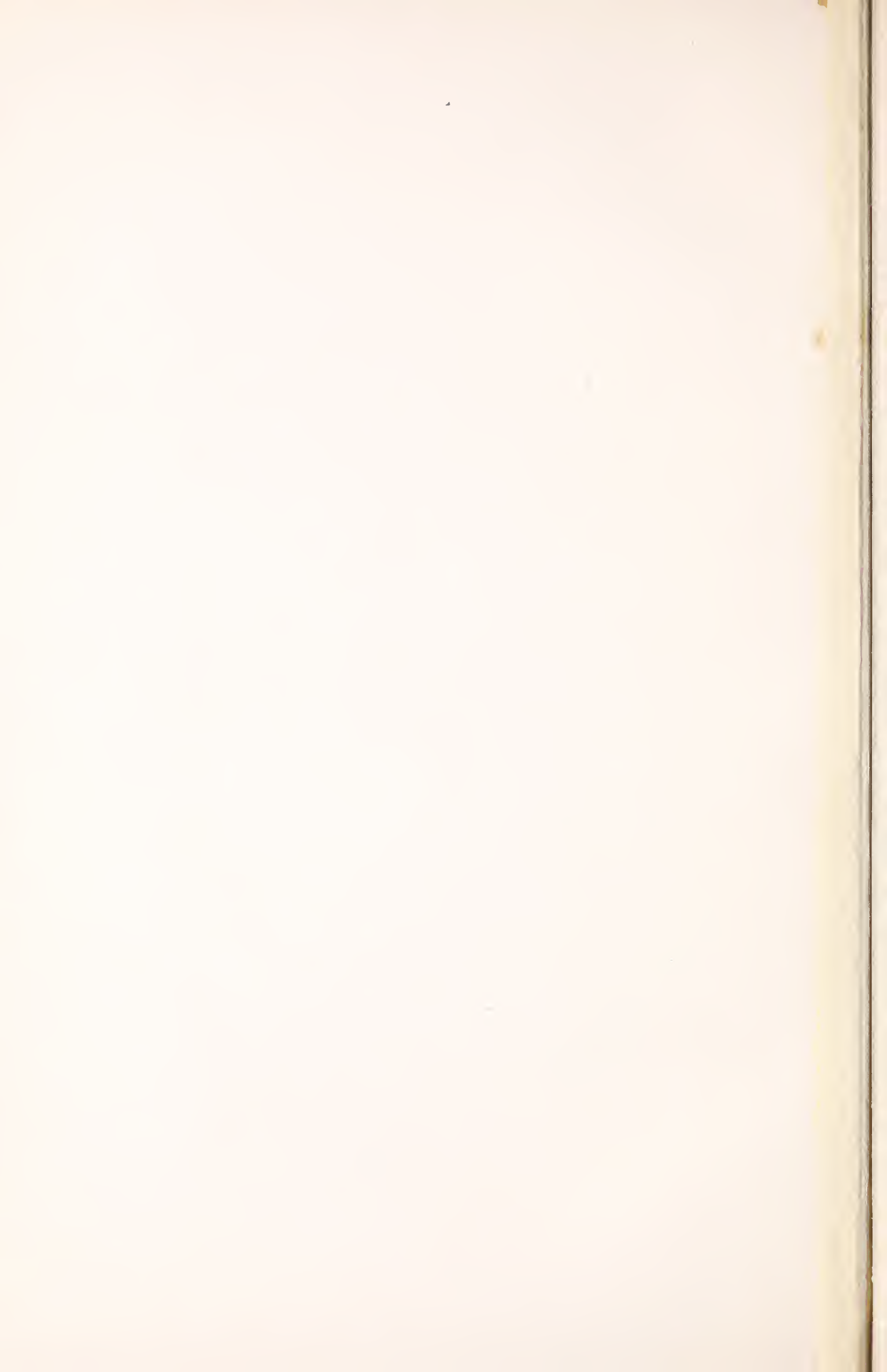




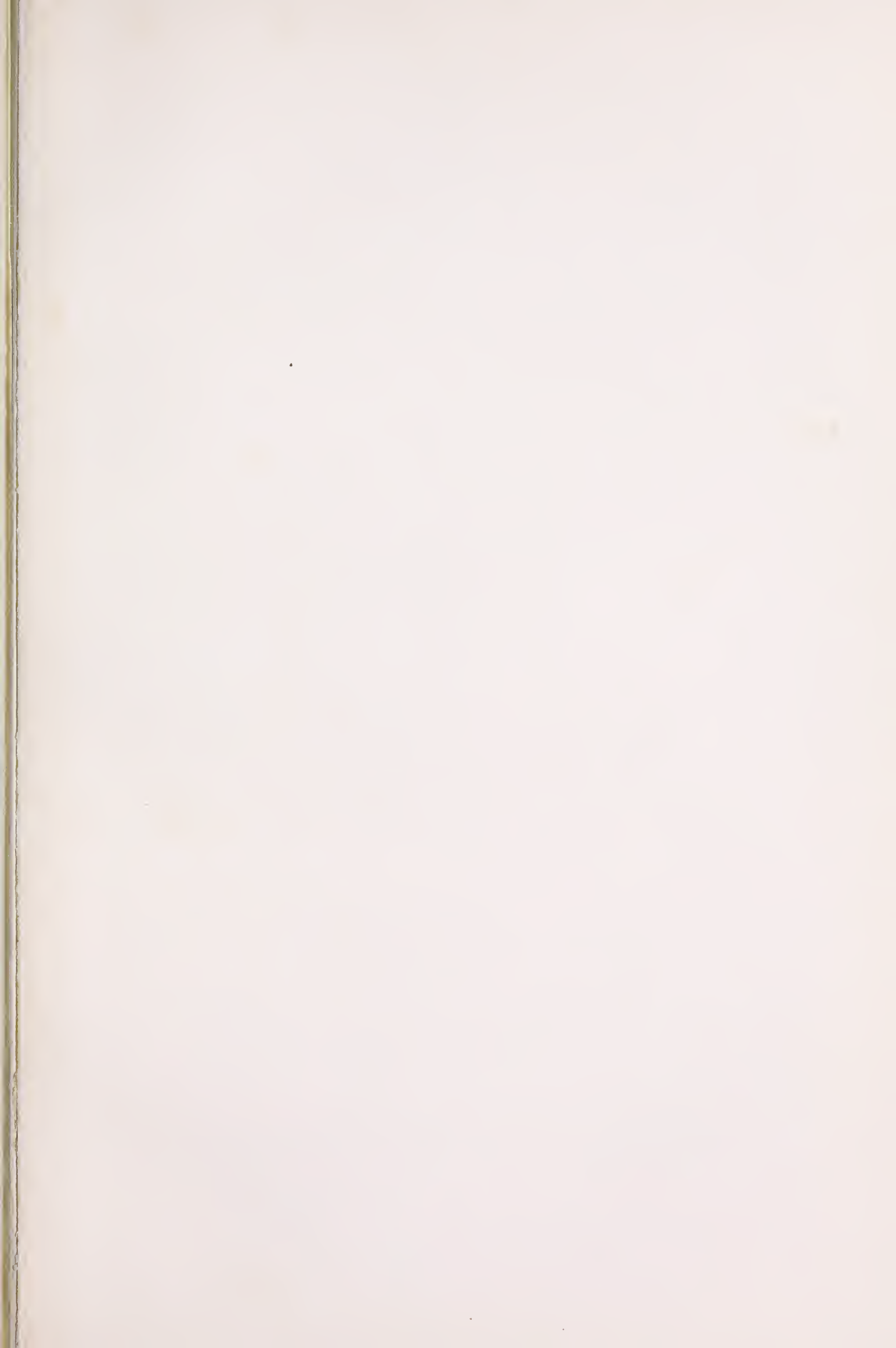


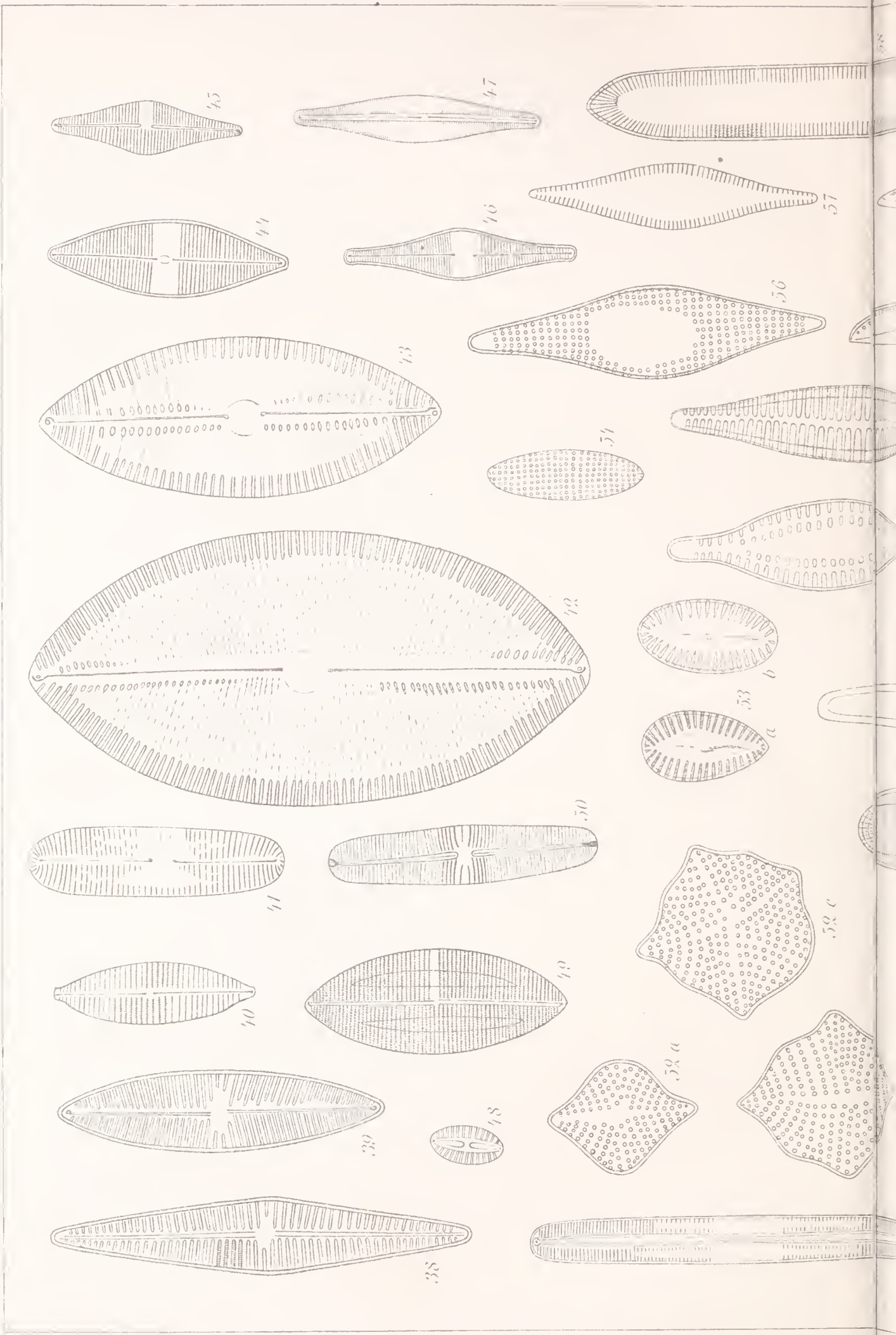












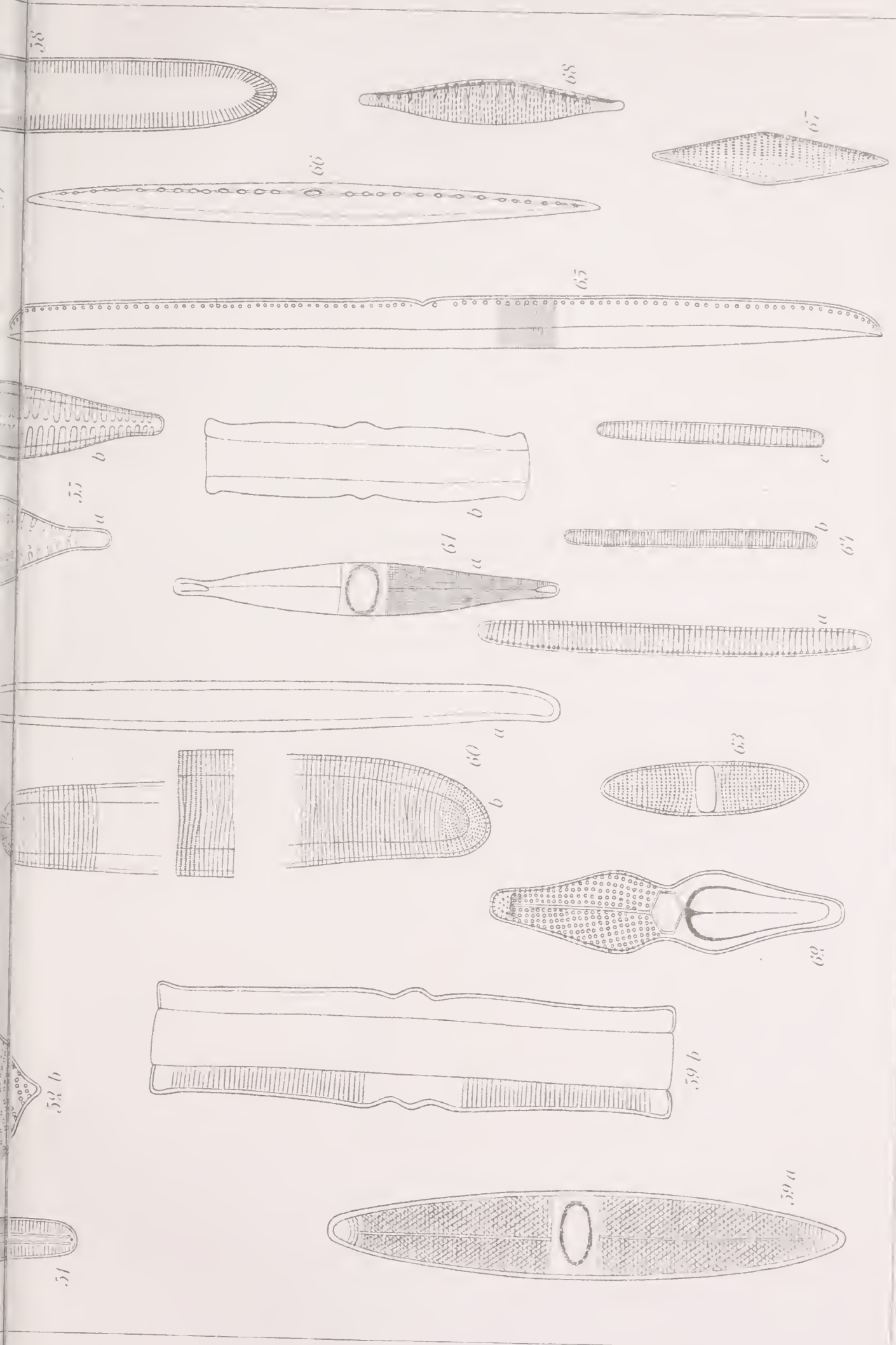
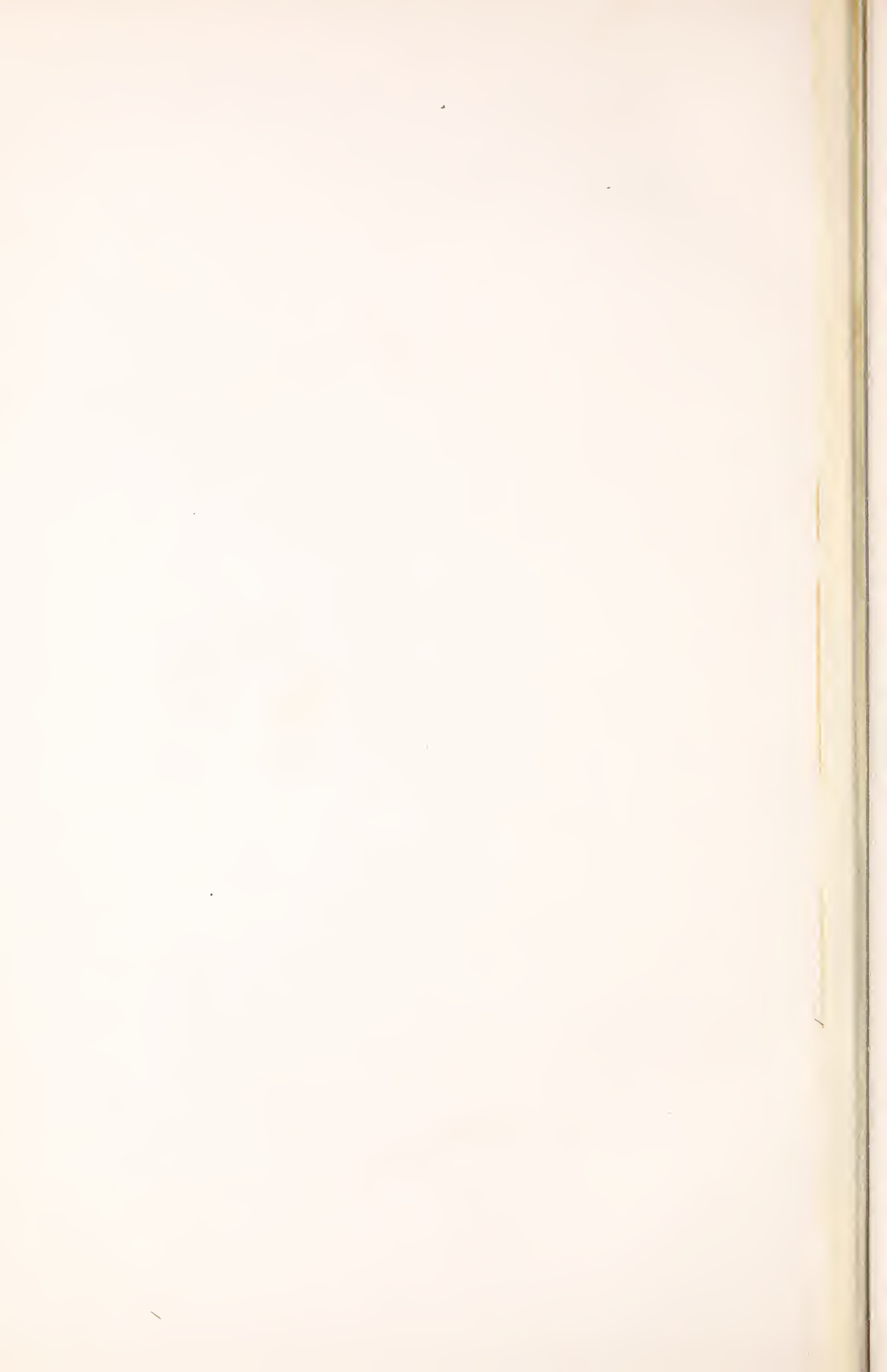
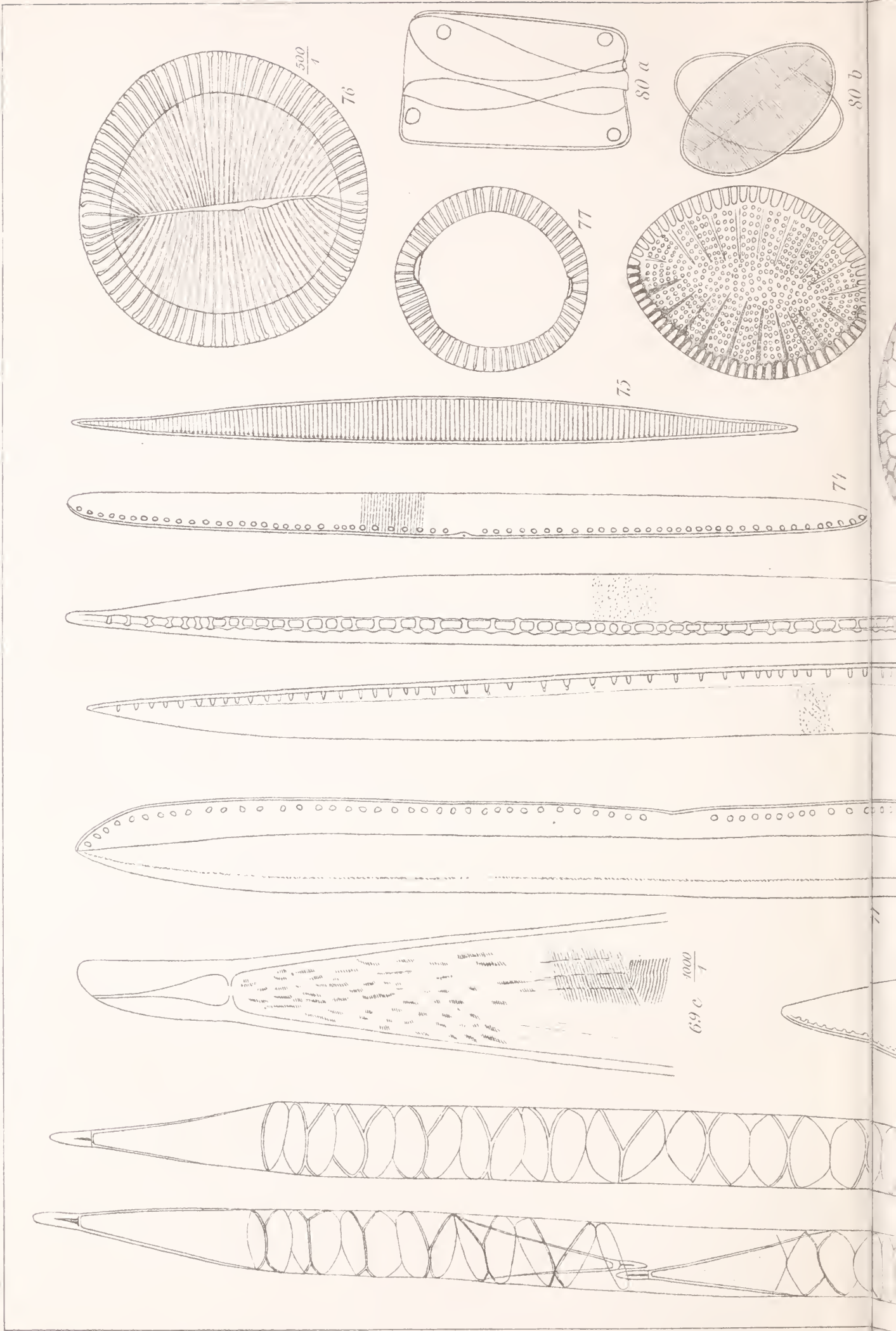


PLATE 59

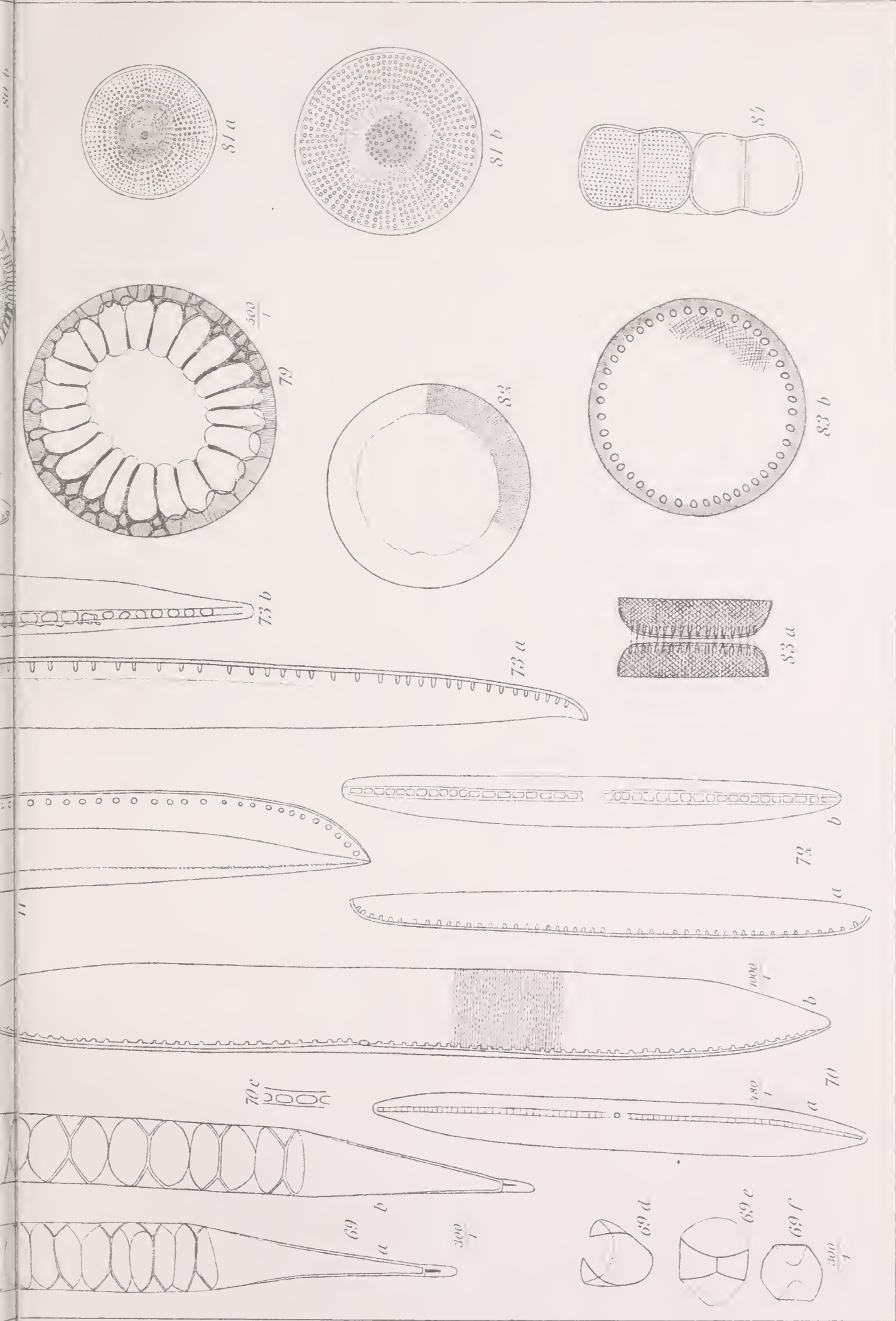


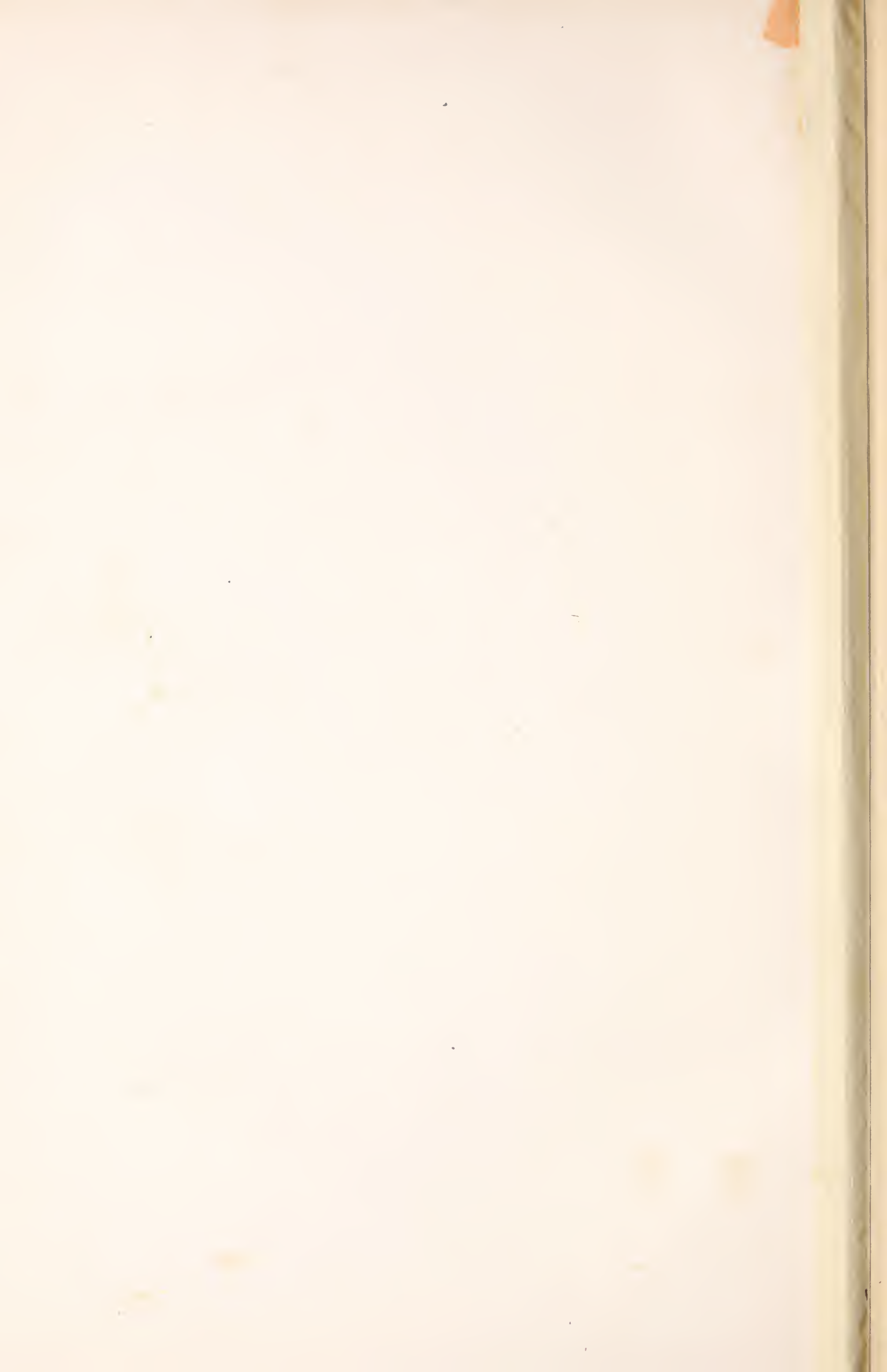






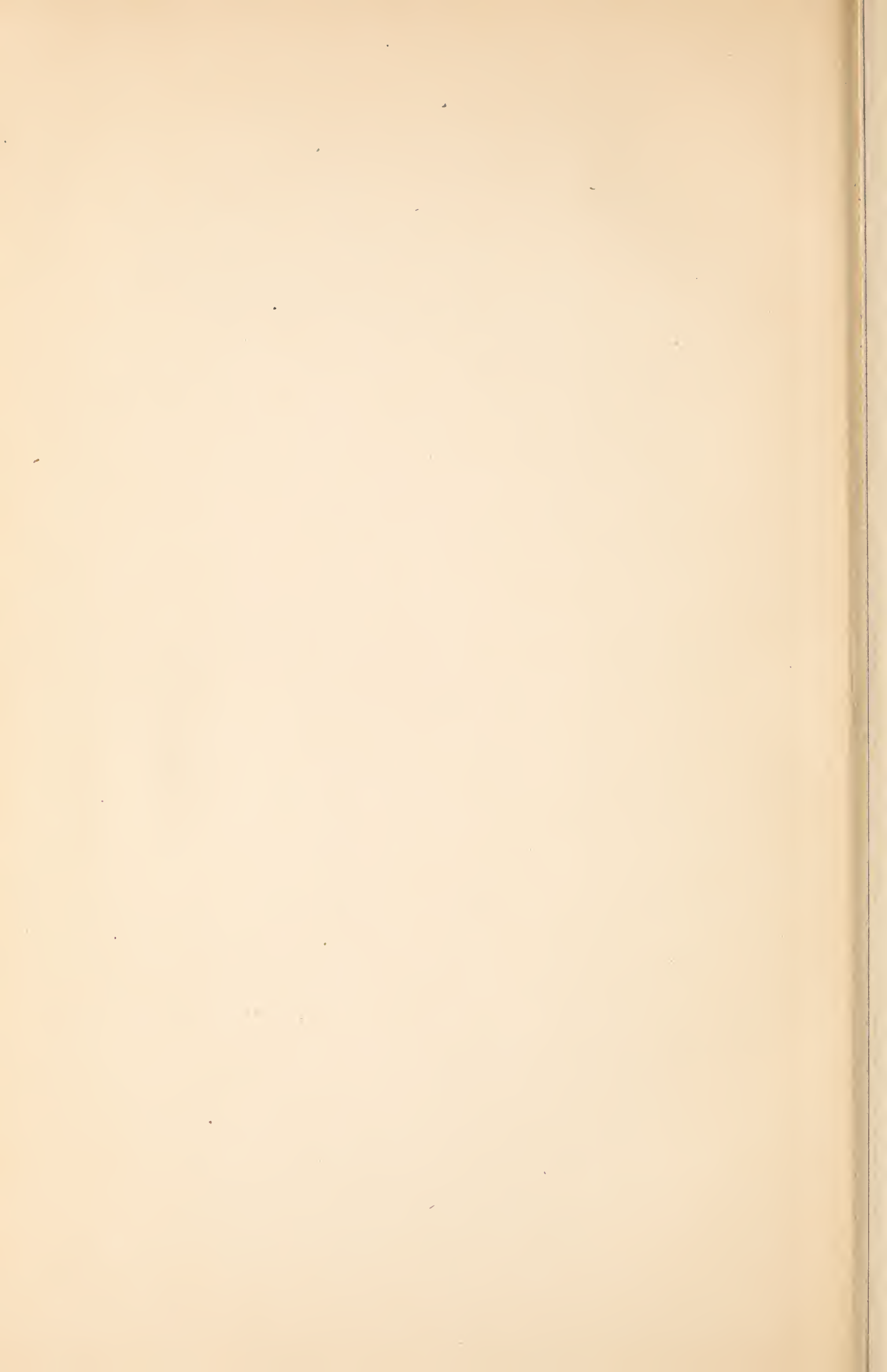




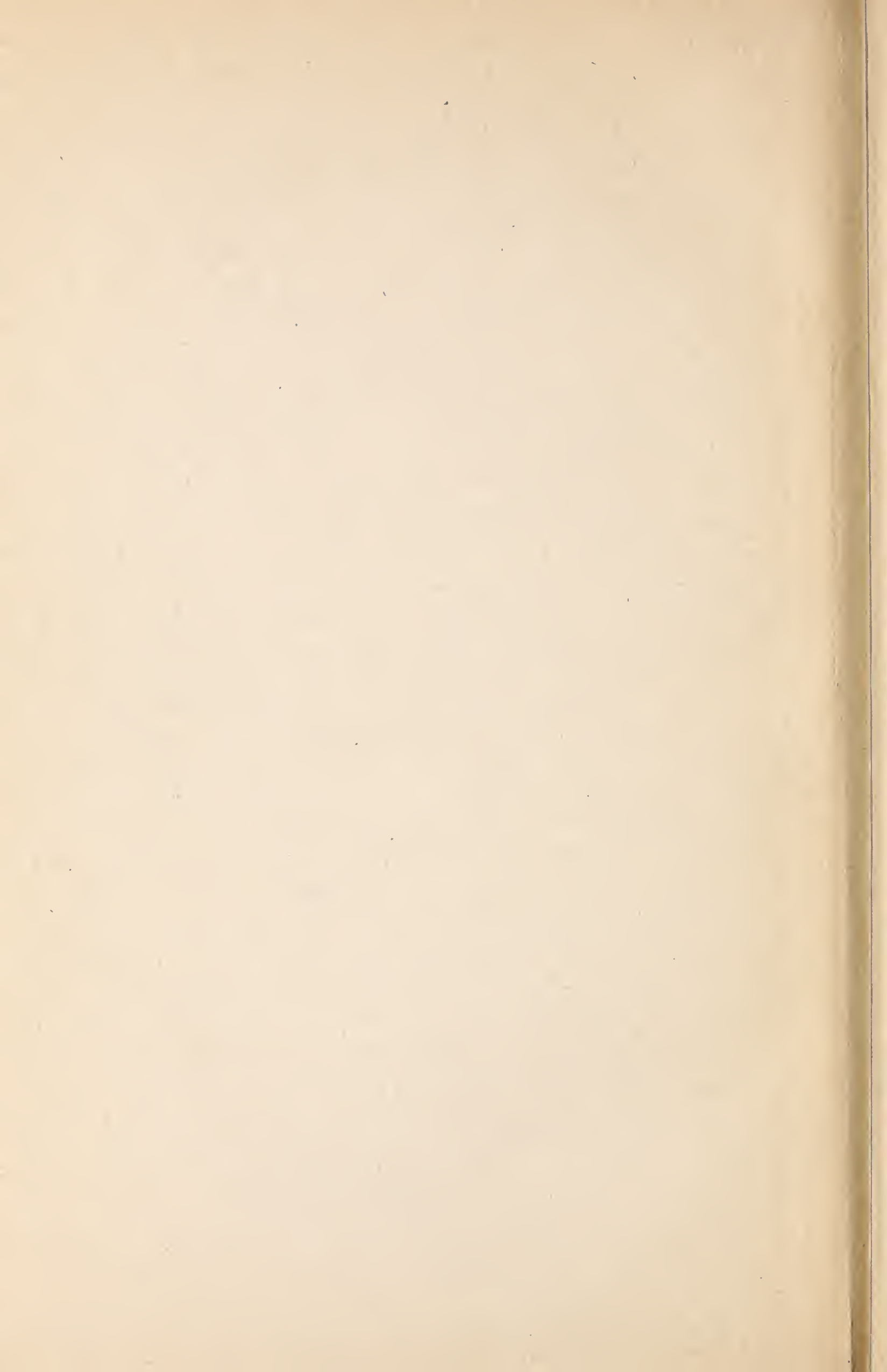














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