

THE DIATOMS

OF

FINLAND

BY

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WITH THREE PLATES

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HELSINGFORS

HEIRS OF J. SIMELIUS, 1891

The diatomaceous flora of Finland has hitherto been the subject of very few investigations. In the years 1838 and 1840 *Ehrenberg* published an account of the diatoms in the diatomaceous earths of Savitaipale and Kymmene gård, and in his large work *Microgeologie* he has (on Plate XVII) figured the forms found by him in these deposits. In some cases the figures are easy enough to identify, but in many other cases this is almost impossible, as the figures have been drawn to too small a scale and with too little detail. From the deposit of Savitaipale Ehrenberg enumerates 59 and from Kymmene gård 47 forms, but these numbers are subject to a considerable reduction, as in several instances Ehrenberg has given specific names to mere varieties. For instance, *Eunotia robusta* which occurs in Savitaipale deposit bears not less than fifteen different names.

In the year 1861 *Nylander*¹⁾ published a list of the fossil diatoms of Finland, based on the researches of *de Brébisson*, who examined 10 samples of diatomaceous earth from different parts of the country. The number of species, enumerated on this list amounts to 130.

The limits of the flora of Finland comprise also parts of the large lake Ladoga, for which reason the researches of *Weisse*²⁾ on the diatoms of Ladoga have to be considered in this work. These researches, published 1864 and 1865, were unfortunately carried out in the same manner as those of Ehrenberg, so that the identification of the 62 species, enumerated and figured by Weisse is in many cases impossible.

¹⁾ Notiser ur Sällskap. pro Fauna et Flora Fennica Förh., 6:te häftet, N. S. 3:dje häftet, pag. 145.

²⁾ Bull. de l'Acad. de St. Petersbourg VIII, 21—25 and 369—371.

In his monograph on the Baltic diatoms *Juhlin Dannfelt*¹⁾ enumerates 67 species from the brackish water of Åbo and Helsingfors, and in this work I have paid careful attention to his researches.

A few forms from Sodankylä and Pudasjärvi deposits have been figured in the Atlas of *A. Schmidt*, and in the Synopsis of *Van Heurck*.

The materials for my investigation of the diatoms of Finland have for the greatest part been brought together by the care of Dr *R. Boldt*, who sent me for examination a large number of samples containing both recent and fossil diatoms from the whole country. I have also obtained a few collections from Åbo, made by Dr *F. Elfving*, and a sample of the Sodankylä deposit from the Riksmuseum of Stockholm.

I have in the following list catalogued the samples examined by me.

A. From the northern Savolaks (*Savonia borealis*, Sb), collected 1883 by R. Boldt.

- 1—3 from Kuopio.
- 4—6 „ Viando.
- 7 „ Alavo.
- 8 „ Neulamäki.
- 9—10 „ Saarijärvi (Puijo).
- 11—12 „ Jynkkä.
- 13 „ Lempyy gästgifveri.
- 14 „ Henriksnäs.
- 15 „ Lempyy gästgifveri.
- 16—19 „ Kuopio.

B. From Imandrian Lapland (*Laponia Imandræ*, Lim) collected 1885 by V. F. Brotherus.

20 from Kandalaks, Krestovoja, on *Amblystegium revolvens* in a rivulet (Reg. abiet.)

21 from Kandalaks, in a rivulet between the village and the mountain of Shelesnaja (Reg. abiet.)

¹⁾ On the diatoms of the Baltic Sea. Bih. till K. Sv. Vet. Akad. Handl. VI, 21, 1882.

22 from the mountain Tshun, in small rivulets and on moist rocks.

23 from the mountain Chibinä, in shallow ponds at the foot of the mountain.

24—27 from a dry rivulet at the shore of Imandra, at the foot of Chibinä (Reg. abiet.)

C. From Tulomian Lapland (Lapponia Tulomensis, Lt.) collected 1885 by V. F. Brotherus.

28—29 from rivulets on the island of Kildin on the shore of the Ice-sea.

30 from bogs on the „tundra“ near Arafjord.

31—35 from Ribatshi (Fiskarhalfön).

D. From the vicinity of Åbo (Regio aboënsis, Ab) collected 1886 and 1887 by R. Boldt.

36—38 Lojo.

E. From Murmanian Lapland (Lapponia murmanica, Lm) collected 1887 by O. Kihlman.

39 Woroninsk.

F. From Onegian karelen (Karelia onegensis, Kon) collected 1888 by O. Kihlman.

40 from Nem'ärvi.

41 „ Suopohja.

42 „ Tiudie.

43 „ Shungu.

G. From the vicinity of Åbo (Regio aboënsis, Ab) collected (44—50) by R. Roldt in the year 1889 and (51—54) by F. Elfving in the year 1877.

44 from the lake of Lojo near Mustasaari, on Myriophyllum.

45 from the lake of Lojo, near Kaurasaari, on Myriophyllum.

46 from the lake of Lojo, coating the stems of Scirpus.

47 from the lake of Lojo, on the bottom among Ranunculus reptans.

48 from the lake of Lojo, at the shore of Mustasaari, on water-plants.

49 from Paloniemi in springs near Puusilta torp.

50 from the lake of Lojo, near Mustasaari, forming thick coatings on the stones at the shore.

- 51 from Pargas, Piukala.
 52 from Pargas, Gunnarsnäs.
 53—54 from Kimito, Norrsundsvik.
- H. From Nyland** (Nylandia, Nyl), collected 1874 by F. Elfving.
 55 from Helsingfors.
- I. From Åland** (Alandia, Al) collected 1871 by F. Elfving.
 56 from Eckerö.
 57 from Geta.
 58 from Eckerö (brackish water).
 59 from Eckerö in a freshwater-pond.
- K. From Nyland** (Nylandia, Nyl) collected 1889 by R. Boldt.
 60 Helsingfors at Berghäll.
- L. From Ladoga** (Lad) collected 1885 by O. Nordqvist.
 61 South of Konjewits at the depth of 27—31 meters on a sandy-bottom, $^{22}/_6$.
 62 Between Keksholm and Verkkosaari, 8—10 meters below the surface, $^{15}/_6$.
 63 From the surface, near Sortanlaks, $^{21}/_6$.
 64 Bay of Sordavala, 12 meters below the surface, $^{25}/_6$.
 65 Bay of Sordavala, on the surface, $^{26}/_6$.
 66 East of Piensaari, soundings in the depth of 192—200 meters.
 67 Near Puutsalo, on the surface, $^{28}/_6$.
 68 Between Puutsalo and Kilpusaaret, on the surface, $^{28}/_6$.
- M. From the northern Savolaks** (Savonia borealis, Sb), collected by O. Nordqvist.
 69 Harbour of Kuopio, on the surface, $^{2}/_9$ 83.
 70 Kallavesi, between Puijo and Vaajasalo, depth 32 meters, $^{3}/_4$ 87.
 71 Southern part of Ollinselkä fjord, depth 33 meters, $^{16}/_9$ 83.
- N. From Kuusamo** (Kus) collected by O. Nordqvist.
 72 Kytämäjärvi, from the surface of a shallow lake, $^{11}/_7$ 86.
 73 Muojärvi, on the surface of a deep lake $^{21}/_6$ 86.
- O. From the vicinity of Åbo** (Regio aboënsis, Ab).
 74 Surface of the lake of Lojo, collected $^{8}/_{10}$ by Miss Signe Granstedt.
- P. From Satakunta** (Sat).

75 Ruovesi, Palovesi, from the surface, collected $\frac{4}{11}$ 88 by V. Nordqvist.

Q. From the Baltic and its tributaries.

76 From the surface of the Bay of Finland (Sinf) collected $\frac{22}{11}$ 88 by O. Nordqvist.

77 From the surface of the harbour of Helsingfors (Sinf.) collected $\frac{19}{5}$ 87 by O. Nordqvist.

78 Baltic (Mb) from the archipelago between Korpo and Aspö, collected on the surface, the $\frac{6}{8}$ 87 by O. Nordqvist.

79 Baltic (Mb) Gullkronefjärden, dredged $\frac{11}{8}$ 87 in a depth of 34 meters by O. Nordqvist.

80 Bay of Bothnia (Sinb), 23 min. West of Höglubb (South of Christinestad) collected $\frac{18}{8}$ 87 at a depth of 91 to 94 meters by O. Nordqvist.

81 Bay of Bothnia (Sinb) S. W. of Björkö (Korsnäs socken) dredged in a depth of 32 meters $\frac{21}{7}$ 87 by O. Nordqvist.

82 Bay of Bothnia (Sinb) out of Marjaniemi, Karlö, gathered at a depth of 10 meters, $\frac{21}{7}$ 87 by O. Nordqvist.

83 Bay of Bothnia (Sinb) Sarvi fiskläge, Torneå, dredged on gravelly and sandy bottom, at the depth of 6—8 meters, $\frac{4}{8}$ 87, by O. Nordqvist.

84 Bay of Bothnia (Sinb) Yxpila harbour (Gamla Karleby) gathered on the surface, $\frac{8}{8}$ 87 by O. Nordqvist.

R. Soundings from the lake of Ladoga (Lad) collected 1885 by O. Nordqvist.

85 South west of Haraluoto, dredged at a depth of 115 fathoms, $\frac{19}{6}$ 85.

86 East of Piensaari (Sordavala) dredged $\frac{26}{6}$ 85.

S. Diatomaceous earths (Foss) obtained from the geological survey of Finland.

87 Brödtorp, Pojo socken, Nylands län (Nyl).

88 Savitaipale, Viborgs län (Sa).

89 Suomenniemi socken, Viborgs län (Sa).

90 Naarajärvi, Urais socken, Vasa (Tb).

91 Pudasjärvi, Uleåborgs län (Ob).

92 Kurki by, Kaitisjärvi, Pudasjärvi (Ob).

93 Niilivaara by, Uleåborgs län, Kittilä (Lk).

94—95 Niemis gård, Isopää, Kalvola socken, Tavastehus län (Ta).

96 Volkis by, Vesilaks, Tavastehus län (Ta).

97 Padasjoki, Tavastehus län (Ta).

98 Niemis gård, Kuurila, Kalvola socken, Tavastehus län (Ta).

T. From Nyland (Nyl).

99 Helsingfors, Berghäll, collected 17/9 89 by R. Boldt.

U. From the vicinity of Åbo (Ab).

100 Åbo, brackish water collected by F. Elfving.

V. Old Baltic deposits, banks with *Mytilus edulis* (Foss B.),
obtained from the geological survey of Finland.

101 Kunnarais, Gustafs socken.

102 Stansvik, Helsingfors.

103 Lexvall, Pojo.

X. Diatomaceous earth (Foss).

104 Sodankylä, Kemi Lappmark, obtained from Riksmuseum of Stockholm.

The number of gatherings, examined by me, is thus considerable and collected from widely distant localities, so that the following list of species may be regarded as fairly representing the diatomaceous flora of Finland. Still I have some reason for believing that future researches may considerably increase the number of species, living in Finland.

Several forms, of frequent occurrence in Sweden and Norway, have not yet been found in gatherings from Finland, as for instance, the whole group of the *Nitzschia* is very poorly represented in the catalogue, which can scarcely arise from any other reason than that my materials have not been sufficiently large.

Diatoms, especially those living in fresh water, are as is well known very cosmopolitan in their habitats. Nevertheless there are certain species characteristic of alpine and arctic regions, others of warmer climates. Among the species, found in Finland, the following seem to inhabit only northern or alpine regions:

<i>Navicula hebes</i> Ralfs.	<i>Cymbella norvegica</i> Grun.
<i>N. semen</i> Ehb.	<i>C. Cistula</i> var. <i>arctica</i> Lagst.
<i>Achnanthes marginulata</i> Grun.	<i>Eunotia Denticula</i> Bréb.
<i>Cymbella heteropleura</i> Ehb.	<i>E. Papilio</i> Ehb.
<i>C. naviculacea</i> Grun.	<i>Diatomella Balfouriana</i> Grev.

Of a less decided arctic character are the following:

<i>Pinnularia mesogonyla</i> (Ehb.) Cl.	<i>Anomæoneis zellensis</i> Grun.
<i>P. divergentissima</i> Grun.	<i>A. exilis</i> Grun.
<i>P. lata</i> Bréb.	<i>Encyonema hebridicum</i> Greg.
<i>Neidium bisulcatum</i> Lagst.	<i>Denticula tenuis</i> var. <i>frigida</i> .
<i>Anomæoneis serians</i> Bréb.	<i>Melosira distans</i> Kütz.

The quantity of salt in the water exercises an immense influence on the diatoms, very few species being common to fresh water and brackish water, and scarcely any to fresh water and salt water. Purely marine diatoms within the limits of Finland are not found, the water of the Baltic and its tributaries being only brackish. Characteristic of these brackish waters and occurring there in immense number are the following species.

<i>Mastogloia Smithii</i> Thw.	<i>Epithemia gibba</i> (Ehb.) Kütz.
<i>M. elliptica</i> C. Ag.	<i>Campylodiscus Clypeus</i> Ehb.
<i>Cocconeis Pediculus</i> Ehb.	<i>C. echineis</i> Ehb.
<i>Achnanthes longipes</i> C. Ag.	<i>Synedra pulchella</i> Kütz.
<i>A. subsessilis</i> Ehb.	<i>S. affinis</i> Kütz.
<i>Rhoicosphenia curvata</i> (Kütz.) Grun.	<i>Chatoceras Wighamii</i> Btw.
<i>Brebissonia Bœckii</i> W. Sm.	<i>Melosira Borreri</i> Grun.
<i>Gomphonema olivaceum</i> Ehb.	<i>M. Jürgensii</i> C. Ag.
<i>Epithemia turgida</i> var. <i>Westermanii</i> Kütz.	<i>Actinocyclus crassus</i> (W. Sm.) Ralfs.
<i>E. Soreæ</i> Kütz.	<i>Coscinodiscus balticus</i> Grun.

In the northern part of the Bay of Bothnia the water becomes more and more fresh and some of the above named species cease to live there, as *Brebissonia Bœckii*, *Campylodiscus Clypeus* and *C. echineis*.

In many parts of Finland as well as in Sweden old Baltic deposits with shells of *Mytilus edulis* are found. They generally contain diatoms, more or less abundant. The species found most commonly in these deposits are

<i>Epithemia turgida</i> var. <i>Westermanii</i> Kütz.	<i>Coscinodiscus balticus</i> Grun.
<i>E. gibba</i> (Ehb.) Kütz.	<i>C. lacustris</i> Grun.
<i>Rhabdonema arcuatum</i> (Ag.) Kütz.	<i>Campylodiscus Clypeus</i> Ehb.
<i>R. minutum</i> Kütz.	<i>C. echineis</i> Ehb.
<i>Grammatophora oceanica</i> Ehb.	<i>Surirella striatula</i> Turp.
<i>Melosira Borreri</i> Grun.	<i>Actinocyclus crassus</i> (W. Sm.) Ralfs.
<i>Hyalodiscus scoticus</i> (Kütz.) Grun.	<i>Diploneis didyma</i> Ehb.
<i>Coscinodiscus asteromphalus</i> (Ehb.) Grun.	<i>D. interrupta</i> Kütz.

The occurrence of *Rhabdonema arcuatum*, *Coscinodiscus asteromphalus*, *Hyalodiscus scoticus* and some other, rarer forms, not enumerated here, prove that the water, in which these deposits were formed, was more salt than it is in our time.

The diatomaceous vegetation of the larger lakes is in general tolerably uniform. On the surface the following forms are found in abundance:

<i>Tabellaria fenestrata</i> Kütz.	<i>Asterionella formosa</i> Hassal.
<i>Melosira granulata</i> Ralfs.	<i>Stephanodiscus Astræa</i> (Ehb.) Grun.
<i>Fragilaria capucina</i> Desm.	<i>Cyclotella comta</i> v. <i>radiosa</i> .

In the lake Lojo (in the vicinity of Åbo) as well as in a lake in northern Savolaks the interesting *Synedra Crotonensis* Edw. was found. This species occurs in a similar manner in the lake Erie in Northern America, in the lake of Geneva, in the northern Italian lakes and in the lake Mälaren in Sweden.

The stones on the bottom of the lakes are often coated by a velvet-like stratum of *Gomphonema geminatum* C. Ag. As is well known, several „relicta“ forms of crustaceans are found in the large lakes of Sweden and Finland, indicating a connection between the arctic sea and the Baltic during the glacial epoch. I have not been able to find any such „relicta“ forms among the diatoms in the gatherings which I have examined. The diatoms of Ladoga are all fresh-water forms. Mr *Grunow* mentions in his monograph of *Grammatophora* ¹⁾ *Gr. oceanica* var. *minor* as occurring in Ladoga, but this may be an error.

¹⁾ Bot. Centralbl. 1881.

Fossil deposits of diatoms are found on many places from the Kemi Lappmark down to southern Finland. The Savitaipale deposit, described already by Ehrenberg, and the Suomenniemi deposit both belong to southern Finland (Viborgs län) and contain diatoms, which seem not to live at present so far to the south, for instance *Anomæoneis serians*, *Eunotia robusta*, *E. pentaglyphis*, *Melosira distans*. It seems therefore very probable that these deposits were formed during a colder period than the present one.

Abbreviations.

I. Authors.

A. S. — Atlas der Diatomaceen-kunde von Ad. Schmidt. — Aschersleben 1874—90.

Btw. — Brightwell, *Micr. Journ.* 1856.

Cl. *D. fr. Grönl.* — Cleve, Färskvattens-Diatomacéer från Grönland och Argentinska republiken. — Öfvers. af K. Sv. Vet. Ak. Förhandl. 1881 N:o 10.

Cl. *N. R. D.* — Cleve, On some new and little known diatoms. — K. Sv. Vet. Akad. Handl. XVIII, n:o 5. 1881.

Cl. *Vega.* — Cleve, Diatoms, collected during the expedition of the Vega. — Vega-expeditionens vetenskapliga iakttagelser III. 1883.

Cl. Gr. *A. D.* — Cleve and Grunow, Beiträge zur Kenntniss der arctischen Diatomeen. — K. Sv. Vet. Ak. Handl. XVII n:o 2. 1880.

Cl. M. *D.* — Cleve and Möller diatoms. Upsala 1877—79.

Dannf. — H. Juhlin Dannfelt, on the diatoms of the baltic sea. Stockholm 1882.

Donk. *B. D.* — Donkin, The natural history of the british diatomaceæ. London 1870.

Ehb. *M. G.* — Ehrenberg, *Microgeologie.* Leipzig 1854.

Greg. — Gregory, *Transactions of the Microscop-Soc.*

Grun. *D. Öst. Ung.* — Grunow, Beiträge zur Kenntniss der fossilen Diatomeen Österreich Ungarns. Wien 1882.

Grun. *F. Jos. Land.* — Grunow, Die Diatomeen von Franz Josefs Land. Wien 1884.

Grun. *Verh. 1860.* — Grunow, Ueber neue oder ungenügend gekannte Algen. — Verh. der k. k. zool.-bot. Ges. zu Wien 1860.

Heib. — Heiberg, *Conspectus criticus diatomearum danicarum.* Kiöbenhavn 1863.

Kütz. *Bac.* — Kützing, Die kieselschaligen Bacillarien, oder Diatomeen. Nordhausen 1844.

Lagst. — Lagerstedt, Sötvattendiatomacéer från Spetsbergen och Beeren Eiland. Stockholm 1873.

Lewis. — On extreme and exceptional variations of diat. in some White mountains localities. — *Proceed. of the Acad. of nat. sc. of Philadelphia* 1865.

Schum. — Schumann, Preussische Diatomeen. — *Schriften d. kön. phys. ökon. Gesellsch. zu Königsberg* 1863, Nachtrag I 1864; Nachtr. II 1867; Nachtr. III 1869.

Weisse. — Diatomeen des Ladoga Sees. — *Bullet. de l'Acad. de St. Petersb.* VIII, 21—25, 369—371. 1864—1865.

V. H. — Van Heurck, *Synopsis de diatomées de Belgique.* Anvers 1885.

W. Sm. — William Smith, a synopsis of the British diatomaceæ. London 1853—56.

II. Localities, etc.

Ab. — Surroundings of Åbo.

Al. — Åland!

Foss. — Fossil; **Foss B.** — Old baltic deposits with *Mytilus*.

Kon. — Onega-karelen.

Kus. — Kuusamo.

Lad. — Ladoga.

Lim. — Imandra lappmark.

Lk. — Kemi lappmark.

Lm. — Murmanska lappmarken.

Lt. — Tuloma lappmark.

Mb. — Baltic.

Nyl. — Nyland.

Ob. — Österbotten.

- Sa. — Savolaks.
- Sat. — Satakunta.
- Sb. — Northern Savolaks.
- Sinb. — Bay of Bothnia.
- Sinf. — Bay of Finland.
- Ta. — Tavastland.
- Tb. — Northern Tavastland.

Systematic arrangement of the diatoms.

In order that the classification of the Diatomaceæ may be something more than a mere list of names, it is necessary to dispose the forms according to their natural affinities, so that the arrangement may represent as far as possible the succession of the evolution of the forms.

It is known from palæontological researches that primordial forms are as a rule complex in their characteristics, and that they bear a more or less close affinity to different groups. In the Diatomaceæ it appears that the most complex characteristics are to be found in the family of the Nitzschieæ. This family may therefore be regarded as the centre of the system, and from this radiate all the other groups of diatoms.

The genus *Hantzschia* and the section *Pseudoepithemia* suggest a passage to *Epithemia*. On the other hand *Cymatopleura* seems to be akin to *Tryblionella*. *Stenopterobia* and *Surirella* connect the Nitzschieæ with the genus *Campylodiscus*. The division *Grunowia* is closely related to *Denticula*. *Thalassiothrix* seems to connect the Nitzschieæ with *Synedra* and *Fragilaria*, from which gradual passages may be traced to *Tabellaria* (*Grammatophora*, *Rhabdonema*), *Eunotia*, *Diatoma* (*Terpsinoë* *Biddulphia*, *Hemiaulus*, *Chaetoceras*, *Rhizosolenia*).

It is generally admitted that the passage from the Nitzschieæ to the Raphideæ is formed by *Amphiprora* and its allied genera, especially *Plagiotropis*. The resemblance between *Perrya*, *Pseudoepithemia* and *Amphiprora* is remarkable. The passage between

Amphiprora and Pleurosigma is formed by Donkinia. Pleurosigma is closely connected with some species of Navicula (N. O'Mearii Grun, N. Kjellmanii Cl., N. vitrea Cl.). Between the last named forms and the other Naviculæ there is a gap. Only a few forms of the Navicula directa-group (N. Kariana) remind us of them. Perhaps is Amphiprora akin also with the group of Naviculæ complexæ (N. Libellus).

The large genus Navicula comprises such a number of widely different forms, as to afford sufficient reasons for splitting it up into different genera. On the other hand many forms now placed in the genera Cymbella, Stauroneis, Rhoiconeis etc., are more nearly related to the Naviculæ than many species of the latter are to each other.

Many characteristics, on which genera and groups are founded, are only of specific value, sometimes of such slight significance that only varieties may be founded on them. For instance the dilated central nodule, which is regarded as a characteristic feature of Stauroneis, the often slightly asymmetric form of the valve, on which Cymbella and Alloioneis are founded, the direction of the end-fissures of the raphe, the sigmoid, bent, or arcuate form of the valves, on which Scoliopleura and Rhoiconeis are founded, and many other such distinctions.

Pfitzer¹⁾ separates from Navicula as distinct genera: *Pinnularia*, *Neidium*, *Anomæoneis*, *Frustulia*, *Colletonema* and *Schizonema*.

The first named genus, *Pinnularia*, has so many peculiarities, that no doubt can exist about the correctness of separating it from Navicula.

Neidium comprises the group of Nav. affinis and of Nav. limosa. If the latter be excluded Neidium is a very natural and distinct group of closely allied forms.

Anomæoneis comprises the groups of Nav. sculpta and Nav. seriens, and may also be regarded as a natural genus.

Frustulia is the same genus as *Van Heurckia*, but an older name. *Colletonema* resembles Frustulia in all respects excepting that the frustules are enclosed in gelatinous tubes or mas-

¹⁾ Unters. über Bau und Entwicklung der Bacillarien. Bonn 1871.

ses. It is not advisable on that account to admit the latter genus. *Frustulia* forms a passage to *Amphipleura*, *Berkeleya* and *Brebissonia*, if from the latter be separated *Br. Weissflogii*, which as well as *Navicula scopulorum* seems to be more conveniently placed in the same group as *Nav. rhombica*.

Schizonema also has its frustules enclosed in gelatinous masses of different forms, but as it comprises species, which are very nearly connected with *Naviculæ* of the groups of *Nav. radiosa*, *Nav. directa* and *Nav. rhombica* I do not see sufficient reason to admit this genus.

If the genera *Pinnularia*, *Neidium*, *Anomœoneis* and *Frustulia* be admitted, the large number of forms remaining in *Navicula* belong, with the exception of some smaller groups, to four different groups viz: *radiosæ*, *punctatæ*, *formosæ* and *didymæ*.

The group *radiosæ* is by some forms connected with *Pinnularia*, and by others with the group *punctatæ*. It is very closely connected with *Nav. directa*, *N. fortis* and many forms of *Schizonema* so that these forms scarcely can be separated from the *radiosæ*. The striæ in all these forms are finely and transversely lineate. *Nav. cuspidata* and allied forms are also (by *Nav. halophila* and *N. gregaria*) connected with the group *radiosæ*.

The small group of *asperæ* seems to be allied to the *radiosæ*, but the structure of these forms is so peculiar, that it seems justifiable to place them in a separate genus, *Trachyneis*.

The group *punctatæ* is distinguished by the structure of the valve, which is covered by rows of, usually, distinct puncta. This group is connected with the *radiosæ* by some species (*Nav. Placentula*).

The large section of *Nav. Lyra* and *Nav. Henedyi*, all marine, seems to form a well defined group, but it has so many transitions to the *punctatæ* (*Nav. prætexta*, *Nav. carinifera*, etc.) that it does not seem desirable to place it in a separate genus, though there might be some reason for combining the *punctatæ* and *lyræ* in a distinct genus.

The group of *formosæ*, to which the *limosæ* may be united, has scarcely any connection with the above named genera and groups. The characteristic longitudinal lines, often indeed scarcely perceptible, remind one of *Amphiprora* (*A. lepidoptera*). The

small group of *Nav. palpebralis*, which has no longitudinal lines, is perhaps to be placed in the vicinity of the *formosæ*. A real affinity with the forms of the *formosæ* group is shown by the *quadriseriatæ*-group (Grun. in *Arct. Diat.* p. 29) as *Nav. æmula*, *N. consimilis*, *N. subdivisa*, *N. latefasciata*, *N. blanda*, *N. Powellii*. Other, included in this group, as *Nav. Bruchii* and *Nav. superimposita*, belong to the *radiosæ*. *Stauroneis robusta* Petit belong to *Trachyneis*.

The group of *Nav. didyma* comprises a large number of closely connected forms and is so well defined that it may be most conveniently treated as a separate genus, for which the old name *Diploneis*, given already by Ehrenberg, may be reserved. In this genus the nonconstricted forms (*N. Smithii*, *N. elliptica*, etc) may also be included, as they agree with the *didymæ* in all respects except the form of the valve, which is of no real importance.

Although there are reasons for splitting up the *Naviculæ* of the groups *radiosæ*, *punctatæ*, and *formosæ* into three genera, I am not for the present inclined to do so in this paper, but on the other hand I admit the genera *Pinnularia*, *Neidium*, *Anomœoneis*, *Frustulia* and *Diploneis*.

Several of the smaller groups of *Navicula* are not natural, as *pseudo-pleurosigma* and *minutula*. The former is founded on the opposite directions of the end-fissures of the raphe, and comprises forms, belonging to *Pinnularia* (*Nav. Flamma*, *Nav. platycephala*) and to the group *formosæ* (*Nav. anomala*). Several forms of *punctatæ* have the endfissures in opposite directions. The *minutulæ* comprise generally small species, which often have very little connection with each other.

The genus *Scoliopleura*, formed for species with sigmoid raphe, is not natural, sigmoid forms being met with in widely different groups. Thus *Nav. Ræana* Castr. comes nearest to *Nav. yarrensis*, which may be either a *Pinnularia* or a form of the group *radiosæ*. A species of *Scoliopleura*, from the Mediterranean, not yet described, comes nearest to *Nav. superimposita*. *Scoliopleura tumida* is widely different from *Sc. convexa* and *Sc. Peisonis*, which may perhaps be classed together with *N. Schneideri* from the Caspian Sea.

The genus *Rhoiconeis* comprises the species *R. Garkeana*

and *R. Bolleana*. The former may perhaps be united with the *complexæ* (*Nav. rhombica*), the latter is closely connected with the *radiosæ*.

The genus *Alloioneis* is entirely unnatural and contains widely different forms. *Alloioneis Antillarum* and *A. Kurzii* belong to *Trachyneis* (*Nav. aspera* group). *A. curvinervia* belongs to the *formosæ*. *A. Grundleri* is an isolated form, remarkable for the peculiar form of the endfissures, and seems to form a transition to some *Amphoræ*.

The genus *Stauroneis* comprises several forms, which may be more naturally classed among the *Naviculæ*, as *St. ventricosa*, which belongs to the *punctatæ*, and *St. platystoma*, which may be classed either among the *punctatæ* or the *radiosæ*. The transversely dilated central nodule is a character of no generic value, as it occurs in widely different groups, as in *Trachyneis* and *lyræ* (*N. Oswaldii* var.) The true *Stauroneis*-forms have fine, distinctly punctate, more or less radiant striæ and seem to be connected with the group of *decipientes* (*Nav. crucicula* etc.), which perhaps is allied to the *complexæ* (*N. rhombica*).

The genus *Cymbella* is closely connected by many forms with the *punctatæ* and the *radiosæ*. *Cymb. Frieseana* Grun. and *C. Brasiliensis* Cl. are more nearly akin to the *decipientes* than to the *Cymbellæ* and may be separated from the true *Cymbellæ*.

With the *Cymbellæ* some forms of the large genus *Amphora* are nearly connected, so nearly indeed, that it is difficult to decide in which genus they may be most conveniently classed. But *Amphora* comprises such widely different forms, that the whole genus seems to be unnatural. Some *Amphoræ* are evidently (*A. acuta* etc.) nearly allied to *Stauroneis*, other to the *complexæ*-group of *Navicula* (*A. obtusa* etc.). Some forms approach to *amphiprora* (*Amporopsis*, *Auricula*). In several *Amphoræ* the structure of the valve is nearly the same as in the genus *Diploneis*. It is thus evident that the genus *Amphora* should be split up in different genera, which might be classed in accordance with the symmetric naviculoid forms.

The genus *Gomphonema* seems to come near to *Cymbella*. *Achnanthes* comprises too many different forms to constitute a

natural genus. Nearly related to some forms of Achnanthes are Cocconeis and Orthoneis and to the latter Mastogloia.

The natural system of the diatoms with a median line (Raphideæ) seems, then, to be represented by the following arrangement.

(*Nitzschia*) — *Plagiotropis* { Amphoropsis — Amphora p. p.
 Amphiprora — Pleurosigma — Navicula (Vegæ Cl.)
 Nav. radiosæ.
 (see below).

Nav. radiosæ { Pinnularia — ? — *N. limosæ* (?)
 Schizonema (ramosissimum-group.)
 Punctatæ (see below).
 Rhoiconeis (R. Bolleana).
 Trachyneis (Nav. velata, *N. pulchella*, *Alloiooneis Kurzii*, *Al. antillarum*).

Nav. punctatæ { ? Group of *N. triundulata* — ? *Diploneis* — ? — Amphora p. p.
 Cymbella { Gomphonema.
 Amphora p. p.
 Lyræ.
 Decipientes (see below).

Nav. decipientes { Stauroneis, Amphora p. p.
 Rhoiconeis (R. Garkeana).
 Scoliopleura (S. tumida).
 Complexæ { ? Amphiprora.
 Schizonema (comoides-group).
 Amphora p. p.

Nav. formosæ { Quadriseriatæ p. p.
 Limosæ { ? Pinnularia.
 ? Neidium.
 ? Palpebrales.
 ? *Nav. Schneideri* — *Scoliopleura* p. p.
 ? Amphora p. p. (*A. Grevilleana*).

Frustulia { Amphipleura, Berkeleya.
 Brebissonia.
 ? Anomæoneis.

Cocconeis { Orthoneis, Mastogloia.
 Achnanthes.
 Campyloneis.
 Rhoicosphenia.

I have in the above exposed my views about the arrangement of the naviculoid diatoms, but I must confess that I am not at the moment prepared to propose it as a definite system. There

remain certainly a large number of forms to be detected, which will no doubt complete the system and fill up the gaps between the larger groups.

Raphideæ.

Pinnularia Ehb.

The genus *Pinnularia* was established by Ehrenberg 1843 for the naviculaceous forms with smooth, strong striae. The genus was admitted by W. Smith and Rabenhorst, but rejected by Kützing, Ralfs and Grunow. Pfitzer on the contrary retains the genus, principally because of the nature of the striae (costae), the slightly asymmetrical structure of the valves, and the arrangement of the cell-content.

As to the striae they seem, with the best objectives, to be smooth, but according to Van Heurck ¹⁾ they have an excessively delicate, and only with difficulty seen, punctation. Still the *Pinnularia* form a very characteristic group of closely allied forms, and although there may be in several cases some difficulty to decide whether a form should be classed as a *Pinnularia* or a *Navicula*, I think it advisable to separate the *Pinnularia* from *Navicula*.

The determination of the species of *Pinnularia* is exceedingly difficult, as the forms are variable and closely resemble each other. In the literature there exists a great confusion. The species of Ehrenberg are in most cases impossible to identify, as the figures are too little detailed and Ehrenberg has given the same names to evidently different species, while on the contrary he often includes under one specific name very different forms. The sketches and descriptions of W. Smith and most older authors are not sufficient. The figures in Donkins Brit. Diat. are better. In the Atlas of A. Schmidt four plates with 204 figures are devoted to *Pinnularia*, and these figures are beyond doubt the best

¹⁾ Synops. des Diat. Belg. p. 225.

and most exact hitherto published. For that reason I have in most cases of uncertainty about the signification of the older names followed the views accepted in the last named classical work.

Although this work gives a valuable help in determining the forms of *Pinnularia*, there still remain great difficulties, which may be got rid of only by a careful study of the minute characteristics, such as the structure of the raphe, the number of striæ, the peculiarities of the end-fissures, the breadth of the band across the striæ, which bands are occasioned by the cavities on the inside of the valve¹⁾. These characteristics, together with the form and size of the valve, as well as the breadth of the area, or unstriated part of the valve, have guided me in limiting the species.

As to the raphe it seems to be formed by a more or less oblique, and sometimes twisted, fissure. Among the larger species of *Pinnularia* two types may be distinguished. In the one the raphe forms simply an oblique fissure, in the other the raphe has a more complicated structure and seems to be twisted¹⁾. The former type of raphe is most developed in *P. transversa* (A. S. Atlas XLIII. 5, 6), the latter in the species named below *P. streptoraphe* (A. S. XLII, 7). I have always found the raphe oblique in *P. major* and in the true *P. Dactylus*, complex in *P. nobilis*, *P. gentilis*, *P. viridis* etc. In some American deposits (Cherryfield, Crane Pond) there occur forms, similar to *P. Dactylus*, but with complex raphe. I regard them as belonging to another species (*P. flexuosa* Cl. mpt).

The end-fissures are generally similar in both ends of the valve, but in *P. Flamma* A. S. and *P. Flammula* A. S. from *Demerara* they are turned in opposite directions. The same is the case with the interesting *P. platycephala* Ehb., which belongs to the flora of Finland.

The number of striæ is more constant than is generally believed and is a valuable characteristic.

***P. platycephala* Ehb.** — M. G. XVII, II, 9. — Valve linear, 5 to 6 times longer than broad, with broad, subcapitate ends and slightly undulate margins. Raphe forms a straight, narrow line

¹⁾ See Otto Müller: Durchbrechungen der Zellwand in ihrem Bez. zu Ortsbewegung der Bacillarien. Ber. d. Deutsch. Bot. Ges. VII, 4, 1889.

and is surrounded by a distinct area, about $\frac{1}{5}$ of the breadth of the valve, and dilated on both sides of the central nodule. End-fissures dissimilar and turned in opposite directions. Striæ 12 in 0,01 m. m., divergent in the middle, convergent at the ends. Length of valve 0,083 to 0,105 m. m. Breadth of valve 0,017 m. m. to 0,018 m. m.

This very distinct species is rather rare. I have seen it in gatherings from the lake Rosslängen (Småland, Sweden), from Lac Gerardmer (Vosges), in the diatomaceous earths from Öjasjö (Blekinge, Sweden) and Pjesörn (Skelefteå, Sweden).

Pl. II, fig. I.

Foss. Sa. 89, Tb. 90, Ob. 92.

P. cardinalis Ehb. — V. H. Suppl. A. 5, A. S. XLIV, 1, 2.

Foss. 97 (abundant).

P. nobilis Ehb. — A. S. XLIII, 1.

This species is easily distinguished by the large size of the valves, which are dilated on the middle and at the ends, by the coarse striæ (4,5 in 0,01 m. m.), by the broad, longitudinal band across the striæ and the slightly complex raphe. The area occupies about one third of the breadth of the valve.

Ab. 36. Sb. 8, 16.

Foss. Ta. 94, 95, 96, 97, Tb. 90, Ob. 92, Lk. 104.

P. gentilis Donk. — B. D. XII, 1.

This species is distinguished from *P. nobilis* principally by its smaller size and closer striæ. It measures in length 0,145 to 0,2 m. m. and in breadth 0,022 to 0,036 m. m. The striæ are always strongly radiant in the middle, 7 in 0,01 m. m. The area is somewhat less than one third of the breadth of the valve. The raphe is distinctly complex.

Sb. 16.

Foss. Tb. 90, Ob. 92, Lk. 104.

P. viridis Ehb.

A great confusion exists about the forms, named by authors *P. viridis* and *P. major*. Following A. Schmidt I admit as *P. viridis* the fig. 20, 21, 11, 12, 13 on the Plate XLII in his Atlas. *P. viridis* is distinguished by the following characteristics.

The valve is 5 to 6 times longer than broad, linear-elliptic, with parallel margins, attenuated towards the rounded ends. The

striæ are only slightly radiant, 6,5 to 7,5 in 0,01 m. m., crossed by a band, occupying about a fourth of the length of the striæ. The raphe is generally distinctly complex. The area is narrow, and occupies about one fifth of the breadth of the valve. Typical specimens are 0,14 to 0,17 m. m. in length and 0,022 to 0,025 m. m. in breadth.

Ab. 36, Lad. 86, Sb. 8, 10, 16, 21, Lt. 29, 30, 31, 32, Lim. 21, 23, 26.

Foss. Nyl. 87, Sa. 88, 89, Ta. 94, 95, 96, 97, 98, Ob. 94, 95, Lk. 93, 104.

Var. *minor* Cl. — Smaller, 0,085 to 0,1 m. m. in length and 0,015 to 0,016 m. m. in breadth, raphe strongly complex, striæ slightly radiant 6 to 7 in 0,01 m. m., often interrupted on one or on both sides of the central nodule.

Pl. 1, fig. 2.

Foss. Ta. 97, Lk. 93.

Var. *distinguenda* Cl. — Valve 0,105 to 0,18 m. m. in length. Striæ strongly convergent in the middle, divergent at the ends, 6,5 in 0,01 m. m. Area broad, about $\frac{1}{3}$ of the breadth of the valve. Raphe complex.

This form, which perhaps may be admitted as a distinct species, occurs often in slightly brackish water. It is found in Sweden in the Karlshamn deposit together with *Campylodiscus Clypeus*, in the Bory deposit of Hungary, in Northern America in earths from Houghton (Michigan) and Sta Rosa (Calif.), in Australia at South Yarra and at Campbell Town in Tasmania.

Pl. I, fig. 1.

Foss. Ob. 92, Lk. 104.

Var. *intermedia* Cl. — Valve 0,075 to 0,11 m. m. in length and 0,014 to 0,015 m. m. in breadth. Striæ 9 in 0,01 m. m., convergent at the middle and divergent at the ends. Raphe complex. Area about a fourth of the breadth of the valve.

A. S. XLII, 9, 11 (as *Nav. major*. The complex nature of the raphe is not represented in these figures).

Ab. 36, 49, Lad. 86, Sb. 2, 8, 10, 15, 16, Lt. 29, 30, 32, 33, Lim. 20, 21, 23, 24, 26.

Foss. Sa. 89, Ta. 95, 96, 97, 98, Tb. 90, Ob. 92, Lk. 93, 104.

Var. *commutata* Grun. — A. S. XLV, 35. V. H. V, 6.

This form is nearly connected with the var. *intermedia* and differs only by more close striae, 10 to 11 in 0,01 m., more narrow area and smaller size. It measures in length 0,07 m. m. and in breadth 0,011 to 0,012 m. m.

Al. 58, Ab. 36, 37, Lad. 86, Sb. 2, 3, 12, 15, Lim. 20, 23, 24, Lt. 28, 29, 31, 32, 34.

Foss. Nyl. 87, Ta. 95, 96, 97, 98, Tb. 90, Lk. 93.

Var. *rupestris* Hantzsch — A. S. XLV, 38, 40, 41.

This form is nearly connected with the var. *commutata* and has more narrow area and closer striae, about 13 in 0,01 m. m. Lim. 21, 26.

P. streptoraphe Cl. n. sp. — Valve linear, with rounded, broad ends, and parallel margins, 0,135 to 0,2 m. m. in length and 0,02 to 0,03 m. m. in breadth. Striae almost parallel or slightly radiant, 5 in 0,01 m. m., crossed by a very distinct band, about one third of the length of the striae. Area narrow. Raphe strongly twisted.

This species is always easily recognized, and is well figured by A. Schmidt (Atl. XLII, 7) and Grunow (Nav. viridis var. *sublinearis* F. Jos. Land 1,22). — As the name *sublinearis* already has been given to a *Pinnularia* (V. H. VI, 25, 26), I think it may be most convenient to propose a new name, which marks one of the most striking characteristics of the species.

Pinn. streptoraphe is widely distributed. Swedish localities are Muddes ape and Gellivaara in Luleå Lapmark, Idvattnet in Wilhelmina Lapmark, Sorcelet in Jämtland, Vernamo and Förrarn (Åsnen) in Småland (all fossil). It occurs also in British deposits from Island of Lewis and in Premney Peat, on Franz Josephs Land (Grun.), in Lac de Grandlieu (Loire inférieur). American localities are: Sing-sing (N. Y.), Salem (Mass.), French pond (Albany), Nova Scotia, Sta Rosa (Cal.).

Ab. 36, Lim. 21, Lt. 29, 31.

Foss. B. Nyl. 102, Ta. 94, 95, Tb. 90, Ob. 92.

P. major Kütz. — V. H. V, 3; A. S. XLII, 8. — *P. leptogongyla* Ehb. p. p.

This species is distinguished by its narrow centrally inflated valves, about 8 to 10 times longer than broad, 0,22 to 0,28 m. m. in length and 0,028 to 0,03 m. m. in breadth, its radiate striae,

7 in 0,01 m. m., traversed by a narrow band, its tolerably large area and the broad, not complex raphe.

This species occurs generally in larger lakes, as Wenern and Rosslängen (Småland) in Sweden, Lac Lemán in Schwizerland, Lac Gerardmer in the Vosges.

Lim. 21, Lt. 33.

Foss. Nyl. 87, Sa. 88, 89, Tb. 90, Ob. 92.

Var. **transversa** A. S. — Atl. XLIII, 5, 6 (the striæ are incorrectly sketched as punctate).

This variety is still more slender than the typical specimens, has closer striæ, about 8 in 0,01 m. m., and a more oblique, and therefore broader raphe.

Foss. Lk. 104.

P. Esox Ehb. — Am, 1, II, 4? — Schum 1, IX, 36.

This species is distinguished by its triundulated valve, 0,145 m. m. in length and 0,022 m. m. in breadth. The striæ are 9 in 0,01 m. m. radiant. The raphe seems not to be complex.

Foss. Lk. 104.

Pl. 1, f. 3.

P. Dactylus Ehb. — V. H. V, 1 — A. S. XLII, 1, 3, 4.

This species is easily recognized by its linear-elliptic form, large size (the length being 0,22 to 0,33 m. m. and the breadth 0,04 to 0,05 m. m.), its coarse striæ (5 in 0,01 m. m.) and the broad band crossing them. The raphe is oblique, not complex. The area occupies about the third part of the valve.

Pinnularia Gigas Ehb. is in no respects, except the large size, different from *P. Dactylus*.

Ab. 34, Lt. 32, Lim. 21, 25.

Foss. Nyl. 87, Ta. 94, 95, Tb. 90, Sa. 88, 89, Ob. 92, Lk. 104.

P. macilenta Ehb. — M. G. I, 2, 7; 1, 3, 13.?

I suppose that the name of Ehrenberg may denote this species, which has the following characteristics: linear, broadly obtuse valves, 0,14 to 0,15 m. m. in length and 0,02 m. m. in breadth, parallel striæ, 8 in 0,01 m. m., crossed by a tolerably broad band, large area and a broad oblique, not complex raphe.

Pl. 1, fig. 7.

This species is found in Sweden in the lake Wenern and in Rosslängen (Småland).

Foss. Nyl. 87.

The same form occurs also in a slide of Pudasjärvi deposit, in the Riksmuseum of Stockholm.

P. brevicostata Cl. n. sp. — Valve linear, 0,12 m. m. in length and 0,02 m. m. in breadth. Striæ almost marginal, short, 7,5 in 0,01 m. m. Area very large, more than half of the valve. Raphe almost straight, not complex.

Pl. 1, fig. 5.

Sb. 2, 8, 10, 16.

Foss. Ta. 97, Tb. 90.

Var. *leptostauron* Cl. n. var. — A. S. XLIII, 25. — Valve smaller, 0,07 to 0,095 m. m. in length and 0,013 m. m. in breadth. Striæ 10 in 0,01 m. m. interrupted in the middle of the valve.

Foss. Ta. 94, 95, 97, Tb. 90.

P. hemiptera Kütz. — Nav. hem. Kütz. Bac. XXX, 11. — A. S. XLIII (26, 27?) 28, XLV, 9 —? *N. instabilis* A. S. XLIII, 35—40 —? *Pinn. acuminata* W. Sm. B. D. XVIII, 164.

Valve linear-elliptic, sometimes subcuneate, 0,06 to 0,08 m. m. in length and 0,011 to 0,013 m. m. in breadth. Striæ radiant, often shortened in the middle of the valve, 9 to 10 in 0,01 m. m. Area broad, generally dilated around the central nodule.

Ab. 36, 37, Sb. 2, 3, 8, 10, 13, Lt. 29, Lim. 20.

Foss. Ta. 94, 95, 96, 97, 98, Tb. 90, Ob. 92, Lk. 93, 104.

P. icostauron Ehb. — Nav. icost. Grun. in Cl. Gr. A. D. I, 14. Ab. 36, Sb. 10, 17.

Foss. Ta. 97, Lt. 29.

P. mesogongyla Ehb.? — Berl. Akad. 1870 II, 16. — A. S. XLV, 45 (without name). — Nav. *decurrens* Cl. Vega XXXVI, 20.

Valve 5 times as long as broad, gibbous in the middle and tapering to the subcapitate, broad ends. Striæ strongly radiant, 11 in 0,01 m. m., shortened on the middle of the valve. Area narrow, dilated around the central nodule. Length 0,06 to 0,09 m. m., breadth 0,013 to 0,015 m. m.

Pl. 1, fig. 11.

This species resembles in outline *P. tabellaria* Ehb. (A. S. XLVIII, 4) but the latter is more slender, has closer striæ (14 in 0,01 m. m.) and bayonet-shaped end-fissures.

P. mesogongyla occurs in Tana elf and at Hjerkin (Norway),

in north Iceland and at Cape Deschneff (north-eastern corner of Asia). It appears consequently to be a northern form.

Sb. 2, 8, 16, Lad. 85, Lim. 20, 21, 23, Lt. 29, 30, 32, 34.

Var. **interrupta** Cl. — Smaller than the typical form (0,06 m. m. in length and 0,01 m. m. in breadth). Striæ interrupted on the middle of the valve, about 12 in 0,01 m. m., strongly divergent.

Pl. 1, fig. 10.

Sb. 8.

P. brevistriata Grun. — V. H. VI, 5. — Pin. biglobosa Schum. II, II, 48.

Ab. 49, Sb. 2, 7, 17.

Foss. Tb. 90, Ob. 92.

P. stauroptera Grun. — V. H. VI, 7. — Nav. parva V. H. VI, 6. — Nav. tabellaria var. stauroneiformis V. H. VI, 8. — Nav. gibba Donk. B. D. XII, 3. — Nav. gibba A. S. XLV, 48, 49, 50, 51.

A great confusion exists about *Navicula gibba* and *N. stauroptera*. *Pinn. gibba* in W. Sm. B. D. XIX, 180, has 11 striæ in 0,01 m. m. and a narrow area. I think this form may be taken as the type and if so the true *P. gibba* has not been found in Finland. This form, determined by Grunow in Cl. & M. D. n:o 291 as *N. gibba* var. *acrosphaeria*, is comparatively rare. There can be no doubt that *Nav. gibba*, *N. parva*, *N. stauroptera* and *N. tabellaria* in Van Heurcks Synopsis are only forms of one and the same species, for which I propose the name of *P. stauroptera*. *P. stauroptera* is larger than *P. gibba* and measures 0,095 to 0,15 m. m. in length and 0,01 to 0,015 m. m. in breadth. The striæ are short and divergent, 9,5 to 10 in 0,01 m. m., continuous or interrupted on one or both sides of the central nodule. The area is broad. The end-fissures are semicircular.

Ab. 36, Sb. 2, 5, 6, 8, 10, 16, Lim. 25.

Foss. Nyl. 87, Sa. 88, 89, Ta. 94, 96, 97, Tb. 90, Ob. 92, Lk. 104.

P. Brandelii Cl. n. sp. — Valve linear, with subundulate margins and broadly rounded, sometimes subclavate ends, 0,07 to 0,08 m. m. in length and 0,007 to 0,009 m. m. in breadth. The striæ are divergent, interrupted in the middle of the valve, 14 in

0,01 m. m. The area is narrow. Endfissures semicircular. There is on both sides of the central nodule a fissure-like line as in *P. stomatophora* Grun.

Pl. 1, fig. 8, 9.

Foss. Tb. 90, Ob. 92.

I found this species in a sample of mud, rich in diatoms dredged from the lake Älmten (Misterhult socken, Calmar län, Sweden) which was given to me by Mr. Brandel. I have found the same species in a sample from Lac Gerardmer (Vosges) sent to me by Mr. P. Petit.

P. stomatophora Grun. — A. S. XLIV 27, 28, 29.

Ab. 36, 37, Sa. 75, Sb. 4, 10, Lt. 33, Lim. 20, 21, 23.

Foss. Nyl. 87, Sa. 89, Ta. 95, Tb. 90, Ob. 92.

A variety without fissure-like lines on the sides of the central nodule occurs rarely in 36 Ab.

P. acrosphæria Bréb. — A. S. XLIII, 14—17. — Donk. B. D. XII, 2. — *Nav. punctata* (Arnott) Bréb. J. Quek. M. C. 1870, 4.

Sb. 10, 13.

P. episcopalis Cl. n. sp. — *P. cardinalis* Ehb. M. G. XVIII, I, 4.

Valve large, 6 to 9 times longer than broad, 0,23 to 0,36 m. m. in length and 0,035 to 0,04 m. m. in breadth, linear, with parallel margins and rounded ends. Striæ 8 in 0,01 m. m., strongly divergent in the middle and convergent at the ends, interrupted on both sides of the central nodule. Area broad, about one third of the valve. Raphe not complex.

Pl. 1, fig. 4.

This large and beautiful species is akin to *P. divergens* var. *elliptica*, but is much larger and more slender, and to *Nav. Hartleyana* Grev., but the latter species has gibbous middle and ends. It occurs in Sweden living in Wenern and Rosslängen (Småland), fossil in the Öja sjö deposit (Blekinge) and in a præglacial or interglacial clay at Hernösand. It is found in Lac Gerardmer (Vosges) and in Cherryfield deposit (America).

Foss. Nyl. 87, Sa. 88, 89, Tb. 90, Ob. 92.

P. divergens W. Sm. — B. D. XVIII, 177.

Lad. 86, Sb. 2, 8, 10, Lm. 39, Lt. 29, 31, 33, 34, Lim. 20, 21, 23, 24, 26.

Foss. Nyl. 87, Sa. 88, 89, Ta. 95, Ob. 92, Lk. 104.

Var. *elliptica* Grun. F. Jos. Land I, 19. — A. S. XLIV, 6, 7. Lim. 21.

Foss. Tb. 90, Lk. 104.

P. divergens is a most variable species, and seems to graduate to *P. Legumen*. An intermediate form is *P. florentina* Grun. (A. S. XLIV, 8).

P. Legumen Ehb. — V. H. VI, 16. — A. S. XLIV, 45, 46. Lad. 85.

Foss. Nyl. 87, Sa. 88, 89, Ta. 94, 95, 98, Tb. 90, Lk. 104.

P. bicapitata Lagst. — Spitsb. D. I, 5. — A. S. XLV, 69, 70. Ab. 36, Sb. 2, Lim. 21, 23, 25, 33.

Foss. Sa. 88, 89, Ta. 97.

P. microstauron Ehb. — *Stauroptera microstauron* Ehb. M. G. XVI, 2, 14. — *Stauroneis microstaura* Kütz. Bac. XXIX, 13. — *Nav. bicapitata* var. *subproducta* Grun. in V. H. VI, 9. — A. S. XLIV, 14, 34 (typic), 35. — *Nav. Brebissonii* var. *subproducta* Grun. in V. H. V, 9.

Valve linear, with subrostrate ends, 0,025 to 0,08 m. m. in length and 0,007 to 0,009 m. m. in breadth. Striæ divergent, 12 in 0,01 m. m., interrupted in the middle of the valve.

Ab. 36, Sb. 1, 2, Lim. 20, 21, 25, Lt. 30.

Foss. Sa. 88.

P. Brebissonii Kütz. — V. H. V, 7. — A. S. XLIV, 17, 18 — *P. stauroneiformis* W. Sm. B. D. XIX, 178 a.

Sb. 2, 4, 10, 15, Lt. 30, 32, Lim. 20, 21.

Foss. Sa. 89.

Var. *diminuta* Grun. — V. H. V, 8.

Sb. 2, 4.

P. karelica Cl. n. sp. — Valve linear-oblong, four times longer than broad, gradually tapering from the middle to the broad and truncate ends. Striæ 15 to 16 in 0,01 m. m., slightly radiant, reaching the raphe, except on the middle, where they are shortened and form a large, orbicular area. The end-areas form a straight angle with the raphe and are turned in the same direction. Length of valve 0,045 to 0,05 m. m., breadth 0,011 to 0,012 m. m.

This small and characteristic species is found in Tana elf (Finmarken), and in the lakes Wenern and Rosslängen (Småland).

Pl. 1, fig. 6.

Kon. 41 (rare).

P. molaris Grun. — Nav. appendiculata in V. H. VI, 18, 19.
— Nav. macra A. S. XLIV, 54.

Sb. 3, 4.

P. leptosoma Grun. — V. H. XII, 29.

One specimen from Finland measures 0,043 m. m. in length and 0,005 m. m. in breadth. The striæ are 18 in 0,01 m. m. in the middle and 20 near the ends of the valve.

Ab. 36, Lim. 21.

P. Braunii Grun. — V. H. VI, 21.

Sb. 10.

P. Hilseana Janich. — V. H. Suppl. A. 11. — Nav. subcapitata Greg. V. H. VI, 22. — Nav. gracillima A. S. XLV, 62, 63. — Nav. termitina A. S. XLV, 64.

In Van Heurcks Synopsis Nav. Hilseana and N. subcapitata are described as different species. The principal distinction is that the striæ of Nav. subcapitata do not reach the raphe, which is the case with the striæ of Nav. Hilseana. The distinction is an exceedingly delicate one, and I think it advisable to unite the two forms.

Al. 60, Ab. 49, 52, Sb. 1, 2, 8, 10, 12, 13, 15, Lm. 39, Lt. 30, Lim. 20, 21.

P. divergentissima Grun. — V. H. VI, 32.

Ab. 36, Lt. 29, 30, 33, Lim. 20, 21, 26.

Foss. Nyl. 87.

P. mesolepta Ehb. — V. H. VI, 10—13, 15. — A. S. XLV, 52, 53, 71, 78. — Nav. nodulosa Kütz. — Pinn. interrupta W. Sm.

Ab. 36, 49, Sb. 1, 2, 3, 4, 5, 7, 12, 15.

Foss. Ob. 92, Lk. 104.

Var. **Termes** Ehb.

Sinf. Nyl. (forma contracta according to Dannf.), Sb. 1, 2, Lim. 23, Lt. 30.

Foss. Nyl. 87.

Var. **crassior** Grun. — Nav. globiceps var. crassior Grun. in Cl. Gr. A. D. I, 13.

Al. 58 (brackish water).

P. nodosa Kütz. — A. S. XLV, 56, 57, 58.

Ab. 36, Sb. 8, 10, 12, 16.

Foss. Nyl. 87, Sa. 88, Ta. 96, 98, Tb. 90, Ob. 92, Lk. 104.

P. polyonca Bréb. — V. H. Suppl. A, 14. — Nav. mesotyla

A. S. XLV, 54, 55.

Foss. Ta. 94.

P. globiceps Greg. — V. H. Suppl. A. 13.

Al. 58 (rare).

P. intermedia Lgst. — Spitsb. D. I, 3.

Ab. 36, Lt. 30.

P. borealis Ehb. — V. H. VI, 3.

Al. 58, Ab. 36, 49, 54, Nyl. 55, Kon. 40, 41, Sb. 1, 2, 15,

Lim. 20, 21, Lt. 29, 33.

Foss. Ta. 94, 95, 98.

P. lata Bréb. — V. H. VI. 1.

Nyl. 99.

P. hungarica Grun. — Verh. 1860, III, 30. — V. H. XI, 23.

— Nav. humilis Donk. B. D. X, 7.

Ab. 46, 47, Kon. 41, Sinb. Ob. 83.

P. Krookii Grun. — Navicula Krookii Grun. D. Öst. Ung. XXX, 40.

This species is named in honour of the Swedish botanist Mr. Krook, for which reason the name given by Grunow has been corrected.

Sinb. Ob. 83 (rare).

P. undulata Greg. — Micr. J. II, IV, 10, 1859.

Valve linear, with more or less distinctly triundulate margins, and large, capitate ends. Striæ 20 to 22 in 0,01 m. m., almost parallel, convergent at the ends, shortened or interrupted in the middle. Length 0,03 to 0,035 m. m., breadth 0,006 m. m.

Foss. Sa. 88, 89.

The fig. of Gregory is too small to admit of a trustworthy identification, for which reason I have drawn a new one of the form I believe to be the *P. undulata*, Pl. II, fig. 8.

Navicula Bory.

Sectio: *Radiosæ*.

- N. vulpina** Kütz. — V. H. VII, 18.
 Kon. 41, Lad. 85.
 Foss. Ob. 92, Lk. 93, 104.
- N. radiosa** Kütz. — V. H. VII, 19, 20.
 Al. 57, Ab. 36, 37, 38, 45, 46, 47, 48, Kon. 41, 42, Nyl. 55,
 Sb. 3, 4, 5, 6, 9, 10, 13, 16, 17, 19, 70, Lim. 23, 26.
 Foss. Nyl. 87, Sa. 88, 89, Ob. 91, Lk. 93, 104.
- N. tenella** Bréb. — V. H. VII 21, 22.
 Ab. 44, 46, 47, Sb. 6, Lim. 23.
- N. Heufleri** Grun. — V. H. VII 15.
 Sb. 7, Sinb. Ob. 83, sinf. Nyl. (Dannf.).
- N. gracilis** (Ehb.) Grun. — V. H. VII 7—10.
 Ab. 47, 48, 49, Sb. 3, 18, Lt. 31, Sinb. Ob. 83, Sinf. Nyl.
 (Dannf.).
- N. viridula** Kütz. — V. H. VII 25, 26. — *N. Slesvicensis* Grun.
 l. c. f. 28, 29.
 Kon. 41, 47, Sinb. Ob. 83, Sinf. Nyl. (Dannf.).
- N. rhynchocephala** Kütz. — V. H. VII 30, 31.
 Al. 58, Ab. 46, Nyl. 55, Sinf. Nyl. (Dannf.), Mb. Ab. (Dannf.),
 Kon. 41, Sb. 2, 5, 15.
- N. lanceolata** Kütz. — V. H. VIII, 16.
 Sb. 1, 2, 5.
 Var. **Cymbula** Donk. — V. H. VII, 32.
 Striæ in the middle 8, at the ends 10 in 0,01 m. m. Length
 0,055 m. m. Breadth 0,011 m. m.
 Kon. 41.
- N. oblonga** Kütz. — V. H. VII, 1.
 Al. 59.
- N. peregrina** Kütz. — V. H. VII, 2.
 Al. 58, Mb. Ab. 100, Sinf. Nyl. (Dannf.).
- N. gastrum** Ehb. — V. H. VIII, 25, 27.
 Foss. Ob. 91.
- N. Reinhardtii** Grun. — V. H. VII, 5, 6.

- Lad. 86.
N. Meniscus Schum. — V. H. VIII, 26.
 Sinf. Nyl. (Dannf.), Sinb. Ob. 83.
N. Menisculus Schum. — V. H. VIII, 20—24.
 Ab. 46, 47, Kon. 41.
 Foss. Ob. 91.
N. Placentula Ehb. — V. H. VIII, 28.
 Ab. 48, Lad. 85, 86, Lt. 31.
 Foss. Ob. 91 (forma minor).
 Var. *subsalsa* Sinf. (Dannf.).
N. (Schizonema) setacea var. *polyclados* Grun.
 Sinf. Nyl. (Dannf.).
N. anglica Ralfs. — V. H. VIII, 29, 30.
 Ab. 36, 37, 46, 47, Kon. 41, Sb. 4.
N. salinarum Grun. — V. H. VIII, 9.
 Al. 58.
N. bottnica Grun.
 Sinf. (Dannf.).
N. cocconeiformis Greg. — V. H. XIV, 1.
 Ab. 45, 46, Sb. 4, 70, Sinb. Ob. 83, Lim. 20, 22, Lt. 32, 33.
 Foss. Sa. 89.
N. dicephala (Ehb?) W. Sm. — V. H. VIII, 33, 34.
 Sinf. Nyl. (Dannf.) 55, Ab. 36, Kon. 40, Sb. 2, 9, 10, 16, 18,
 Lt. 31.
 Foss. Ta. 95, 98, Ob. 92, Lk. 104.
N. elegans W. Sm. — Donk. B. D. IV, 1.
 Mb. Ab. 100.
N. Placenta (Ehb.) Lewis. — Cl. Gr. A. D. III, 60.
 Sb. 10.
N. cryptocephala Kütz. — V. H. VIII, 1, 2.
 Sinf. Nyl. (Dannf.), Ab. 49, Kon. 43, Sb. 1, 4, 5, 6, 7, 12, 15.
 Var. *latior* Dannf. — Sinf. (Dannf.).
 Var. *Turholmensis* Dannf. — Sinf. (Dannf.).
N. cuspidata Kütz. — V. H. XII, 4.
 Kon. 41.
 Foss. Sa. 89, Lk. 104.

Sectio: *Punctata*.

N. humerosa Bréb. — V. H. XI, 20.

Foss. B. 102, 103.

N. latissima Greg. — A. S. VI, 7.

Foss. B. 101, 102.

N. Cluthensis Greg. var. *maculifera* Cl. — N. R. D. II, 23.

Mb. Ab. 100.

Foss. B. 102.

N. marina Ralfs.

Sinf. Nyl. (Dannf.)

N. amphibola Cl. — *N. punctata* var. *asymmetrica* Lagst. II, 7.

— *N. gastrum* var? *styriaca* Grun. E. Öst. Ung. XXX, 50, 51, F. Jos. Land, I, 35.

Foss. Lk. 93.

This form seems to be a good species, for which I should have liked to have proposed the name *N. styriaca*, had not this name been given to another species.

N. pusilla Ralfs. — V. H. XI, 17.

Al. 58.

N. scutelloides W. Sm. — A. S. VI, 34.

Foss. Sa. 89, Lk. 104.

Var. *minutissima* Cl. — D. fr. Grönland, XVI, 10.

Ab. 45, 46, 48, Kon. 41.

N. torneensis Cl. n. sp. — Valve broadly lanceolate, 0,017 to 0,024 m. m. in length and 0,008 to 0,01 m. m. in breadth. Rows of puncta 14 in 0,01 m. m., slightly radiant, shortened on the middle of the valve. Puncta 14 in 0,01 m. m.

Pl. II, fig. 6.

Sinb. Ob. 93.

Var. *aboënsis* Cl. — Valve elliptic, 0,012 m. m. in length and 0,0075 m. m. in breadth. Rows of puncta 12 in 0,01 m. m. shortened around the middle. Puncta 18 in 0,01 m. m.

Pl. II, fig. 7.

Ab. 48.

N. Jentzschii Grun. — D. Öst. Ung. XXX, 64.

Ab. 45, 47, 48, Sinb. Ob. 83.

N. quinquenodis Grun. — Verh. 1860, I, 33; Verh. 1863, IV, 9. — V. H. X, 21.

Valve somewhat more than twice as long as broad, with subcapitate-rostrate ends and triundulate margins. Striæ 18 in 0,01 m. m. composed of distinct puncta, about 24 in 0,01 m. m. Length of valve 0,015 m. m. Breadth 0,006 m. m.

Sb. 10 (rariss.)

Pl. II, fig. 5.

This small species is nearly akin to *Stauroneis ventricosa* (V. H. IV, 1, b), which is no *Stauroneis*.

N. tuscula (Ehb.) Grun. — V. H. X, 14.

Al. 59.

Foss. Ob. 91, 92, Lk. 93.

N. lacustris Grun. — Cl. Gr. A. D. pag. 40 ad specim. authent.!

This species, which is an inhabitant of fresh water, seems to have been confounded with *N. scandinavica* Lagst., which is a marine and different species. As no figure of sufficient size is found in the literature, I have given one Pl. II, fig. 14.

Specimens from Finland are 0,04 to 0,05 m. m. in length and 0,015 m. m. in breadth. The striæ are 14 in 0,01 m. m., somewhat more crowded near the ends. The puncta are distinct, more approximate near the ends, on the average about 18 in 0,01 m. m. The end-fissures are short and seem to be turned in opposite directions.

Kon. 41.

Foss. Ob. 92.

N. platystoma (Ehb.) Cl. — *Stauron. plat.* Cl. Gr. A. D. III, 61. Sinb. Ob. 83 (rare).

N. obliqua Greg. — *Stauroneis obliqua* M. J. 1856, I, 35, ad specim. authent.!

Valve elliptic, 0,021 to 0,025 m. m. in length and 0,007 to 0,012 m. m. in breadth. Striæ 21 to 24 in 0,01 m. m., composed of crowded, small puncta, forming irregular longitudinal lines.

Pl. III, fig. 1.

Ab. 48, 54, Sinf. 83.

The fig. of Gregory shows the median line sigmoid, which is not exact.

N. Rotæana Grun. — V. H. XIV, 17.

Ab. 46, 48, Kon. 41, Sb. 4, 5, 7, Sinb. Ob. 83, Lt. 32.

Sectio: *Lyræ*.

N. hyalina Donk.
Sinf. Nyl. (Dannf.).

Sectio: *Formosæ*.

N. formosa Greg. — T. M. S. IV, V, 5.
Mb. Ab. 100.

Var. **holmiensis** Cl. — N. R. D. II, 18.

This form has coarser striæ (on finnish specimens 10 in 0,01 m. m.) than *N. formosa* (14 striæ in 0,01 m. m.), a larger area and a very indistinct line crossing the striæ.

Mb. Ab. 100.

N. hebes Ralfs. — Donk. B. D. III, 12.

Lim. 21, 23, 26, Lt. 32, 33.

This species is a northern or alpine form.

N. perpusilla Grun. — V. H. XIV, 22, 23.

Ab. 52, 53, Lim. 22.

N. trinodis W. Sm. — V. H. XIV, 31.

Ab. 54.

N. ladogensis Cl. n. sp. — Valve broadly lanceolate, with subrostrate ends, 0,025 m. m. in length and 0,014 m. m. in breadth. Striæ slightly radiant, 17 in 0,01 m. m., finely punctate, shortened around the central nodule, where is a broad, transverse area.

Pl. II, fig. 3.

Lad. 62 (rare).

N. amphisbæna Bory. — V. H. XI, 7.

Mb. Ab. 100.

Var. **subsalina** Sinf. Nyl. (Dannf.).

Var. **Fenzlii** Sinf. Nyl. (Dannf.).

N. depressa Cl. n. sp. — Valve elliptic, with rostrate ends, 0,022 m. m. in length and 0,009 m. m. in breadth. The surface of the valve has four depressed areas, so that the margins and the parts around the median line and the central nodule are higher. The valve is covered with fine striæ, 27 in 0,01 m. m., more distant (about 24 in 0,01 m. m.) on the middle of the valve, slightly radiant, especially near the ends. The striæ reach the

median line, except around the central nodule, where is a tolerably large and transversely dilated area.

Pl. II, fig. 4.

Lim. 23.

Foss. Sa. 99.

This small species stands alone among the other *Naviculæ*, so that if I place this form here in the section of the *formosæ*, it is only with great hesitation. The structure of the valve is extremely delicate, and I am greatly obliged to Prof. *Van Heurck*, who was so kind as to help me in resolving the striation and sent me a photograph, which however was not distinct enough to be reproduced.

Sectio: *Decipientes*.

N. Semen Ehb. — Donk. B. D. III, 8, Grun. F. Jos. Land I, 34.
Foss. Ta. 97, Ob. 92, Lk. 93.

N. Bacillum Ehb. — V. H. XIII, 8.
Ab. 36, Lad. 86, Kon. 41, Sb. 8, 10.

Foss. Ob. 92.

N. lepida Greg. — V. H. XIII, 12.

The fig. in V. H. is too small and indistinct to admit of identification. One specimen from Finland is 0,022 m. m. in length and 0,01 m. m. in breadth. The striæ are 24 in 0,01 m. m., except in the middle of the valve, where they are stronger and more distant.

Ab. 36, 47.

N. Pseudobacillum Grun. — V. H. XIII, 9.

Ab. 36, Lad. 85, Kon. 40.

Foss. Ob. 92, Lk. 93, 104.

N. bacilliformis Grun. — V. H. XIII, 11.

Ab. 36, 49, Sb. 4, 10.

Foss. Lk. 104.

N. pupula Kütz. — V. H. XIII, 15, 16.

Ab. 36, 46, 47, 48, Sb. 2, 5, 8, 10, 16, Lt. 31, 33, Lim. 23, 26.

Foss. Tb. 90, Ob. 91, 92, Lk. 93, 104.

N. americana Ehb. — V. H. XII, 37.

Ab. 36.

Foss. Ta. 94, 95, 97, Tb. 90.

This species has not the characters of this section, but seems me nevertheless to be akin to *N. Bacillum*.

N. crucicula Donk. — V. H. X, 15.

Mb. Ab. 100.

N. subtilissima Cl. n. sp. — Valve linear, 0,032 m. m. in length and 0,005 m. m. in breadth, with capitate ends. Striæ very fine and close, about 40 to 45 in 0,01 m. m., stronger, more distant around the central nodule, reaching very nearly to the raphe, slightly radiant, except around the nodule, where they are strongly radiant.

Pl. II, fig. 15.

Lim. 25.

The structure of this small species is extremely delicate and it was only with the kind assistance of Prof. Van Heurck I could give the above description.

N. inflata Donk? — B. D. III, 9.

The fig. in Donk. B. D. is too small and the description too incomplete to admit of a trustworthy identification. The valve is lanceolate with capitate ends, 0,026 m. m. in length and 0,0075 m. m. in breadth. The striæ are radiant in the middle, 19 in 0,01 m. m., convergent at the ends, 22 in 0,01 m. m. and reach the median line, except in the middle of the valve, where they are shortened and alternately longer and shorter. The punctuation of the striæ is seen only with great difficulty.

Pl. II, fig. 2.

This species is found in the lake Rosslängen (Småland, Sweden) and in diatomaceous earth from Houghton (Michigan).

Sectio: *Limosa*.

N. limosa Kütz. — V. H. XII, 18, 19, 20.

Al. 59, Ab. 36, 37, Lad. 86, Sb. 4, Lim. 23, 26, Lt. 31.

Foss. Ob. 91, Lk. 93, 104.

Var. ***ventricosa*** Donk. — V. H. XII, 24.

Ab. 36, 48, Kon. 41, Sb. 5, 10.

Foss. Ob. 92.

forma ***minuta***. — V. H. f. 26.

Sb. 12.

N. fontinalis Grun. — V. H. XII, 33.

Sb. 5.

Foss. Sa. 88.

One specimen from Savitaipale is 0,025 m. m. in length, 0,006 m. m. in breadth, and has 23 striæ in 0,01 m. m.

N. Schumanniana Grun. — V. H. XI, 21.

Lad. 85 (rare).

N. silicula Grun. — V. H. XII, 21.

Lim. 26, Lt. 29, 32, 34, 35.

N. gracillima Greg. — V. H. VI, 24.

Ab. 36, Sb. 3, 4, Lt. 31, Lim. 21, 22, 23.

Foss. Sa. 88, Lk. 93.

Neidium Pfitzer.

The species belonging to *Neidium* form together a very natural and well limited group of forms so closely connected, that it is exceedingly difficult to distinguish the species. The characteristics of *Neidium* consist in the arrangement and division of the endochrome, described by *Pfitzer*¹⁾, the opposite directions of the interior ends of the median lines, the peculiar structure of the endpores, and the structure of the valve. The puncta of the valve form longitudinal and transverse, often oblique lines, which are interrupted by one or more longitudinal lines. In the arrangement of the endochrome, and to a certain extent in the structure of the valve *Neidium* comes near to the *limosæ*-group of *Navicula*.

N. Iridis Ehb. — V. H. XIII, 1. — A. S. XLIX 2, 3.

Ab. 37, Al. 59, Kon. 43.

Foss. Ob. 92, Lk. 93, 104.

N. amphigomphum Ehb. — A. S. XLIX, 31, 32, 33, 34.

Al. 59, Ab. 37.

Foss. Sa. 88, 89, Tb. 90.

N. dilatatum Ehb. — A. S. XLIX, 6.

Ab. 36.

Foss. Sa. 89, Tb. 90.

N. dubium Greg. — V. H. Suppl. B 32, A. S. XLIX, 11, 24.

¹⁾ Unters. über. d. Bau und Entw. der Bacillarieen 1871, p. 39.

- Al. 59, Ab. 36, Kon, 41, Sb. 1, 4.
 Foss. Ob. 91, 92, Lk. 93.
N. Hitchcockii Ehb. — A. S. XLIX, 35, 36.
 Ab. 46, 48, Kon. 41, Lad. 86.
 Foss. Lk. 104.
N. amphirhynchum Ehb. — A. S. XLIX, 27, 28, 29.
 Ab. 36, Sb. 4, 5, 7, 8, 10, Lt. 30.
 Foss. Sa. 89, Ob. 92, Lk. 104.
N. firmum Kütz. — A. S. XLIX, 19.
 Ab. 36, 37, Lad. 86, Lim. 23, 25.
 Foss. Nyl. 87, Tb. 90.
N. affine Ehb. — A. S. XLIX, 20—23.
 Sb. 10, Lim. 21.
 Foss. Sa. 89, Ta. 97, Tb. 90, Ob. 92, Lk. 104.
N. productum W. Sm. — A. S. XLIX, 37, 38, 39.
 Ab. 36, 49, Sb. 2, 4, 8, 15.
N. bisuleatum Ldt. — A. S. XLIX, 15, 17.
 Ab. 36, Sb. 2, 4, 8, Lim. 20, 21, Lm. 39.
 Lt. 29, 32.
 Foss. Lk. 93.

Stauroneis Ehb.

A. *Pleurostauron*.

- S. acuta** W. Sm. — V. H. IV, 3.
 Ab. 46.
S. legumen Ehb. — V. H. IV, 11.
 Ab. 36.
S. Smithii Grun. — V. H. IV, 10.
 Sb. 5, 18, Lim. 23.
 Ab. 36, 48.

B. *Salina*.

- S. salina** v. **latior** Dannf. — V. H. III, 21.
 Sinf. Nyl. (Dannf.).
S. hyalina Dannf. — V. H. III, 20.
 Sinf. Nyl. (Dannf.).
S. Gregorii Ralfs. — V. H. Suppl. A. 4.
 Mb. Ab. 100.

C. *Lacustres*.

S. dilatata Ehb. — Cl. Gr. A. D. III, 62.

Lad. 85, 86.

S. Phœnicenteron Ehb. — V. H. IV, 2.

Ab. 36, Kon. 41, Lad. 86, Sb. 13, 16, 19, Lim. 21, 25,
Lt. 30.

Foss. Nyl. 87, Ta. 94, 95, 97, Tb. 90, Ka. 89, Ob. 92, Lk. 104.

Var. **lanceolata** (S. linearis Ehb.). — *S. lanceolata* (Kütz.)
Grun. — This form is so closely connected with the last, that no
limit can be traced.

Ab. 36, 37, 49, Kon. 41, Sb. 1, 2, 8, 9, 10, 12, 15, Lim. 23.

Foss. Ka. 88, 89, Ta. 94, 96, Tb. 90.

S. anceps Ehb. — V. H. IV, 4—6.

Ab. 36, 47, 48, Kon. 40, 41, Sb. 1, 2, 3, 4, 6, 9, 12, 15, 16,
Lim. 23, 25.

Foss. Ka. 89, Ta. 97, Tb. 90, Lk. 93, 104.

Var. **fossilis** Cl. — Valve lanceolate, 0,09 m. m. in length
and 0,016 m. m. in breadth, with capitate and flattened ends.
Striæ fine, about 23 in 0,01 m. m., oblique.

Pl. II, fig. 18.

Foss. Sa. 88.

The same variety occurs also in the Degernäs deposit
(Sweden).

Anomœoneis Pfitzer.

A. sphærophora Kütz. — V. H. XII, 2, 3.

Kon. 41.

A. serians (Bréb.) Kütz. — V. H. XII, 7.

Lim. 23, 25, Lt. 33.

Foss. Sa. 89.

A. brachysira Bréb. — *Nav. serians* forma minor et minima
Grun. in V. H. XII f. 8, 9.

Lim. 20, 22, 25, 27, Lt. 30, 32, 34.

Foss. Sa. 88, 89.

A. Zellensis Grun. — V. H. XII, 14.

Lim. 23, 24, 26.

A. exilis Grun. — V. H. XII, 11, 12.

Lim. 23, 24, Lt. 34, Sinb. Ob. 83.

A. Follis Ehb. — Donk. B. D. VI, 15.

Foss. Sa. 88, 89.

Brébissonia Grun.

B. Boeckii (W. Sm.) — W. Sm. B. D. XXIV, 223.

Mb. Ab. 100, Sinf. Nyl. (Dannf.).

Amphipleura Kütz.

A. pellucida (Ehb.) Kütz. — V. H. XVII, 14, 15.

Kus. 72, Kon. 41, Sb. 4, Sinb. Ob. 83.

Berkeleya Grev.

B. Dillwynii (Ag.) Grun. — V. H. XVI, 15.

Sinb. Ob. 83.

B. fennica Dannf.

Sinf. Nyl. (Dannf.).

Frustulia (Ag.) Rabh.

(Vanheurekia Bréb. 1869).

F. vulgaris Thw. — V. H. XVII, 6.

Ab. 36, 49, Sb. 2, 3, 6, 7, 8, 12, 18.

F. rhomboides Bréb. — V. H. XVII, 1.

Ab. 36, Sb. 70, Lt. 30, 32, 33, 34, Lim. 20, 21, 25, 27.

Foss. Sa. 89, Tb. 90.

Var. **crassinervia** Bréb. — V. H. XVII, 4.

Ab. 36, Kus. 72, Sb. 2, 4, 17, Ltm. 20, 21, 22, 23, Lt. 29,

30, 34.

Var. **amphipleuroides** Grun. — A. D. III, 59.

Lad. 85, 86, Lim. 21.

Diploneis Ehb.1. *Didyma*.

D. didyma Ehb. — V. H. IX, 5, 6.

Foss. B. 101, 103.

D. interrupta Kütz. — V. H. IX, 7, 8.

Mb. Ab. 100, Sinb. Ob. 83.

Foss. B. 102, 103.

2. *Elliptica*.

D. Smithii Bréb. — V. H. IX, 12.

Mb. Ab. 100, Sinf. Ob. 83.

Foss. B. 101, 102, 103.

D. elliptica Kütz.

A very great confusion prevails in the *Nav. elliptica* of different authors, so that is difficult to decide what form may be regarded as the type. The fact is that several different species are thrown together under the name *Nav. elliptica*. It is therefore necessary to separate the different forms, and I have below made an attempt in this direction so far as regards the forms of Finland. As *D. elliptica* I regard the forms, which have a tolerably large, more or less quadrate central nodule and arcuate furrows, which closely follow the thickenings, which project from the central nodule and enclose the raphe. The costæ of *D. elliptica* are strong, about 10 in 0,01 m. m., and alternate with rows of generally distinct puncta, 10 to 12 in 0,01 m. m. The length of the frustule is 0,027 to 0,037 m. m., the breadth 0,015 to 0,02 m. m.

This form corresponds with the *Nav. elliptica* var. *minor* Grun. (*D. Öst. Ung.* pag. 145), with the upper fig. 10 Pl. X in Van Heurcks Synopsis and with the fig. 29, 32 in A. Schmidt Atlas. *Nav. cocconeiformis* Schum. (I pag. 188) belongs also probably to *D. elliptica*.

Diploneis elliptica has been found on the following localities in Finland: Lake Lojo (Ab. 45, 48), Suopohja (Kon. 41) and Pudasjärvi (Foss. Ob. 92).

Var. **ladogensis** Cl. — Costæ 9 in 0,01 m. m. anastomosing irregularly. Puncta indistinct, 10 in 0,01 m. m. Length 0,06 m. m. Breadth 0,025 m. m.

Pl. II, fig. 9.

This form seems to come near to *D. (Navicula) Domblittensis* Grun. (*D. Öst. Ung.* XXX, 60).

Lad. 85, 86.

D. finnica (Ehb.) Cl. — *Cocconeis Finnica* Ehb. *M. G.* XVII, II, 19.

Valve broadly elliptic, 0,05 to 0,055 m. m. in length and 0,034 to 0,036 m. m. in breadth. Central nodule small. The furrows are equally arcuate and at a considerable distance from the raphe, so that the interior space, confined by the furrows, occupies about one third of the valve. The costæ are 7 in 0,01 m. m.; the puncta 12 in 0,01 m. m., forming longitudinal lines, crossing the costæ.

Pl. II, fig. 11.

Ab. 36, Lad. 85, Sb. 4.

Foss. *Nyl.* 87, *Ta.* 94, 95, 98, *Ob.* 92.

This species is of frequent occurrence in the diatomaceous earths of Sweden, Scotland, United states and Finland, and retains every where its characteristics, so that it may be regarded as a good species.

D. Parma Cl. n. sp. — Valve broadly elliptic, 0,03 m. m. in length and 0,02 m. m. in breadth. Central nodule quadrate. Furrows arcuate, equally bent, approximate to the prolongations of the central nodule. Costæ 14 in 0,01 m. m.; puncta 20 in 0,01 m. m., forming longitudinal lines, crossing the costæ.

This species has a great resemblance to the preceding but is only half the size and has twice the number of costæ and puncta in 0,01 m. m.

Pl. II, fig. 10.

I have found this form in the lake Rosslängen (Småland, Sweden) and from the two finnish localities: Lojo Lake (Ab. 36) and Viando (Sb. 5), exactly similar in all these localities.

D. Boldtiana Cl. n. sp. — Valve oblong-elliptic, 0,03 m. m. in length and 0,012 m. m. in breadth. Costæ 14 in 0,01 m. m. Puncta fine and indistinct. Central nodule quadrate, small. Fur-

rows closely accompanying the prolongations of the central nodule, almost straight, except on the middle, where they are bent.

Pl. II, fig. 12.

This species, of which I have seen only some few specimens occurs at Viando (Sb. 4). It comes probably very near to *Cocconeis baltica* Schum. (II, I, 13) but this form differs, according to the figure, published by Schumann, in the end-nodules, which are at a considerable distance from the ends.

D. ovalis Hilse.

As *D. ovalis* I regard all the forms with large, more or less orbicular central nodule, with furrows strongly bent around the nodule, with 13 to 19 rows of puncta in 0,01 m. m. and 13 to 20 puncta on 0,01 m. m. No costæ are perceptible. The length of the valve is 0,035 to 0,043 m. m., the breadth 0,02 to 0,026 m. m. As type I consider the fig. 33 in A. S. VII. This form from Hjerken on Dovre (Norway) has 15 rows of puncta and 18 puncta in 0,01 m. m. Length 0,035 m. m. Breadth 0,02 m. m.

The specimens, which I have examined, are the following: from Kantalaks (Lim. 21) with 19 rows of puncta and 20 puncta in 0,01 m. m.

› Kittilä Lappmark (Foss. Lk. 93)	17	.....	14
› Ribatschi (Lt. 31)	13	.....	16
› Chibinä (Lim. 21)	13	.....	13
› › (Lim. 23)	13	.....	15
› Fårön, Gottland (Cl. M. D. 161)	13	.....	14

As *D. ovalis* I regard fig. 34, 35, 36 Pl. VII in A. S. Atl. Fig 30 seems also to be a form of *D. ovalis*.

Pl. II, fig. 13.

D. (ovalis var.?) oblongella Nægeli. — V. H. X, 12.

Specimens from Kuopio (Sb. 10) are 0,02 m. m. in length and 0,0065 m. m. in breadth. Rows of puncta 19 in 0,01 m. m.

Cymbella Ag.

Sectio: *Naviculaceæ*.**C. Ehrenbergii** Kütz. — V. H. II, 1.

Al. 59, Kon. 41.

Foss. Ta. 94, 95.

forma minor. Foss. Ta. 95.

C. heteropleura Ehb. — A. S. IX, 5, 6.

This species is a characteristic northern form, found in Spitsbergen and Grönland, in Dovre and in diatomaceous earth from Lule Lapmark.

Lt. 30, 32, 33, 34.

forma minor. — Cymb. Ehrenbergii Lagst. II, 17.

Lt. 34.

C. cuspidata Kütz. — V. H. II, 3. — A. S. IX, 50 to 55.

Ab. 37, 47, 48, Lad. 85, 86, Kon. 41, Sb. 4, Lt. 30.

Foss. Nyl. 87, Lad. 86, Sa. 88, Tb. 90, Ob. 91, 92, Lk. 93, 104.

C. amphicephala Nägel. — V. H. II, 6. — *C. anglica* Lagst. V. H. II, 4.

There is no difference between *C. amphicephala* and *C. anglica* except in the breadth of the area around the raphe, which is more perceptible in *C. anglica* than in the other form.

Ab. 36, 47, 48, 49, Sb. 1, 2, 5, 7, 8, 10, 12, 15, 16, Kon. 40, Lm. 39, Lt. 29.

Foss. Ob. 92.

C. abnormis Grun. — V. H. III, 8.

Ab. 48, Kon. 41.

Foss. Ob. 92, Lk. 104.

C. naviculacea Grun. — Cl. D. fr. Grönl. XVI, 11.

Lim. 20, 21, 23, 24, Lt. 32, 33, 34.

This species belongs to the northern parts of the world. It has been found in Greenland, in Dovre and in Lule Lappmark.

Var. *incerta*. — Cl. I. c. 12.

Lt. 32.

C. norvegica Grun. — A. S. X, 41.

Lim. 23, 26.

C. subæqualis Grun. — V. H., III, 2 Suppl. A. 1. — *C. obtusa* A. S. IX, 41 to 45.

Al. 59, Ab. 37, 50, Lt. 28, 31, Lim. 21, 23, 24, 26.

Foss. Ob. 92, Lk. 93.

C. æqualis W. Sm. — A. S. IX, 69; LXXI, 50. — *Navic. inæquilatera* Lagst. II, 10.

Ab. 59, Kon. 42, Lim. 23.

C. Cesati Rabh. — *Navic. Cesati* V. H. VIII, 35.

Lim. 22, 23, 26.

C. borealis Cl. n. sp. — Valve slightly asymmetric, slender, 8 to 9 times longer than broad, gradually tapering from the middle to the ends. Striæ strong, 10 in 0,01 m., on the middle of the valve, about 13 to 14 at the ends, finely transversely lineate. Area narrow. Length of valve 0,06 to 0,07 m., breadth 0,007 to 0,009 m. m.

Pl. II, fig. 19.

Lim. 25.

The lineation of the striæ is seen only with great difficulty and I am indebted to Prof. Van Heurck in helping me to resolve it. The species is evidently akin to *Naviculæ radiosæ*.

Sectio: *Cocconema*.

C. gastroides Kütz. — V. H. II, 8—9.

Al. 59, Ab. 36, 37, 46, 47, Lad. 63, 85, 86, Kon. 40, 41, Sb. 8, 10, 16, Lim. 21, 23, 24, 26, Lt. 28, 31.

Foss. Nyl. 87, Nyl. B. 102, Ta. 97, Tb. 90, Ob. 92, Lk. 93, 104.

C. lanceolata Ehb. — V. H. II, 7.

Ab. 36, 38, 44, 45, 47, 50, Lad. 85, 86, Kon. 41, 43.

Foss. Ta. 94, Ob. 92, Lk. 104.

C. Boeckii Kütz.

Sinf. Nyl. (Dannf.)

C. Cistula Hempr. — V. H. II, 12.

Ab. 38, 45, 50, Mb. Ab. 100, Sinf. Nyl. (Dannf.). Lad. 85, 86, Kon. 41, 43, Sb. 4, 18, Lim. 23.

Foss. Ta. 96, Ob. 92, Lk. 104.

Var. *maculata* Kütz. — V. H. II, 16.

Ab. 36, 44, 48, 50, Al. 57, Kon. 43, Sb. 4, 5.

Foss. Ta. 95, Ob. 92.

Var. *arctica* Lagst. — *C. variabilis* β . *arct.* Lagst. II, 21, A. S. X, 12, LXXI 23—25.

Lim. 22, 23, 24, 26.

C. helvetica Kütz. — V. H. II, 15.

Al. 59, Ab. 36, 44, 45, 46, 47, Lad. 85, Kon. 41, 42, Lt. 28, Lim. 23, 24.

Foss. Ob. 91.

C. cymbiformis Ehb. — V. H. II, 11.

Al. 59, Ab. 36, 46, 47, 48, Sinf. Nyl. (Dannf.), Kon. 41.

C. parva W. Sm. — V. H. II, 14.

Al. 59, Ab. 37, 46, Kon. 43, Lim. 24, 26, Lt. 28, 31.

C. affinis Kütz. — V. H. II, 19.

Ab. 38, Sinf. Nyl. (Dannf.).

C. salinarum. Grun.

Sinf. Nyl. (Dannf.).

C. delicatula Kütz. — V. H. III, 6.

Kon. 42, Lt. 28, Lim. 23, 24.

C. lævis Nægel. — V. H. III, 7.

Kon. 42, Lim. 24.

C. tumida Bréb. — V. H. II, 10.

Ab. 36, 44, 45, 47, Lad. 85, 86, Kon. 41, Sb. 4, 5, 18.

Foss. Ta. 94.

Encyonema Kütz.

E. prostratum Ralfs. — V. H. III, 9—11.

Ab. 45, 46, 47, 48, Lad. 63, 85, 86, Sinb. Ob. 83.

E. turgidum (Greg.) Grun. — V. H. III, 12.

Ab. 36, 50, Lad. 86, Kon. 41, 43, Lim. 23.

E. ventricosum Kütz. — V. H. III, 15—19.

Ab. 36, Nyl. 55, Lad. 63, Sb. 3, 8, 11, 13, 15, Lt. 29.

Foss. Lk. 93.

Var. *cæspitosum* Kütz. — V. H. III, 13, 14.

Al. 57, Ab. 36, 38, 44, 45, 46, 47, Kon. 41, 43, Sb. 1, 2, 3, 6, Lt. 31.

Foss. Ob. 91, Lk. 104.

E. hebridicum (Greg.) Grun. — Cl. M. D. 37.

This form seems to be comparatively constant. The valve measures in length 0,03 to 0,04 m. m. in breadth 0,007 to 0,008 m. m. The raphe is bordered by a narrow area. The striæ are indistinctly granulate and 10 in 0,01 m. m.

Lim. 21, 25, Lt. 30.

Foss. Nyl. 87, Sa. 89.

Pl. II, fig. 16, 17.

E. gracile (Ehb.) Rabh. — V. H. III, 20 to 22.

Sb. 2, 4, 6, 89, Lim. 20, 23, 25.

Foss. Nyl. 87, Sa. 88, 89, Tb. 90.

Var. *lunatum* W. Sm. — V. H. III, 23.

Ab. 35, 36, 52, Sb. 5, 10, Lim. 21, 22, Lt. 33, 35.

Gomphonema Ag.

G. geminatum Ag. — W. Sm. B. D. XXVII, 235.

Ab. 50, Lad. 66, 85, 86, Kon. 41, Sb. 5, 14.

G. constrictum Ehb. — V. H. XXIII, 5—8, including *G. capitatum*.

Ab. 36, 37, 38, 45, 46, 47, 48, 50, Al. 56, 57, 59, Kon. 40, 41, 43, Sb. 4, 5, 6, 18.

Foss. Sa. 88, Ta. 94, 95, Ob. 91 (var. *italicum*), Lk. 104.

G. Augur Ehb. — V. H. XIII, 28, 29.

Ab. 38, Kon. 40.

G. acuminatum Ehb. — V. H. XXIII, 15—18, including var. *coronatum*, *laticeps*, *trigonocephalum*.

Ab. 36, 38, 44, 45, 46, 47, 48, Lad. 86, Kon. 40, Sb. 4, 5, 11, 18,

Foss. Nyl. 87, Sa. 88, 89, Ta. 94, 96, 97, Tb. 90, Ob. 92, Lk. 93, 104.

G. elongatum W. Sm. — V. H. XIII, 22.

Ab. 36, 37, Sb. 5, 6.

Foss. Sa. 89, Lk. 93.

G. apicatum (Ehb.?) Cl. — Valve clavate, acuminate, 0,022 to 0,025 m. m. in length and 0,006 to 0,007 m. m. in breadth.

Striæ 14 in 0,01 m. m., reaching the raphe, almost parallel, near the apex slightly radiant, indistinctly punctate.

This species agrees in the outline with *G. apicatum* Ehb. M. G. IX, I, 41, but it is also very probable that Ehrenberg, as in many other cases, includes under this name some different forms, for instance of *G. acuminatum*. It seems also probable that *G. apicatum* may be the same as *G. cristatum* W. Sm. (BD. XXVIII, 239), but the figure is too small and indistinct for admitting identification. The same is also the case with the sketch published by Heiberg in *Consp. D. D. V*, 17. From *G. Augur* *G. apicatum* is distinct by its much smaller size, finer and more close striæ.

Pl. III, fig. 20, 21.

Ab. 38, 48, Kon. 40.

G. subtile Ehb. — V. H. XXIII, 13, 14.

Foss. Sa. 89.

G. sphærophorum Ehb. — V. H. XXIII, 30.

Al. 57 (rare).

G. tenellum Kütz. — V. H. XXIV, 22—25.

Ab. 50.

G. subclavatum Grun. — V. H. XXIII, 38; XXIV, 1.

Ab. 37, 49, Sb. 1, 2, 5, 7, 12 (abundant), Lt. 35.

G. montanum Schum. — V. H. XXIII, 32—37.

Låd. 86, Sb. 8 (abundant), 13, Lim. 21, 23.

Foss. Ta. 97.

G. Mustela Ehb. — V. H. XXIV, 4—6.

Ab. 36, 44, Sb. 6, 11, 19, Lim. 26, Sinb. Ob. 83.

Foss. Ta. 96.

G. Vibrio Ehb. — V. H. XXIV, 26, 27.

Ab. 36.

Foss. Nyl. 87, Ta. 97.

G. Turris Ehb. — V. H. XXIII, 31.

Foss. Sa. 89, Ta. 97.

G. intricatum Kütz. — V. H. XXIV, 28—36.

Ab. 36, 38, 45, 48, Kon. 40, Sb. 4, Lim. 23, 24, 26.

Foss. Sa. 88, Ta. 98.

G. gracile Ehb. — V. H. XXIV, 12—20,

Al. 57 (with the var. *G. auritum*), Ab. 36 (var. *auritum*), 38 (var.? *G. lanceolatum*), 44, 46, 48, 54, Kon. 40, 41 (var. *linearis*), Sb. 2, 6, 8, 9, 10, 18, Lt. 32, 33, 34, Lim. 21, 22, 25.

Foss. Sa. 89, Ob. 92, Lk. 93.

G. Sarcophagus Greg. — V. H. XXV, 2.

Ab. 36, 49, Lad. 86, Lim. 23.

G. angustatum Kütz. — V. H. XXIV, 49—55; XXV, 1; *G. micropus* (Kütz.) — V. H. XXIV, 4; XXV, 4—5.

The two forms *G. angustatum* and *G. micropus* described as different species in Van Heurcks Synopsis are so closely allied, that I find it advisable to unite them. *G. angustatum* passes also over into *G. Sarcophagus* and *G. parvulum*.

Al. 57, Ab. 36, 37, 49, 52, 55, Kon. 40, 41, Ta. 94, 95, 96, 98, Sb. 1, 2, 3, 5, 6, 7, 8, 9, 11 (abundant), 12, 13, 15, 19, Lt. 29.

G. parvulum Kütz. — V. H. XXV, 9—12.

Al. 57, Ab. 44, Kon. 40, Sb. 2, 3, 4, 6, 8.

G. ventricosum Greg. — V. H. XXV, 13.

Ab. 50, Lad. 63, 66, 85, 86, Kon. 41, Sb. 70.

G. abbreviatum Kütz. — V. H. XXV, 16.

Sinb. Ob. 83.

G. olivaceum Ehb. — V. H. XXV, 20—27.

Ab. 44, 45, 48, 50, 100, Lad. 66, Kon. 41.

Mastogloia Thwaites.

M. Smithii Thw. — V. H. IV, 13.

Mb. Ab. 51, 100, Sinb. Ob. 83.

M. Braunii Grun. — V. H. IV, 21, 22.

Mb. Ab. 51, 100.

Var. *pumila* Mb. Ab. (Dannf.).

M. elliptica (C. Ag.). — *M. Dansei* v. *elliptica* V. H. IV, 19.

Mb. Ab. 51, 100 (Dannf.).

M. exigua Lewis. — V. H. IV, 25, 26.

Mb. Ab. 100 (Dannf.).

Cocconeis (Ehb.) Grun.

C. Pediculus Ehb. — V. H. XXX, 28, 29. — *C. Placentula* var. *baltica* Dannf. I, 1.

Lad. 63, 66, 85, 86, Sinb. 83.

Foss. B. 101, 102.

C. Placentula Ehb. — V. H. XXX, 26, 27.

Ab. 47, Al. 57, Lad. 86, Sb. 9, 18, Sinb. Ob. 83.

Foss. Ob. 91.

C. scutellum Ehb. — V. H. XXIX, 1, 2.

Foss. B. 101.

Achnanthes Bory.

A. longipes C. Ag. — V. H. XXVI, 13—16.

Mb. Ab. 51, Sinf. Nyl. (Dannf.).

Foss. B. 102.

A. subsessilis Ehb. — V. H. XXVI, 21—24.

Mb. Ab. 100, Sinb. 83.

A. lanceolata (Bréb.) Grun. — V. H. XXVII, 8—11.

Sinf. (Dannf.) Ab. 48, 49, Sb., 1, 2, 7, 8, 10, 12, 18, Sinb. Ob. 83, Lt. 29, 31.

Var. *dubia* Grun. — V. H. 12, 13.

Ab. 48.

Var. *elliptica* Cl. — Upper valve elliptic, 0,012 to 0,016 m. m. in length and 0,007 to 0,009 m. m. in breadth, with 16 striæ in 0,01 m. m. The lower valve is not accurately known.

P. III, f. 10 and 11.

Ab. 48.

A. Calcar Cl. — Upper valve broadly elliptic, 0,012 m. m. in length and 0,009 m. m. in breadth, with about 24 striæ in 0,01 m. m. It carries on the one side a horseshoe-like thickening, which is prolonged on the other half of the valve into a spur-like projection. The lower valve is not known with certainty, but in the same gathering, in which this species has been found, occurs a valve of similar outline and size, the striæ of which reach the raphe and are 25 in 0,01 m. m. That valve, which has a greta

resemblance to *Diadensis lucidula* Grun. (V. H. XIV, 40) may possibly be the lower valve of *A. Calcar*.

Pl. III, fig. 8, (9?).

Ab. 45, 47.

A. Clevei Grun. var. *bottnica* Cl. — Upper valve lanceolate with coarse and coarsely punctate striæ, 11 to 12 in 0,01 m. m. (puncta 18 in 0,01 m. m.). Lower valve with a more or less broad area around the raphe. Striæ radiant, 17 in 0,01 m. m. in the middle, 25 on 0,01 m. m. at the ends, often alternately longer and shorter in the middle. Length 0,017 to 0,032 m. m. Breadth 0,005 to 0,01 m. m.

Pl. III, fig. 4, 5.

Slightly brackish water in the Bay of Bothnia near Torneå (83).

A. dispar Cl. n. sp. — Upper valve broadly lanceolate, with rostrate ends, 0,023 m. m. in length and 0,009 m. m. in breadth, covered with strong, parallel, not distinctly punctate, striæ, 19 in 0,01 m. m. Lower valve with radiant striæ, about 19 in 0,01 m. m., reaching the raphe, except in the middle, where they are shortened and alternately longer and shorter.

Pl. III, fig. 2, 3.

Slightly brackish water in the Bay of Bothnia near Torneå (83).

A. danica Flögel.

Sinf. (Dannf.).

A. linearis (W. Sm.) Grun. — V. H. XXVII, 31, 32.

Ab. 36, 46, 47, 48, Sb. 4, 6, 9, Sinb. Ob. 83, Lim. 23, 26.

A. minutissima var. *cryptocephala* Grun. — V. H. XXVII, 41—44.

Ab. 47, 49, Sb. 1, 6, 19, Lim. 22, 23.

A. marginulata Grun. — V. H. XXVII, 45, 46.

Lim. 20, 22, 23, Lt. 32, 33.

A. exigua Grun. — V. H. XXVII, 29, 30.

Ab. 44, 47, 48.

Achnanthisdium (Kütz.) Grun.

A. flexellum Bréb. — V. H. XXVI, 29, 31.

Al. 59, Kon. 42, Lt. 28, 34, Lim. 23, 24, 26.

A. minutum Cl. n. sp. — Valves elliptic with rounded ends, 0,029 m. m. in length and 0,01 m. m. in breadth. Upper valve with a linear area, dilated in the middle to a round space. Striæ almost parallel, 25 in 0,01 m. m. Lower valve with 20 striæ in 0,01 m. m. on the middle, all equal, and about 25 striæ in 0,01 m. m. at the ends.

Pl. III, fig. 6, 7.

This species, of which the lower valve has a great resemblance to *Navic. Rotæana* var. *oblongella*, occurs on the shores of the lake Lojo (Ab. 48). — I have found the same species in the lake Wenern (Christinehamn, Sweden).

Rhoicosphenia Grun.

R. curvata (Kütz.) Grun. — V. H. XXVI, 1.
Sinf. 76, Sinb. Ob. 83.

Amphora Ehb.

A. ovalis Kütz. — V. H. I, 1.

Ab. 37, 100, Lad. 85, 86, Kon. 41, 42, Sinb. Ob. 83.

Foss. Nyl. 87, Tb. 90, Ob. 91, 92.

Var. *affinis* Kütz. — V. H. I, 2.

Ab. 36, Lad. 63, Kon. 41, 42, Lt. 31, Sinb. Ob. 83.

Foss. Lk. 104.

Var. *globosa* Schum. — 1867, I, 24.

Lt. 31, Sinb. Ob. 83.

Var. *Pediculus* Kütz. — V. H. I, 4–10.

Ab. 46, 47, 48, Sinb. Ob. 83.

A. commutata Grun. — V. H. I, 14,

Mb. Ab. 100.

A. sulcata (Bréb.) Greg.

Sinf. Nyl. (Dannf.).

A. salina W. Sm. — V. H. I, 19.

Al. 58. Sinf. Nyl. (Dannf.).

Amphiprora Ehb.

- A. ornata** Bail. — V. H. XXII, bis, 5.
Kon. 81 (only one specimen).
A. paludosa W. Sm. — V. H. XXII, 10.
Sinf. Nyl. (Dannf.), Sinb. Ob. 83.
A. duplex Donk. — V. H. XXII, 15, 17.
Sinf. Nyl. (Dannf.), Sinb. Ob. 83.

Pleurosigma W. Sm.

- P. elongatum** W. Sm. — V. H. XVIII, 7.
Mb. Ab. 100, Sinf. Nyl. (Dannf.).
P. Kützingii Grun. — V. H. XXI, 14.
Ab. 47, Kon. 41, Sb. 4, 5.
P. strigilis W. Sm. — V. H. XX, 2.
Sinb. Ob. 83.
P. spenceri W. Sm. — Cl. Gr. A. D. p. 59.
Sinf. Nyl. (Dannf.), Sinb. Ob. 83.

Specimens from Torneå measure in length 0,11 m. m., in breadth 0,01 m. m. and have 22 longitudinal and 18 transverse striae in 0,01 m. m. They agree with the var. *Arnottii* Grun., which is scarcely different from the varr. *Smithii* and *borealis*.

- P. balticum** (Ehb.) W. Sm. — V. H. XX, 1.
Mb. Ab. 100.
P. attenuatum (Kütz.) W. Sm. — V. H. XXI, 11.
Sinf. Nyl. (Dannf.), Lad. 85, 86.

Pseudoraphideæ.**Epithemia Bréb.**

- E. turgida** (Ehb.) Kütz. — V. H. XXXI, 1, 2, 8.
Al. 57 (v. *granulata*) 58, Ab. 36, 37, 51, 54, Sinf. Nyl. 100
(var. *Westermanni*), Lad. 85, 86, Kon. 40.

- Foss. Ob. 92, Lk. 104, B. 101, 102, 103 (v. Westermanni).
E. Sorex Kütz. — V. H. XXXII, 7, 8.
 Al. 58, Ab. 36, 50, 51, Sinf. Nyl. 100, Lad. 86, Kon. 40, 43.
 Foss. Ob. 91, 92, Lk. 104.
E. Zebra (Ehb.) Kütz. — V. H. XXXI, 9—13.
 Al. 59, Ab. 36, 45, 46, 47, Lad. 87, Kon. 43, Lb. 4, 9, 18.
 Foss. Ob. 91, 92, 93.
E. Argus (Ehb.) Kütz. — V. H. XXXI, 14—17.
 Lim. 23, 26.
E. Musculus Kütz. — V. H. XXXII, 1, 4, 5.
 Ab. 36.
E. gibba (Ehb.) Kütz. — V. H. XXXII, 1, 2, 4, 5.
 Al. 59, Ab. 38, 45, 46, 47, 51, Lad. 85, 86, Sinf. Nyl. 100,
 Kon. 41, 43, Sb. 4, 5, 9, 70, Sinb. Ob. 83, Lim. 23, 26.
 Foss. Ob. 92, Lk. 93, 104, B. 103.

Eunotia Ehb.

E. Clevei Grun. — C. M. D. n:o. 104, 1878.

This large and distinct species has never been described, and no figure of it exists in the literature.

The valve is gently arcuate, with slightly protracted, rounded ends. It has a very distinct raphe, following at some distance the lower margin and ending in very distinct, downwards curved end-nodules. The whole valve is covered with rows of puncta, which (as is seen on the F. W.) project in short bristles. The puncta are 13 in 0,01 m. m. and the rows of puncta 13 on the middle, 15 at the ends in 0,01 m. m. — In T. W. the outline is lanceolate, with rostrate ends. Length of the valve 0,11 to 0,18 m. m., breadth of the valve 0,025 m. m.

Pl. III, fig. 13--16.

Lad. 85, 86.

Foss. Lk. 104.

This species occurs in the deposit of the lake Förrarn (Ås-nen, Sweden), in glacial clay from Hernösand, in the lake Mälaren (Sweden) and in a deposit from North Jackima (Washington territory.)

E. monodon Ehb. — V. H. XXXIII, 3, 4.

- Lim. 21, Lt. 33, 34.
E. parallela Ehb. — V. H. XXXIV, 16.
 Lim. 21, 25, Lt. 30, Kon. 42.
E. major (W. Sm.) Rabh. — V. H. XXXIV, 14.
 Ab. 36 (with the var. *bidens*), Lim. 21, 24, Lt. 30, 33, 34.
 Foss. Sa. 89 (var. *bidens*) Lk. 104.
E. Formica Ehb. — V. H. XXXIV, 1.
 Foss. Sa. 88, Ta. 95, Tb. 90.
E. prærupta Ehb. — V. H. XXXIV, 17—25.
 Ab. 54, Lim. 20, 21, 22 (var. *bidens*), 25, 27, Lt. 30, 32, 33,
 34 (var. *bidens*).
 Foss. Ta. 94 (v. *bidens*), 95 (v. *bidens*), 97, 98.
E. denticula (Bréb.) Rabh. — V. H. XXXIII, 14.
 Lim. 20, 21, 25, 27, Lt. 30, 31, 33.
E. tenella Grun. — V. H. XXXIV, 5—6.
 Sb. 15, Lim. 20.
E. Arcus Ehb. — V. H. XXXIV, 2—7.
 Sb. 2, 9, Kon. 42, Lt. 28, 29, 32, 33, 34, Lim. 21, 22, 23
 (with the var. *uncinata*), 24, 26, 27.
 Foss. Sa. 89 (var. *uncinata*), Ta. 95.
E. exigua Bréb. — V. H. XXXIV, 8, 12.
 Sb. 15 (var. *paludosa*), 17, Lim. 20 (var. *Nymmanniana*), Lt. 30
 (var. *Nymmanniana*).
E. pectinalis (Kütz.) Rabh. — V. H. XXXIII, 15—19.
 Ab. 36, Kon. 40, Sb. 4, 6, 18, Lim. 20, 21, Lt. 29.
 Foss. Nyl. 87, Sa. 88, 89, Ta. 97, Tb. 90, Ob. 92.
E. lunaris (Ehb.) Grun. — V. H. XXXV, 2—6.
 Ab. 36, Nyl. 60, 99, Sb. 1, 2, 3, 7, 8, 9, 10, 12, 17, Lt. 30,
 Lim. 21, 25.
 Foss. Ta. 98.
E. gracilis (Ehb.) Rabh. — V. H. XXXIII, 1.
 Ab. 36, 46, Sb. 4, 9, Lim. 26, Lt. 33, 34, 35.
 Foss. Sa. 88, 89.
E. Faba (Ehb.) Grun. — V. H. XXXIV, 34.
 Lim. 21.
E. incisa Greg. — V. H. XXXIV, 5; *E. Faba* Ehb.
 Ab. 36, Sb. 5, Lim. 20, 21, 22, Lt. 34.
 Foss. Nyl. 87, Sa. 88, 89, Ta. 95, 98, Tb. 90, Ob. 92.

- E. diodon** Ehb. — V. H. XXXIII, 5—7.
Ab. 36, Nyl. 99, Sb. 2, 9, 15, Lim. 22, Lt. 31 (var. *diminuta*), 34.
Foss. Nyl. 87, Sa. 88, 89, Ta. 94.
- E. bidentula** W. Sm. — V. H. XXXIV, 28.
Foss. Sa. 88, 89.
- E. Papilio** Ehb. — V. H. XXXIII, 8.
Lim. 22, 27.
- E. triodon** Ehb. — V. H. XXXIII, 9, 10.
Lim. 21, 25, Lt. 33.
- E. robusta** Ralfs. — V. H. XXXIII, 11—13.
Sb. 5, 17, Lim. 21, Lt. 33, 34.
Foss. Nyl. 87, Sa. 88, 89, Ta. 94, 95, 97, 98, Tb. 90.
- E. pentaglyphis** Grun. — V. H. XXXIV, 33.
Sb. 17.
Foss. Sa. 88, 89.
- E. tridentula** Ehb. — V. H. XXXIV, 29—31.
Ab. 39, Sb. 7, 9, Lim. 20, 22, 25, 27, Lt. 29, 35.
- E. Crista Galli** Cl. n. sp.
Valve with denticulate dorsal margin, truncate ends. Its lower margin with two slight projections. Striae 13 in 0,01 m. m. Length 0,024 m. m. Breadth 0,05 m. m.
Pl. III, fig. 12.
Lim. 20.

Surirella Turpin.

- S. striatula** Turp. — V. H. LXXII, 5.
Sinf. 100.
Foss. B. 102.
- S. robusta** Ehb. — V. H. LXXI, 1, 2.
Ab. 36, Kus. 72, Lad. 85, 86.
Foss. Nyl. 87, Sa. 88, 89, Ta. 94, Tb. 90, Sa. 88, 89, Ob. 92, Lk. 104.
- S. splendida** Ehb. forma minor. — V. H. LXXII, 4.
Ab. 36, 47, Sb. 5.
- S. turgida** W. Sm. — B. D. II, IX, 60. *S. ladogensis* Weisse f. 20.
Lad. 85, 86.

S. bifrons Kütz. — A. S. XXII, 11.

Sb. 4.

S. linearis W. Sm. — A. S. XXIII, 27—33.

Kon. 41, Lim. 20, Lt. 32.

S. ovata Kütz. — V. H. LXXIII, 5, 6, 7.

Mb. Ab. 58, Sinf. Nyl. 100.

S. angusta Kütz. — V. H. LXXIII, 13 and *S. pinnata* 12.

Ab. 49, Sinf. Nyl. (Dannf.), Sb. 1, 2, 3, 4, 7, 8, 12, 70.

Cymatopleura W. Sm.

C. Solea (Bréb.) W. Sm. — V. H. LV, 5.

Ab. 47, Lad. 63, 85, 86, Kon. 41.

Foss. Lk. 104.

C. elliptica (Bréb.) W. Sm. — V. H. LV, 1. *Surirella undata*

Weisse 19.

Lad. 85, 86, Kon. 41.

Campylodiscus Ehb.

C. hibernicus Ehb. — V. H. LXXVII, 3.

Lad. 85, 86.

C. bicostatus W. Sm. — V. H. LXXV, 2.

Sinf. Nyl. 100.

C. echineis Ehb. — V. H. LXXVI.

Sinf. Nyl. 100.

Foss. B. 102.

C. clypeus Ehb. — V. H. LXXV, 1.

Foss. B. 101, 102, 103.

Stenopterobia Bréb.

S. anceps Bréb. — *Surirella anceps* Lewis Proc. Philad. Ac.

N. S. 1864 I, 3.

Sb. 4, 8, 10, Lim. 23, 25.

Nitzschia (Hassal) Grun.Sectio: *Tryblionella*.**N. punctata** (W. Sm.) Grun. — V. H. LVII, 2.

Sinf. Nyl.

Foss. B. 102.

N. Tryblionella Hantzsch. — V. H. LVII, 9—15.Ab. 36 (v. *Victoriæ*), 48, (v. *Victoriæ*), Sinf. Nyl. 100 (with
the var. *Victoriæ*), Lad. 85.

Foss. B. 101.

Var. *ambigua*

Sinf. Nyl. (Dannf.)

Var. *levidensis* Sinf. (Dannf.).**N. angustata** (W. Sm.) Grun. — V. H. LVII, 24.

Al. 59, Ab. 36, Lad. 85, Kon. 41, Sb. 4, Lim. 23.

Foss. Sa. 89, Ob. 92, Lk. 93.

Sectio: *Apiculata*.**N. hungarica** Grun.

Sinf. Nyl. (Dannf.)

N. apiculata (Greg.) Grun.

Sinf. Nyl. (Dannf.).

Sectio: *Circumsuta*.**N. circumsuta** (Bail.) Grun. — V. H. LIX, 8.

Foss. B. 102.

Sectio: *Dubia*.**N. dubia** W. Sm. — V. H. LIX, 9—12.

Lt. 32.

N. thermalis var. *minor*.

Sinf. Nyl. (Dannf.).

Sectio: *Grunowia*.**N. Denticula** Grun. — V. H. LX, 10.

Al. 59, Kon. 42, Lim. 23.

N. Sinuata (W. Sm.) Grun. — V. H. LX, 11.
Kon. 42, Lim. 23.

Sectio: *Scalares*.

N. scalaris (Ehb.) W. Sm. — V. H. LX, 14—15.
Foss. Ta. 94, 95, 98.

Sectio: *Bacillaria*.

N. paradoxa (Gmel.) Grun. — V. H. LXI, 6.
Sinf. Nyl. (Dannf.), Sinb. Ob. 83.

Sectio: *Dissipatae*.

N. dissipata Grun. — V. H. LXIII, 1—3.
Sb. 11, 12.

Sectio: *Sigmoidea*.

N. sigmoidea (Ehb.) W. Sm. — V. H. LXIII, 5—7.
Ab. 36, Sinb. Ob. 83.

Sectio: *Sigmata*.

N. sigma W. Sm. — V. H. LXVI, 23.
Mb. Ab. (Dannf.), Sinf. Nyl. 100 (Dannf.).

Sectio: *Obtusa*.

N. obtusa W. Sm. — V. H. XVIII, 1, 2.
Sinf. Nyl. 100 (Dannf.).

Sectio: *Spectabiles*.

N. spectabilis (Ehb.) Ralfs var. *Americana* Grun. — Cl. Gr.
A. D. p. 92.
Foss. Sa. 89, (Str. 16, Punct. 5), Ta. 97, (Str. 14, p. 7 in
0,01 m. m.).

Sectio: *Lanceolatae*.

N. subtilis Grun. — V. H. LXVIII, 7—8.
Sb. 4.

- N. intermedia** Hantzsch: — V. H. LXIX, 10.
Lim. 23.
- N. palea** (Kütz.) W. Sm. — V. H. LXIX, 226.
Al. 59, Ab. 37, 49, Kon. 41, 43, Sb. 11, 13, 19 (var. *tenuirostris*).
- N. Kützingiana** Hilse.
Sinf. Nyl. (Dannf.).
Var. *exilis*. Sinf. Nyl. (Dannf.).
- N. fonticola** Grun. — V. H. LXIX, 15—19.
Sb. 11.
- N. communis** Rabh. — V. H. XXI, 32—35.
Sb. 6.
- N. amphibia** Grun. — V. H. LXVIII, 15—20.
Kon. 41, Sinb. Ob. 83.
Foss. Ob. 91.
- N. Frustulum** (Kütz.) Grun. — V. H. LXVIII, 27—31.
Kon. 41, Lim. 21.
- N. Hantzschiana** Rabh. — V. H. LXIX, 1, 2.
Sb. 13.

Sectio: *Nitzschiella*.

- N. acicularis** var. *closteroides* Grun.
Sinf. Nyl. (Dannf.).

Hantzschia Grun.

- H. virgata** (Roper) Grun. — V. H. LVI, 12—13.
Sinf. Nyl. 100.
- H. elongata** (Hantzsch) Grun. — V. H. LVI, 7—8.
Ab. 36, Sb. 2, 10, 16.
Foss. Nyl. 87; Sa. 88, 89; Ta. 97; Tb. 90; Ob. 92, Lk. 93, 104.
- H. amphioxys** Grun. — V. H. LVI, 1—4.
Al. 59, Sb. 7, 12, 13, 18, Lt. 29.
Foss. Ta. 94, 95, 98.

Denticula Kütz.

- D. tenuis** Kütz. — V. H. XLIX, 31—32, 35—37.
Sinb. Ob. 83, Lt. 28, Lim. 23, 24.

Diatoma De Cand.

- D. hiemale** var. **mesodon** Kütz. — V. H. LI, 3—4.
 Ab. 39, Lim. 23, Lt. 28, 29, 35.
D. anceps (Ehb.) Grun. — V. H. LI, 6—8.
 Sb. 8, 9, 10.
D. tenue Kütz. — V. H. L, 11, 14, 18, 19.
 Al. 56, 57, Sinf. Nyl. 77 (var. *normalis* and var. *elongata*
 Dannf.), Lad. 63, 65, Sb. 6.
D. vulgare Bory. — V. H. L, 1—9.
 Sinb. Ob. 83 (with var. *constricta*).

Meridion Ag.

- M. circulare** C. Ag. — V. H. LI, 10—12.
 Ab. 39, Nyl. 55, Sb. 10, Lt. 29, 30.
M. constrictum Ralfs. — V. H. LI, 14—15.
 Ab. 39, 49, Sb. 6, 10, 12, Lt. 35.
 Foss. Ta. 96.

Ceratoneis Ehb.

- C. Arcus** (Ehb.) Kütz. — V. H. XXXVII, 7.
 Sb. 5, 6, Lad. 66, Sinb. Ob. 83, Lim. 22.

Synedra Ehb.

- S. pulchella** Kütz. — V. H. XL, 27.
 Sinf. Nyl. 100 (Dannf.), Sinb. Ob. 83.
S. Vaucheriae Kütz. — V. H. XL, 19. *Fragilaria intermedia*
 Grun. — V. H. XLV, 9—11.
 Ab. 37, 38, 45, 46, 47, 48, 49, Sb. 18, Sinb. Ob. 83.
S. Ulna Ehb. — V. H. XXXVIII, 1—14.
 Al. 56 (v. *longissima*), 57, Ab. 45, 46, 47 (with var. *longissima*),
 48 (v. *capitata*), Lad. 85, Kon. 40, 41 (with the var. *capitata*), 43,
 Sb. 2, 4 (var. *longissima*), 5, 6, 8, 11, 13, 18, Sinb. Ob. 83, Lt.
 28, Lim. 21, 23 (var. *vitrea*), 24 (var. *vitrea*), 26.
 Foss. Ob. 91, Lk. 104.
S. Acus Kütz. — V. H. XXXIX, 4, 5.

Al. 56, Ab. 50, Kon. 43, Sb. 5, 11, 18, 19, Lt. 28.

S. delicatissima W. Sm. — V. H. XXXIX, 6—10.

Sb. 7.

S. amphicephala Kütz. — V. H. XXXIX, 14, 15.

Sb. 7.

S. familiaris Kütz. — V. H. XL, 15.

Sb. 13.

S. crotonensis Edw. — C. M. D. n:o 128.

Ab. 74, Sb. 71.

S. affinis Kütz. — V. H. XLI, 9, 15—19.

Sinf. Nyl. 100, Sinb. Ob. 83 (striae 16 in 0,01 m. m.).

Var. *tabulata* Sinf. Nyl. (Dannf.).

Var. *parva* Sinf. Nyl. (Dannf.).

Asterionella Hassal.

A. formosa Hassal. — V. H. LI, 19—21.

Ab. 74, Sat. 75, Lad. 62, 63, 64, 65, 66, 67, 68, Sb. 69, 70, 71.

Fragilaria Lyngb.

F. virescens Ralfs. — V. H. XIV, 1—3.

Al. 58 (var. *exigua*), Ab. 39, Sb. 2, 8, 9, Lt. 29, 33, 35.

Foss. Tb. 90, Lk. 104.

F. undata W. Sm. — V. H. XLIV, 9.

Ab. 36, 46, Lim. 25, Lt. 30.

Foss. Sa. 88, Ta. 97, Tb. 90.

F. capucina Desm. — V. H. XLV, 2.

Ab. 44, 74(?), Lad. 62(?), 64(?), 65(?), Kon. 40, Sb. 70.

The ? signifies that I have not seen the valvular face of the frustule, for which reason these forms may possibly be the following variety.

Var. *mesolepta* Rabh. — V. H. XLV, 3.

Al. 57, Ab. 47, Kon. 40, 41, 43, Sb. 5, 11, 18.

F. construens Ehb. — V. H. XLV, 26.

Al. 57, Ab. 46, 47, Kon. 40, Sb. 6.

Foss. Lk. 104.

F. Harrisonii (W. Sm.) Grun. — V. H. XLV, 28.

Sinb. Ob. 83.

Foss. Ob. 91.

F. mutabilis (W. Sm.) Grun. — V. H. XLV, 12.

Al. 59, Ab. 45, 46, Sb. 4.

Foss. Ob. 92, Lk. 104.

Licmophora Ag.

L. paradoxa C. Ag.

Sinf. Nyl. (Dannf.).

Rhabdonema Kütz.

R. minutum Kütz. — V. H. LIV, 17—21.

Foss. B. 102.

R. arcuatum (Ag.) Kütz. — V. H. LIV, 14—16.

Foss. B. 101, 102.

Tetracyclus (Ralfs.) Grun.

T. lacustris Ralfs. — W. Sm. B. D. II, XXXIX, 308.

Ab. 36, 37, Kon. 40, Sb. 4, 5, 8, 10, 18, 70.

Foss. Nyl. 87, Sa. 88, 89, Ta. 96, 97, Tb. 90, Ob. 92, Lk. 104.

Var. *emarginatus*.

Ab. 36, 38, 46, 48, Sb. 4.

Diatomella Grev.

D. Balfouriana Grev. — W. Sm. B. D. II, LXI, 383.

Lim. 23, 26.

This species is a most characteristic alpine and arctic form.

Tabellaria Ehb.

T. flocculosa Rabh. Kütz. — V. H., LII, 10—12.

Al. 57, Ab. 36, 38, 44, 45, 46, 47, 48, 49, Sa. 75, Kus. 72,
Lad. 63, 64, 65, 66, 67, Kon. 40, 41, 43, Sb. 2, 4, 5, 6, 8, 9, 10,
13, 16, 17, 70, Sinb. Ob. 83, Lim. 22, 23, 24, 26, 27, Lt. 28, 32, 33.

T. fenestrata Kütz. — W. Sm. B. D. XLIII, 317.

Ab. 36, 44, 45, 46, 47, 48, Sa. 75, Kus. 72, 73, Nyl. 55, Lad. 61, 62, 63, 65, 67, 68, 85, Kon. 40, 43, Sb. 4, 6, 8, 9, 18, 69 (var. *asterionelloides*), 70, 71, Lt. 33.

Foss. Sa. 88, 89, Ta. 96, Tb. 90, Lk. 104.

Grammatophora Ehb.

G. oceanica Ehb.

Mb. Al. 56, 58, Sinf. (Dannf.).

Foss. B. 101, 102, 103.

The form that occurs in 103 has 29 striæ in 0,01 m. m., its valve is 0,04 m. m. in length and 0,006 m. m. in breadth. It comes consequently near to the var. *intermedia* (Grun. V. H. LIII, 15).

Cryptoraphideæ.

Chaetoceras Ehb.

Ch. danicum Cl. — Det videnskablige Utbytte av Kanonbaaden Hauch's Togter i de danske Have 1889.

Sinf. Nyl. 76.

Pl. III, fig. 18, 19.

Ch. Wighamii Btw. — M. J. IV, 108; VII, 33.

Mb. 78, Sinf. 76, Sinb. 80, 81, 82, 84, Ob. 83.

Pl. III, fig. 17.

I have seen only sterile specimens of this species, which occurs in the Baltic from Helsingfors to Torneå.

Ch. Wighamii in V. H. LXXXII, 1 seems to be the foregoing species, which is quite different. *Ch. Wighamii* is less siliceous than *Ch. danicum* and has not such strong awns, which on *Ch. danicum* are armed with small, spirally arranged spines. The outline of the cells in *Ch. Wighamii* is in the S. W. lanceolate, but almost orbicular in *Ch. danicum*. *Ch. Wighamii* forms long chains, and *Ch. danicum* occurs in isolated cells or short chains of 2, rarely 3, cells.

Melosira Ag.

- M. nummuloides** Dillw.
Mb. Ab. (Dannf.), Sinf. Nyl. (Dannf.).
- M. Borreri** Grev. — V. H. LXXXV, 5—7.
Sinf. Nyl. 77 (Dannf.), Sinb. Ob. 83.
Foss. B. 101, 102, 103.
var. **bottnica** Sinf. Nyl. (Dannf.).
var. **octogona** Grun. — Casp. S. Alg. IV, 12. Sinb. Ob, 83.
- M. varians** C. Ag. — V. H. LXXXV, 11—18.
Nyl. 55, Sinf. Nyl. (Dannf.), Sb. 5.
- M. Jürgensii** C. Ag. — V. H. LXXXVI, 1—2.
Mb. 78, Sinf. Nyl. 77, 100, Sinb. 82, Sinb. Ob. 83.
- M. Roseana** Rabh. — V. H. LXXXIX, 1—3,
Sb. 5, Lim. 22.
- M. distans** Kütz. — V. H. LXXXVI, 21—27.
Sinb. Ob. 83, Lim. 21, Lt. 30.
- M. crenulata** Kütz. — V. H. LXXXVIII, 3, 4.
Ab. 36, 47, 74 (with the var. *tenuis*), Sat. 75 (with the var. *ambigua*), Lad. 62 (var. *tenuis*), Kon. 40, Sb. 5 (var. *ambigua*), 6 (var. *lineolata*).
Foss. Sa. 88, Ta. 94, 95, 97, 98, Tb. 90 (var. *ambigua*), Ob. 92, Lk. 104.
- M. granulata** Ralfs. — V. H. LXXXVII, 7—12.
Ab. 36, 47, Kus. 73, Lad. 61, 62, 63, 64, 65, 66, 67, 68, 85, 86, Kon. 41, Sb. 2, 18, 70.
Foss. Ta. 95, 96.
- M. lyrata** Ehb. — V. H. LXXXVII, 1—6.
Ab. 36.
Foss. Nyl. 87, Sa. 88 (var. *lacustris*), Tb. 90 (var. *lacustris*), Lk. 93.
- M. undulata** Kütz. — V. H. XC, 8—9.
Lad. 85 (rare).
- M. arenaria** Moore. — V. H. XC, 1—2.
Lad. 85.
Foss. Ob. 91, 92, Lk. 104.

Hyalodiscus Ehb.

H. scoticus (Kütz.) Grun. — V. H. LXXXIV, 15—17.
Foss. B. 101, 102.

Cyclotella Kütz.

- C. Kützingiana** Chauvin. — V. H. XCIV, 1—10.
Ab. 36, Kon. 41,
Foss. Sa. 89.
var. **Schumannii**.
Lad. 66, 85, 86.
C. Meneghiniana Kütz. — V. H. XCIV, 17—19.
Ab. 37, 43.
Foss. Ta. 95, 96.
C. comta Ehb. var. **radiosa** Grun. — V. H. XCIII, 1—9.
Al. 57, Ab. 36, 38, 45, 46, 48, Kus. 72, Lad. 61, 68, 85
Kon. 41, 42, Sb. 4, 5, Lim. 23.
C. stelligera Cl. a. Grun. — V. H. XCIV, 22—26.
Foss. Ta. 95, 98.

Actinocyclus Ehb.

- A. crassus** (W. Sm.) Ralfs. — V. H. CXXIV 6, 8.
Mb. Al. 58.
Foss. B. 101, 102.
var. **moniliformis** Ralfs. — V. H. CXXV, 9.
Foss. B. 102.

Stephanodiscus (Ehb.) Grun.

- S. astræa** (Ehb.) Grun. — V. H. XCV, 5.
Ab. 47, Lad. 63, 68, 85, 86, Kon. 41.
var. **minutulus** Grun. — V. H. 7—8.
Al. 57, Ab. 48, Lad. 61, 65, 66, Sb. 5, 6.
Foss. Ta. 96.

Coscinodiscus Ehb.

C. asteromphalus (Ehb.) Grun.

Foss. B. 102.

C. lacustris Grun. — F. Jos. Land. IV, 25, 28.

Lad. 86.

Foss. B. 103.

C. balticus Grun. — Gr. Cl., A. D. pag 112.

Mb. 78, 79, Sinb. 80, 81, 82.

Foss. B. 103.



Plate I.

Fig.

1. *Pinnularia viridis* var. *distinguenda* Cl. 500/1 p. 22.
2. *Pinnularia viridis* var. *minor* Cl. 500/1 p. 22.
3. *Pinnularia Esox* Ehb. 500/1 p. 24.
4. *Pinnularia episcopalis* Cl. 500/1 p. 27.
5. *Pinnularia brevicostata* Cl. 500/1 p. 25.
6. *Pinnularia karelica* Cl. 1000/1 p. 28.
7. *Pinnularia macilenta* Ehb. 500/1 p. 24.
8. *Pinnularia Brandelii* Cl. var. 500/1 p. 26.
9. *Pinnularia Brandelii* Cl. 1000/1 p. 26.
10. *Pinnularia mesogongyla* Ehb. v. *interrupta* Cl. 1000/1 p. 26.
11. *Pinnularia mesogongyla* (Ehb.?) Cl. 1000/1 p. 25.

Del. P. T. Cleve.

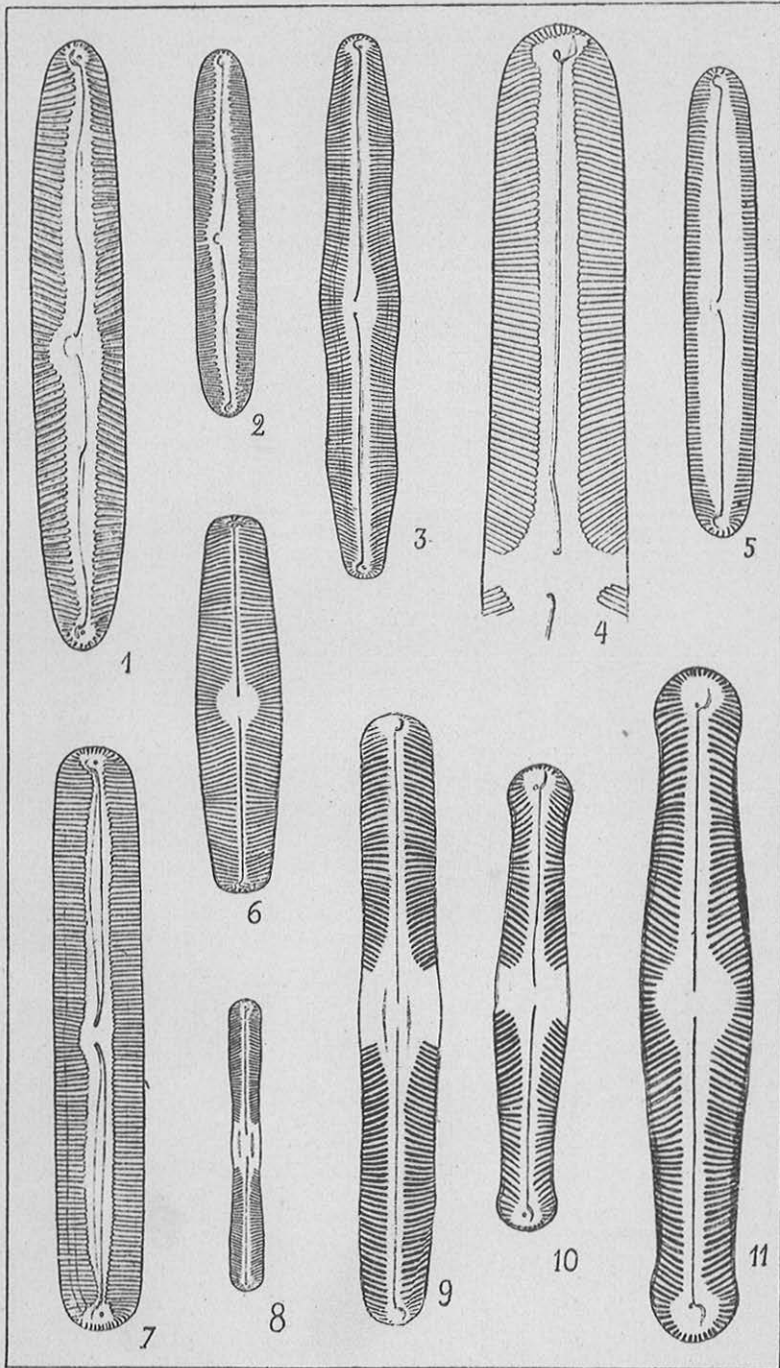


Plate II.

Fig.

1. *Pinnularia platycephala* Ehb. ⁵⁰⁰/₁ p. 20.
2. *Navicula inflata* (Donk.?) Cl. ¹⁰⁰⁰/₁ p. 37.
3. *Navicula ladogensis* Cl. ¹⁰⁰⁰/₁ p. 35.
4. *Navicula depressa* Cl. ¹⁰⁰⁰/₁ p. 35.
5. *Navicula quinquenodis* Grun. ¹⁰⁰⁰/₁ p. 33.
6. *Navicula torneensis* Cl. ¹⁰⁰⁰/₁ p. 33.
7. *Navicula torneensis* v. *aboënsis* Cl. ¹⁰⁰⁰/₁ p. 33.
8. *Pinnularia undulata* Greg. ¹⁰⁰⁰/₁ p. 30.
9. *Diploneis elliptica* var. *ladogensis* Cl. ¹⁰⁰⁰/₁ p. 43.
10. *Diploneis Parma* Cl. ¹⁰⁰⁰/₁ p. 43.
11. *Diploneis finnica* (Ehb.) Cl. ¹⁰⁰⁰/₁ p. 43.
12. *Diploneis Boldtiana* Cl. ¹⁰⁰⁰/₁ p. 43.
13. *Diploneis ovalis* (Hilse) ¹⁰⁰⁰/₁ p. 44.
14. *Navicula lacustris* Grun. ¹⁰⁰⁰/₁ p. 34.
15. *Navicula subtilissima* Cl. ¹⁰⁰⁰/₁ p. 37.
- 16—17. *Encyonema hebridicum* Greg. ¹⁰⁰⁰/₁ p. 48.
18. *Stauroneis anceps* var. *fossilis* Cl. ⁵⁰⁰/₁ p. 40.
19. *Cymbella borealis* Cl. ¹⁰⁰⁰/₁ p. 46.

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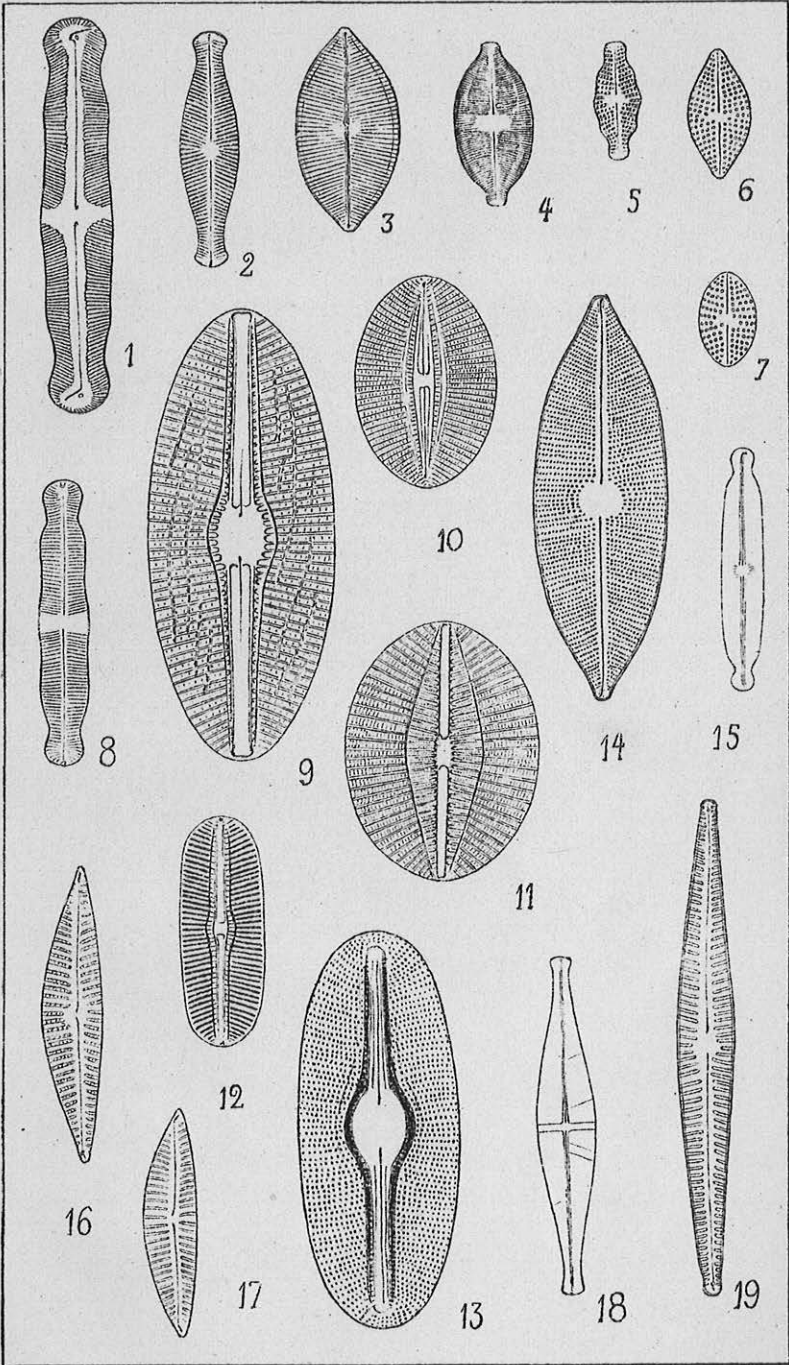


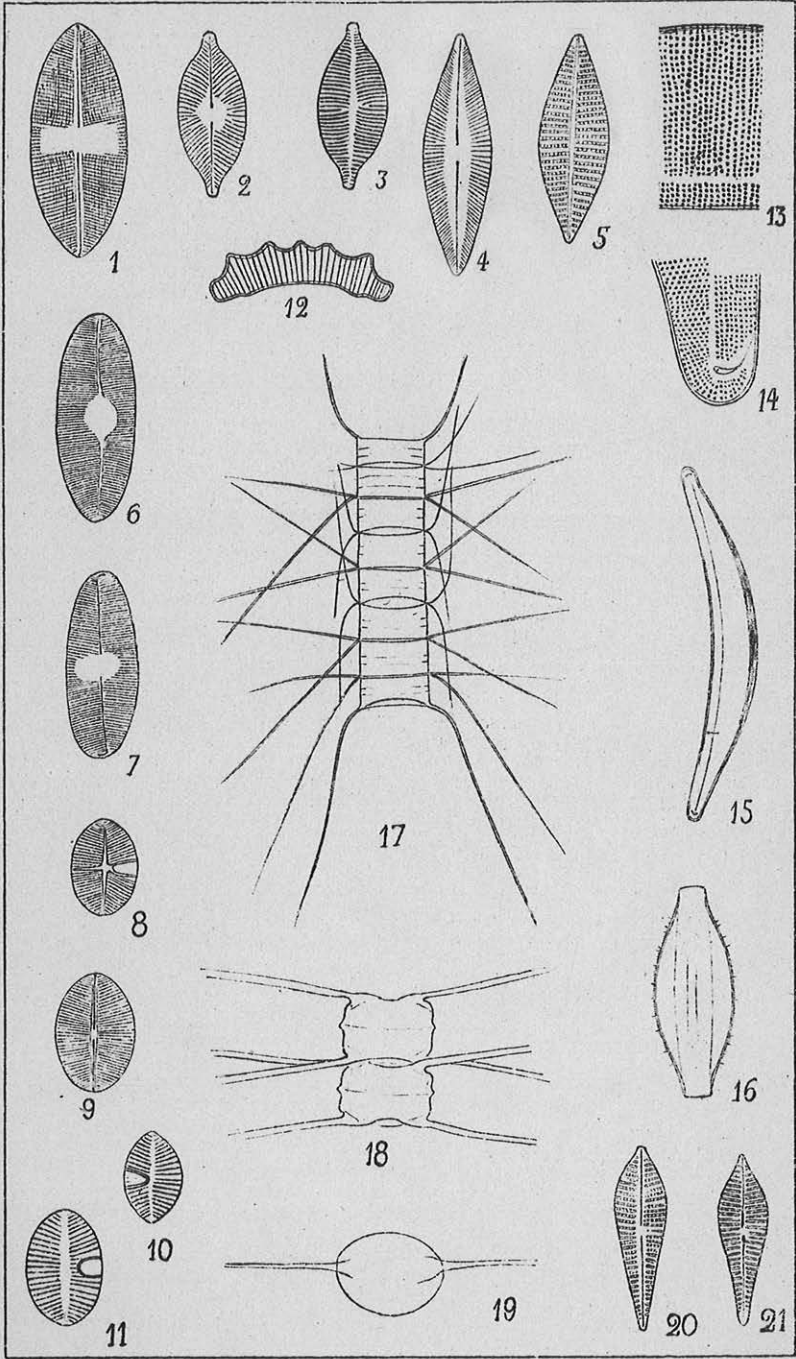
Plate III.

Fig.

1. *Navicula obliqua* (Greg.) ¹⁰⁰⁰/₁ p. 34.
- 2—3. *Achnanthes dispar* Cl. ¹⁰⁰⁰/₁ p. 52.
- 4—5. *Achnanthes Clevei* var. *bottnica* Cl. ¹⁰⁰⁰/₁ p. 52.
- 6—7. *Achnanthidium minutum* Cl. ¹⁰⁰⁰/₁ p. 53.
8. *Achnanthes Calcar* Cl. ¹⁰⁰⁰/₁ p. 51.
9. *Achnanthes Calcar* Cl. lower valve? ¹⁰⁰⁰/₁ p. 51.
- 10—11. *Achnanthes lanceolata* var. *elliptica* Cl. ¹⁰⁰⁰/₁ p. 51.
12. *Eunotia Crista Galli* Cl. ¹⁰⁰⁰/₁ p. 57.
- 13—16. *Eunotia Clevei* Grun. 13. Part of the valve ¹⁰⁰⁰/₁ p. 55.
14. End of the valve ¹⁰⁰⁰/₁. 15. Valve in valvar view
²⁴⁰/₁. 16. Frustule in zone-view ²⁴⁰/₁ p. 55.
17. *Chaetoceras Wighamii* Btw. ⁵⁰⁰/₁ p. 65.
- 18—19. *Chaetoceras Danicum* Cl. ⁵⁰⁰/₁ p. 65.
- 20—21. *Gomphonema apicatum* (Ehb.?) Cl. ¹⁰⁰⁰/₁ p. 48.

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Ab. = Regio aboënsis
Al. = Alandia
Ik. = Isthmus kareliens
Ka. = Karelia australis
Kb. = Karelia borealis
Kk. = Karelia keretina
Kol. = Karelia olonetsensis
Kon. = Karelia onegonsis
Kp. = Karelia pomorica
Kus. = Kuusamo

Lad. = Karelia ladogensis
Le. = Lapponia enontekiensis
Li. = Lapponia inarensis
Lim. = Lapponia Imandrae
Lkem. = Lapponia kemensis
Lm. = Lapponia murmanica
Lp. = Lapponia ponjensis
Lt. = Lapponia tulomensis
Lv. = Lapponia Varsugao
Nyl. = Nylandia

Oa. = Ostrobottnia australis
Ob. = Ostrobottnia borealis
Ok. = Ostrobottnia kajanensis
Om. = Ostrobottnia media
Sa. = Savonia australis
Sat. = Satakunta
Sb. = Savonia borealis
Ta. = Tavastia australis
Tb. = Tavastia borealis.