AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

EDITED BY PROFESSOR T. HARVEY JOHNSTON,
UNIVERSITY OF ADELAIDE.

VOL. I. PART 1.

DIATOMS

BY
ALBERT MANN, PH.D.,
UNITED STATES NATIONAL MUSEUM, WASHINGTON, D.C.

WITH SIX PLATES.

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REPORT ON THE DIATOMS COLLECTED BY THE AUSTRALASIAN ANTARCTIC EXPEDITION*.

By Albert Mann, Ph.D., National Museum, Washington, U.S.A.

With Six Plates (I–VI).

The Antarctic and the Arctic Diatoms.

The similarities and dissimilarities of the two polar diatom floras are very instructive. Both areas produce an enormous wealth of diatom life, so far as quantity is concerned. Contrary to what one might expect, the mass of living diatoms inhabiting these two inhospitable seas is far greater than that which we find, as a rule, in the Tropics. All the expeditions to these remote regions confirm this fact, and various explanations have been advanced to explain the seeming anomaly. Although we know at present too little to analyse fully and satisfactorily the phenomena, it seems probable that at least two factors must play a conspicuous role in such enormous diatom growths in the polar regions. One is the high percentage of carbonic acid held in solution in these regions because of their low temperature. The abundance of this valuable food-supply must have a powerful effect upon the growth of such green chlorophyll-bearing plants as the diatoms. A second and perhaps more potent factor is the abundance of continuous light during a large period of the year, when the sun does not set in those regions. It is true that this is counterpoised by an equal number of days of darkness during the year; but inasmuch as all plants require a period of rest, this does not operate as disadvantageously as the benefits secured by an abundance of food material and an abundance of continued light energy. However other factors may increase or diminish these two, they go far toward explaining the richness of the diatom floras of both polar regions.

But when one compares the two as to the kinds of diatoms characteristic of these areas we come upon a contrast of startling difference. The diatoms of the north polar region are mostly small and simple in construction, both as to their shapes and the elaborateness of their ornamentation. Those in the Antarctic are so remarkably rich in large and elegant forms that they contrast well in these respects with even such exceptionally ornate diatom floras as those of the Philippine Islands and the East Indies. In fact, as will be here brought out, no small proportion of these elegant Antarctic diatoms appears to be subtropical rather than temperate or frigid. If we turn to maps of Oceanography showing the great ocean currents we discover a significant fact that goes

* Received for publication July, 1929. (Author since deceased).

far to explain the foregoing. We see that the great continental masses of the world broaden out and almost touch each other at the north, but at the south they taper down into narrow wedge-shaped masses and leave open seas between them and the Antarctic region. The Arctic, on the contrary, is more or less bottled in, and practically only a single narrow entrance remains for carrying marine life from the warmer regions lying southward into that area. This is the opening of Bering Strait, between the western end of North America and the eastern end of Siberia. A second opening or group of openings from the Arctic occurs between the western masses of Europe and the broad expanse of North America including Greenland. Here the communicating waters move almost uniformly southward following along the eastern shores of Greenland, around Iceland and southward by Labrador and the United States; and the only northward approach is that which skirts the western shores of Europe along England and Scandinavia, where the residue of the great Gulf Stream breaks up and blends with the Arctic waters about Spitzbergen, Franz Josef Land, etc. But if we turn from this to the south polar continent, we find a remarkable difference. All north of it is open water. The great equatorial currents of the world, moving more or less westward, are split by the continental masses and diverted north-westward or south-westward. Thus between North and South America on the east and the continental masses of Asia, East Indies, and Australia on the west lies the Pacific Ocean, and the equatorial currents flowing westward across it and coming in contact with these latter barriers move northward into the complex of islands of Japan, Philippines, etc., and also southward around New Zealand and along the eastern border of Australia toward the south polar regions. The same is true of the South Atlantic Ocean between the west coast of Africa and the east coast of South America. Here the South Equatorial Current forks at the apex of Brazil, part of it moving north-westward among the West Indies and into the Gulf of Mexico, and part of it south-westward along the coasts of Argentine and Patagonia, whence it moves on toward the south polar regions. The remaining vast ocean area namely that lying south of the Indian Ocean, shows the same diversion. The equatorial current impinges upon the coast of Madagascar and the eastern shores of Africa, part of it turning northward, and part of it diverted south-westward toward the polar regions. This mass of moving water includes the strong Mozambique Current.

It is impossible to study this great contrast between the north and south polar areas without seeing how open to the approach of all forms of marine life travelling with these currents the south polar areas are, and how beset by barriers that hold back the warmer sea life to the south the Arctic regions are.

Some day our knowledge of animal and plant life in these two areas may enable us to speculate with some chance of success and how, and specially where, the forms of diatoms and other life in these two polar areas originated. It would be idle to attempt this at the present time. Whether all of them originated elsewhere, so far as their ancestry is concerned, and have persisted in their primitive form in some cases or have been modified by a new environment in other cases; or whether, on the other hand, we are

dealing with the ancestral birthplace of many of them, and which, having originated in these prolific regions, have subsequently moved out over the rest of the world,—such suppositions constitute merely alluring puzzles that it would be idle to attempt to solve at the present time.

A list of seemingly subtropical diatoms is given in this report, and their large number constitutes a startling fact in the distribution of life upon the earth. Many species in the list have never been discovered except in tropical or subtropical waters, and many more suggest subtropical life conditions by reason of their size and elaborate ornamentation.

On the Preparation of this Report.

The diatoms enumerated in the list of genera and species are those actually found in the researches of which this paper is a report. In nearly every instance each species named is mounted separately, sometimes with duplicates, and a representative set is deposited in the diatom collection of the United States National Museum at Washington, D.C., which collection is available to all persons interested in this branch of science. No diatom is herein recorded as occurring in the Antarctic on the authority of any other investigator; nor is there any reference to a species in the Antarctic flora, unless the specimen or specimens found unmistakably represent the species named. Doubtful specimens are sometimes mentioned as such, with a suggestion of the possibility of their being widely diverse varieties peculiar to the Antarctic region. But so far as the actual list of recorded species is concerned, it is considered to be perfectly authentic by the writer, and only so after an extensive examination of all literature bearing on this subject.

By far the larger portion of material is that collected by the Australasian Antarctic Expedition under Sir Douglas Mawson during the years 1911–1914. The report of the location and the character of the samples examined for this paper is given in a separate publication, known as Series A, Vol. II, Oceanography, Part 1, with the title "Sea-Floor Deposits from Soundings," and compiled by Frederick Chapman, issued in December, 1922. The numbering of the Australasian Antarctic Expedition gatherings as mentioned in the present report, corresponds with that indicated in Roman numerals in Chapman's report, pages 3–5.

A much smaller set of gatherings was some years ago brought to me for study by a member of the Expedition to the South Pole under the leadership of Sir Ernest Shackleton. As the purpose of this Expedition was one of exploring the area of the extreme South and, if possible, the discovery of the South Pole, the gathering of extensive scientific material was impossible and only such samples were secured as was possible during the winter spent in McMurdo Bay and at Cape Royds, together with a few scattering additions. The diatoms resulting from these meagre collections did not prove to be sufficiently numerous or unusual to demand the preparation of a separate

paper. I have, therefore, taken advantage of my study of the much larger collections secured by the Australasian Expedition to combine with these the material sent to me from the Shackleton Expedition. As would be expected, a very large proportion of the diatoms found in the Shackleton material occurs also in the Australasian material, and the very few forms of those not duplicated (certainly not over six or eight) would make the separation of these two superfluous. However, I have in every instance recorded the presence of the diatoms discovered in the Shackleton material as being found by that Expedition as well as by the Australasian Expedition.

Some of the names in the list of species are used as a matter of convenience, although the author is convinced that they have no actual separate status in diatom taxonomy. Most authors are pursuing this plan; for in the present stage of this science the supreme value of taxonomy is merely as a guide to the names and locations of the species and genera mentioned. The matter of relationship and any valid distinction as between genera or between species is at present in too misty a condition to warrant extensive changes in the established names, unless the author is convinced that those names are not helpful but misleading. Thus, for example, it is evident that the genus *Trinacria* is merely a triangular phase of the genus *Hemiaulus*, but both *Trinacria* and *Hemiaulus* are so widely used in diatom literature that a dropping of the former would be confusing rather than helpful to future students of the diatoms. In other words, changes are made in the established nomenclature only where such changes evidently are an aid to identification.

For the foregoing reasons, the classification of the genera and species in higher groups is here omitted and, irrespective of any possible relationship, the genera are alphabetically arranged and the species alphabetically arranged under each genus. This facilitates finding such genera and species as are included and makes unnecessary a separate alphabetical index.

Other Reports on Antarctic Diatoms.

Two very valuable reports on Antarctic diatoms, that of Karsten in his Valdivia Report, 1907, and that of Van Heurck, 1909, have thrown much light on this subject and have been much consulted in the preparation of this report. The number of species recorded in each is unusually large and the identifications show the care and exactness characteristic of their authors. Karsten's report, however, deals almost entirely with plankton diatoms while those in this report are mainly bottom-living species; so that the diatoms considered in the two reports have few correspondences. Nor can the chiefly plankton flora of the Valdivia report be used in this paper on problems dealing with the native diatom life of the Antarctic, because in the opinion of the writer they are of much less significance than the bottom diatoms in that respect. Plankton diatoms are pre-eminently travellers, voyaging long distances by the aid of ocean currents or swept onward to new lands by the surface drift of the winds. As a result of this, they

are as a group the most cosmopolitan of all the diatoms. Contrasted with them, the bottom diatom flora rarely fails to show an especially local significance, at least by some of its members. For example, if one finds a species of *Auliscus*, *Stictodiscus*, *Navicula*, *Gomphonema*, or other bottom form in the polar area and which is also recorded at San Diego Bay, California, it is a matter of surprise and demands explanation. But if he finds a *Chaetoceros diadema* or *Rhizosolenia hebetata* or *Thalassiothrix longissima* in the Antarctic, it is not at all to be wondered at, although these same species are known to be abundant in Northern Europe and along the Atlantic seaboard of the United States. For a plankton diatom in any locality is a subject for speculation chiefly as to whether it came in recently or is a descendant from aboriginal ancestors which lived in that locality in the remote past. And it is this distinction between plankton and bottom diatoms which gives significance to the large number of bottom species recorded here which are known to be either sub-tropical forms or suggest a sub-tropical origin because of their size, robustness and elaborate ornamentation.

Furthermore, Karsten's Valdivia list records several new forms that are not strictly plankton species in the same sense as are *Chaetoceros*, *Rhizosolenia*, *Corethron*, *Thalassiosira*, etc., but are species normally of bottom habitat which have become mixed with the plankton flora and have been borne along as mere passengers in the plankton tangle. For example, *Entopyla antarctica*, *Grammatophora antarctica*, *Hyalodiscus Kerguelensis*, *Coscinodiscus Bouvarti*, *Coscinodiscus minimus*, *Coscinodiscus bifrons*, *Actinocyclus Ehrenbergii*, *Navicula antarctica*, etc., we may know are "found in the Antarctic." But with such species taken in plankton hauls we need caution in deciding on their local significance. For it is difficult at times to determine whether they are bottom diatoms and consequently have a fixed habitat in the locality in which they were found or are merely accidentally present there in a drifting mass of plankton taken in that spot at that time; that is to say, whether or not they are permanent members of the diatoms belonging to that particular place. For when we locate a collected sample by latitude, longitude, depth, character of the bottom, etc., we have something definite to go by, and its particular flora and fauna should have as far as possible a local meaning.

Subtropical or Tropical Affiliations of some of the Antarctic Diatom Flora.

The following list of species represents those recorded in this report which are known to have at the present time a subtropical or tropical habitat or else originally appeared in such habitat, as is proven by their presence in fossil deposits that flourished under subtropical or tropical conditions. The references to living forms, those now growing in subtropical regions, are not so significant as the fossil references; because the latter antedate them and are more suggestive of the ancestral life-conditions of such species. It also must be borne in mind that we cannot positively affirm from such analogies that any of the species now living in the Antarctic have been long native to that area. For, as is pointed out in these introductory discussions, the openness of the antarctic seas to the approach of outside species precludes any certainty that our

specimens are old inhabitants of that region. In the case of bottom diatoms such a deduction would be almost a conclusive one; but even in such cases, especially where the specimens are scarce, a stray individual could easily be added to the local flora from the outside world and actually be a stranger in the place where it was found. But admitting all that has been said in the way of caution, the following list of subtropical species is most significant. It brings out the undeniable fact that the antarctic diatom flora is remarkably close in its affiliations to diatom floras which we know to be inhabitants of warm water regions,—and in that respect it differs amazingly from the diatoms now living in the arctic seas.

Actinocyclus alienus Ratt., Santa Monica and San Pedro, California; fossil.
Actinocyclus Barkleyi (E.) Grun., Japan; Yucatan; living.
Actinocyclus curvatulus Jan., Bolivia guano; fossil; later Cape of Good Hope.
Actinocyclus Ehrenbergii Ralfs, "Nottingham earth" (Maryland and Virginia). "Nottingham earth" is here used for the subtropical fossil deposit extending over a great part of Maryland and the northern part of Virginia.
Actinocyclus obscurus Ratt., Monterey, California; fossil.
Actinoptychus splendens Ralfs, Nottingham earth; fossil.
Actinoptychus undulatus E., Nottingham earth; now cosmopolitan.
Amphiprora gigantea Grun., Adriatic Sea; living.
Amphora mexicana A.S., Gulf of Mexico; Borneo; living.
Anaulus bivittatus (Grun.) V.H., Oamaru, New Zealand; fossil.
Arachnoidiscus indicus E., Indian Ocean; Nottingham earth; Simbirsk, Russia; fossil and living.
Asterolampra marylandica E., Nottingham earth; fossil.
Asteromphalus Arachne (Breb.) Ralfs, Peru guano; Indian Ocean; fossil and living.
Asteromphalus elegans Grev., Indian Ocean; living.
Asteromphalus flabellatus (Breb.) Grev., Peru guano; Corsica; Sendai, Japan; fossil.
Asteromphalus heptactis (Breb.) Ralfs, Peru and California guano; Japan; fossil.
Asteromphalus moronensis (Grev.) Ratt., Moron, Spain; Santa Monica, California; fossil.
Asteromphalus Roperianus (Grev.) Ralfs, Bolivia guano; Indian Ocean; fossil and living.
Biddulphia dubia (Bright.) Cl., Mauritius; living.
Biddulphia mobiliensis Bail., Mobile, Alabama; St. Augustine, Florida; living.
Biddulphia punctata Grev., Barbados; fossil.
Biddulphia Tuomeyi Bail., Nottingham earth; California guano; fossil.
Cestodiscus Lewisianus (Grev.) Mann, Nottingham earth; Naparima, Trinidad; fossil.
Chaetoceros (*Bacteriastrum*) *varians* Laud., Hongkong; living; however, this and other plankton diatoms are too unstable in locality to permit safe conclusions to be drawn as to their origin.

Climacodium Frauenfeldianum Grun., Sumatra; living; also plankton, but mentioned because all its records are from subtropical waters.

Cocconeis antiqua Br., Sendai, Japan; fossil.

Cocconeis Baldjikiana Grun., Bory, Hungary; fossil.

Coscinodiscus africanus Jan., Barbados; Indian Ocean; fossil and living.

Coscinodiscus asteroides T. & W., Hayti; fossil.

Coscinodiscus asteromphalus E., Nottingham earth; fossil; has become cosmopolitan.

Coscinodiscus centralis E., Oran, Africa; fossil.

Coscinodiscus curvatulus Grun., Nottingham earth; Monterey, California; Barbados; Fiji; fossil and living.

Coscinodiscus elegans Grev., Monterey, California; fossil.

Coscinodiscus elegantulus Grev., Barbados; fossil; very common in the Antarctic.

Coscinodiscus excentricus E., Nottingham earth; Oran; Campeche Bay; Singapore; fossil and living.

Coscinodiscus fimbriatus-limbatus E., Aegean Islands; fossil.

Coscinodiscus Janischii A.S., Ichaboe Island guano; fossil.

Coscinodiscus leptopus Grun., Ascension Island, Indian Ocean; living.

Coscinodiscus lineatus E., Nottingham earth; Barbados; Moron, Spain; Yokohama; Indian Ocean; fossil and living.

Coscinodiscus marginatus E., Nottingham earth; Barbados; Santa Monica, California; Oamaru, New Zealand; fossil.

Coscinodiscus nodulifer A.S., Nottingham earth; Santa Monica, California; Indian Ocean; Galapagos Islands; Campeche Bay; fossil and living.

Coscinodiscus Normanii Greg., Nottingham earth; Arafura Sea; fossil and living.

Coscinodiscus oculus-iridis E., Nottingham earth; Indian Ocean; fossil and living; now cosmopolitan.

Coscinodiscus praetextus Jan., Sendai, Japan; Indian Ocean; fossil and living.

Coscinodiscus radiatus E., Nottingham earth; Barbados; Sicily; Aegean Islands; fossil.

Coscinodiscus reniformis Cast., Philippine Islands, common there; locality of specimen found by Janisch is undiscoverable, nor does Castracane give the source of his specimen.

Coscinodiscus subtilis E., Nottingham earth; Caltanisetta, Sicily; Moron, Spain; Yokohama; Savannah, Georgia; Campeche Bay; fossil and living.

Coscinodiscus suspectus Jan., Miocene deposit near San Francisco, California; fossil.

Eucampia cornuta (Cl.) Grun., Sea of Java; living; this however is a plankton form.

Eupodiscus radiatus Bail., origin of type indeterminate; but living and common on coast of Georgia; at Colon, Panama; Nicobar Island, Bay of Bengal.

Grammatophora flexuosa Grun., Honduras; fossil.

Grammatophora maxima Grun., Bory, Hungary; fossil.

Hemidiscus cuneiformis Wall., Nottingham earth; Philippine Islands; Ceylon; fossil and living.

Hyalodiscus subtilis Bail., Peru guano; Honduras; Java; fossil and living, now widely distributed.

Melosira hungarica A.S., Kekko, Hungary; fossil.

Melosira omma Cl., St. Peter, Hungary; fossil.

Novicula bombus (E.) K., Sendai, Japan; Nagy Kurtos, Hungary; Moron, Spain; Honduras; fossil; now widely distributed although infrequent.

Navicula californica Grev., California guano; Ceylon; Campeche Bay; Yokohama; fossil and living.

Navicula directa W.S., Peru guano; Honduras; Adriatic Sea; fossil and living; now widely distributed.

Navicula eudoxia A.S., Monterey, California; fossil.

Navicula nitescens (Greg.) Ralfs, Nagy Kurtos and St. Peter, Hungary; Philippine Islands; fossil and living.

Navicula praetexta E., Sendai, Japan; Hayti; Greece; fossil; now widely distributed.

Navicula spectabilis var. *oamaruensis* Grove, Oamaru, New Zealand; fossil; type form living mostly in warm latitudes, as Indian Ocean, etc.

Nitzschia Kolaizeckii Grun., Honduras; fossil.

Nitzschia longissima (Breb.) Ralfs, Sendai, Japan; Adriatic Sea; Borneo; fossil and living; now frequent in temperate and arctic waters.

Nitzschia marina Grun., Gulf of California; Ceylon; Aden; living.

Nitzschia mediterraneana Hust., Naples, Italy.

Planktonella sol (Wall.) Schuett, Bay of Bengal; Bay of Rio Janeiro; West Indies; a typically warm water plankton species.

Pleurosigma acus Mann., Philippine Islands; living.

Pleurosigma directum Grun., Sendai and Yeddo, Japan; fossil.

Pleurosigma longissimum Cl., Balearic Islands; living.

Pleurosigma naviculaceum Breb., Colombo, Ceylon; coast of Sicily; now widely distributed.

Pleurosigma nicobaricum Grun., Nicobar Island; Java, etc.; living.

Podosira hormoides Mont., Peru guano; Adriatic Sea; coast of Peru; fossil and living.

Pseudoeunotia doliolus (Wall.) Grun., Peru guano; Indian Ocean; Philippine Islands; Campeche Bay; fossil and living.

Pyxilla prolongata Br., Troublesome Gully, New Zealand; fossil.

NOTE.—Species of *Rhizosolenia* are omitted, being strictly plankton and without any local habitat; several, however, like *R. indica* Perag., have hitherto been reported only from warm waters. Also *Skeletonema costatum* (Grev.) Cl., very prevalent in the Antarctic, is especially abundant at Hongkong, Java, West Indies, Philippine Islands, etc., its earliest appearance being in Peru guano.

Rhoicosigma mediterraneanum Cl., Balearic Islands; living.

Stephanopyxis Palmeriana (Grev.) Grun., Hongkong; Java; Arafura Sea; living.
Stictodiscus californicus Grev., Monterey, California; Szakal, Hungary; fossil.
Stigmaphora rostrata Wall., Bay of Bengal; in Sargasso weed of Honduras, etc.; a strictly tropical plankton diatom.
Synedra nitzschioides Grun., St. Peter and Kekko, Hungary; Lompoc, California; coasts of Peru and Brazil, etc.; fossil and living.
Trigonium cinnamoneum (Grev.) Mann, Moron, Spain; Nankoori; Monterey, California; Naparima, Trinidad; fossil.
Trigonium oamaruense (Cr. & St.) Mann, Oamaru, New Zealand; fossil.
Trinacria excavata Heib., Nottingham earth; Ananino, Russia; fossil.

BIBLIOGRAPHY AND ABBREVIATIONS.

The following is a list of references to diatom literature used in this report, together with the abbreviations of their titles. Although all diatom publications having illustrations were consulted in these researches the following list includes only those that proved to be of service in this work. The references selected are those which most accurately represent the actual specimens found. Consequently the citations do not invariably refer to the original type figure, especially where a later and better illustration is available. In the few cases where no satisfactory figure exists, one is here supplied.

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LIST OF SPECIES AND SYSTEMATIC DISCUSSIONS.

ACHNANTHES *Bory.*

Achnanthes antarctica Perag.

Perag. Antarc. Exp. Franc., 1/25–26.

Achnanthes Bongrainii (Perag.) Mann.

Perag. Antarc. Exp. Franc., 1/4–6; 2/1.

The fact that the silica is thickened at the ends of the valve is not a sufficient reason for creating a new genus, *Achnanthepyla*, as is done by Peragallo, to accommodate this and twelve other species. A large number of species of *Navicula* would have to be isolated in a new genus for the same trivial reason.

Achnanthes Charcotii Perag.

Perag. Antarc. Exp. Franc., 1/10–11.

This has a close resemblance to *A. subsessilis* Ehr.

Achnanthes flexella (Kutz.) Mann.

V. H. Syn., 26/29–31.

There is doubtless room to question the transfer from the original genus, *Achnanthidium*, of this single valid species, into *Achnanthes*. But in suggesting the abandonment of the former as a needless confusion in taxonomy I draw attention to the fact that the only essential difference between this and other *Achnanthes* is its sigmoid raphe. It has the characteristically dissimilar valves of *Achnanthes*, one with and the other without true raphe; it is, like the others, bent at the middle toward the raphe-bearing valve, as seen in girdle view; it grows as the others do attached to the end of a gelatinous stripe or stalk; it does not have a stauros across the middle of the raphe-bearing valve, like *A. longipes*, *A. brevipes*, etc., but neither have at least ten authentic species of *Achnanthes*. If then we continue to hold this sigmoid quality as sufficient to separate this from other *Achnanthes*, what is to be said of those species of *Cocconeis*, like *C. heteroidea*, that have also a sigmoid raphe on one valve and pseudo-raphe on the other valve, instead of being straight, as in most species; or of those non-sigmoid species of *Pleurosigma*, like *P. vitreum* Cl., *P. directum* Grun., *P. acus* Mann, etc.; or of those species of *Navicula* with sigmoid raphe, like *N. scoliopleura* A. Sch. ? It is hardly consistent to base generic rank on this characteristic in one place and not in the others. Nor would dropping *Achnanthidium* make more difficult the identification of this form, but quite the contrary. One would naturally look for it in *Achnanthes*, and there the name, *flexella*, would lead straight to the species.

ACHNANTHES GAINII (Perag.) Mann.

Perag. Antarc. Exp. Franc., 1/12.

See remarks under *A. Bongrainii*.

ACHNANTHES LONGIPES Ag.

V. H. Syn., 26/13–16.

ACHNANTHES SUBSESSILIS Ehr.

V. H. Syn., 26/21–24.

ACTINOCYCLUS *Ehr.*

ACTINOCYCLUS ALIENUS var. ARCTICA Grun.

ACTINOCYCLUS ALIENUS var. ARCTICA Grun. Pl. 1, fig. 1.

V. H. Syn., 125/12.

ACTINOCYCLUS BARKLEYI (E.) Grun.

V. H. Syn., 124/12; Ratt. Actinoc., p. 158.

The specimens agree exactly with the above; they are smaller than those in my collection from other localities and the inconspicuous pseudonodule just touches the rim. Found in only one gathering, Australasian No. B, there abundant.

ACTINOCYCLUS BIFRONS (Cast.) Mann (not Karst.). Pl. 1, figs. 2–4.

Cast. Chall. Exp., 2/1; Karst. Valdivia, 4/3; V. H. Belgica, 11/151, all misnamed.

By comparing a great number of specimens of this unique, but extremely variable, form, of which there is an unlimited supply in some of the gatherings examined for this report, I have found that several specific names created by Van Heurck in the report of the Belgica Expedition, by Castracane in the report of the Challenger Expedition, and by Karsten in the report of the Valdivia Expedition, are only variants of the same diatom; and I have selected the first recorded of these synonyms, despite the fact that Karsten names an *Actinocyclus bifrons* (Valdivia Exp., pl. 9, fig. 8) because that diatom is not an *Actinocyclus* but, like the older *A. Oliverianus* O'Me., belongs in a separate genus for which Grunow has proposed the name *Micropodiscus*, which see in this report.

Synonymous with the present species are the following:—*Coscinodiscus Janus* Cast., Chall. Exp., pl. 2, fig. 2; *C. polygonus* Cast., Chall. Exp., pl. 22, fig. 6, and compare V. H. Belgica, pl. 11, fig. 176 and pl. 12, fig. 161; *C. planus* Karst., Valdivia Exp.,

pl. 4, fig. 1; *C. australis* Karst., Valdivia Exp., pl. 4, fig. 2 and V. H. Belgica, pl. 11, fig. 154; *C. Castracanei* Karst., Valdivia Exp., pl. 4, fig. 4; *C. chromoradiatus* Karst., Valdivia Exp., pl. 4, fig. 5, and V. H. Belgica Exp., pl. 11, figs. 152, 153, 155, 156. Perhaps *C. cycloteres* Cast., in Chall. Exp., pl. 22, fig. 8 should also be included. All the foregoing are from the Antarctic; all have the same strikingly open, radial lines of beading, generally more or less wavy, sometimes straight, and sometimes both on the same valve; all have interpolated between these radii shorter lines of beading starting inward near the rim and sometimes so dense as to form a decided border, well shown in V. H. Belgica Exp., pl. 11, fig. 156, less so in fig. 152, and lacking in figs. 153 and 155, four figures of the same species; in all the above the radial lines of beading stop short of the centre, leaving a small central area which may or may not have from one to a cluster of crowded beads. In addition to the lines of beading the valve surface is occasionally marked with a fine dusty "shagreen," its particles showing a radial tendency. This is greatly over-emphasised in Castracane's figures of *C. bifrons* and *C. Janus* (pl. 2, figs. 1 and 2), is lacking in Van Heurck's figure of the former (his pl. 11, fig. 151), appears only as a marginal band in his figures 152, 154 and 156 and not at all in his figures 153 and 155. I have found this shagreen on one valve but not on both of the same frustule, and again on neither. There are also certain processes set beneath the surface of the valve next to the rim and equidistant around its periphery, lacking in several of the figures in the above list, very minute in others and very prominent in still others, when they closely resemble carpet-tacks. They are more or less common in the genus *Actinocyclus* and are well marked in many illustrations of other species, as Perag. Diat. France, pl. 114, fig. 5, V. H. Syn., pl. 124, fig. 11, pl. 125, fig. 11, his Belgica, pl. 12, fig. 161, etc.

It will be seen from the foregoing that this species shows an unusual degree of variability, not due to any arbitrary grouping here of several species that should remain apart, but due to an inconstancy that is inherent in them all, as can be seen from the figures and descriptions above quoted. Nor are the divergences the result of carelessness in the illustrations. An examination of hundreds of specimens in the same gathering shows even more clearly than do the illustrations the startling variability here brought out. And it is this which has resulted in the creation of the seemingly different species enumerated and here united into a single species.

Along with this changeability, however, are the characteristics previously enumerated, and in every case one distinctive mark,—the pseudonodule, the unmistakable sign of the genus *Actinocyclus*. It is very small and always set close to the rim, and consequently just where the valve bends downward, and for both of these reasons it is easily overlooked. But if we remember that the true *Actinocyclus* pseudonodule is a double convex thickening of the silica, that is to say, *a lens* (not a mere circular blank space like the spot in *Roperia*) we can invariably detect its presence by the simple expedient of having it a little out of focus, when its lenticular concentration of light will reveal it as a gleaming spot totally unlike anything else in diatom structure. Looked for in this way, it becomes visible in every one of the variants here united under the

name *A. bifrons*. In fact, Van Heurck figures this pseudonodule in several illustrations but strangely fails to assign them to *Actinocyclus;* see the following in his Belgica pl. 11, figs. 151, 153, 154, 155, 156, and compare with his *A. polygonus* (Cast.) V. H. in fig. 176 and pl. 12, fig. 161. I replace the latter name with *A. bifrons* because it precedes it in both description and illustration. It incidentally gets rid of the misleading name "*polygonus*," based on Castracane's having accidentally found a specimen from which the rim was broken away. The species is never polygonal.

ACTINOCYCLUS COSCINODISCOIDES Mann, nom. nov. Pl. 1, fig. 5.

Ratt. Actino., 11/1, misnamed.

This species seems to be shown in the above reference to Rattray's monograph and named *A. subocellatus* Ratt.; the diagnosis in the text agrees even more closely with the present species. There the references are to Grunow's *Coscinodiscus curvatulus* var. *subocellata* in Diat. F. Jos. Land, pl. 4, fig. 15, and to *Actinocyclus curvatulus* Jan. in Sch. Atlas, pl. 57, fig. 31. Grunow's form may be a variety of that named by Janisch, in which case the name given in 1878 by Janisch should not be disturbed. But the above mentioned figure in Rattray's work is wholly unlike either of these and should be recognised as a separate species. Its diameter is 0·034 mm., whereas *A. curvatulus* Jan., which Rattray unites with this, is far larger, ranging from 0·124 to 0·160 mm., and its pseudonodule is considerably smaller. See next species.

ACTINOCYCLUS CURVATULUS Jan.

Sch. Atlas, 57/31; Grun. Diat. F. Jos. Land, 4/15 (?).

See remarks under preceding species. The statement in Rattray and De Toni that the markings of this species are areolate is misleading. Frequently they are closely set, but evident, beading, and invariably so in all the specimens found by me in the Antarctic material.

ACTINOCYCLUS EHRENBERGII Ralfs. var.

V. H. Syn., 124/5; Perag. Diat. France, 114/2 typical (fig. 1 doubtful).

This rather common species is rare here.

The variety of this species found is quite unique. It has a minute pseudonodule somewhat smaller than normal and located on the inner edge of the indistinct border. Adjacent to this there is always a single process which seems to be a modification of one of the processes in which the radii of the valve end. The markings consist of minute beading so arranged that they exhibit the concentrate sunburst effect generally seen in *A. Ralfsii* more evidently than they do the radii of *A. Ehrenbergii*. Especially is this seen in low magnifications.

ACTINOCYCLUS OBSCURUS Ratt.

Ratt., Rev. Actinoc., p. 187, 11/5.

The crude figure and the written characters of the above are based on a single and supposedly immature valve, recorded as from Monterey, but whether from the fossil deposit near there or from the bay is not stated. The status therefore of this species is well expressed by its name. I have a specimen from Australasian material No. 74 which seems to agree with this rather misty species. It is smaller, its diameter being 0·061, Rattray's 0·087 mm.

ACTINOCYCLUS POLYSCULPTUS n. sp. Pl. 1, figs. 6–8.

Valve circular, barely if at all convex; markings of strong, widely and somewhat irregularly spaced, radiating rows of beads, extending from a large, loosely beaded central area, about $\frac{1}{4}$ the diameter of the valve, to the evident and differently marked border; shorter rows of beading, without any uniformity in their length, interpolated between these long rows; the beading of the central area collected in a crude ring around its outer part and with 10 to 20 similar beads grouped in the middle; border flat, sharply distinct from the rest of the valve, about 1/10th its radius in width, cross-hatched with closely set rows of fine beading and also with evenly spaced, strong, raised cross-bars, distant from each other about the width of the border and numbering about 50 in the circumference of the valve; pseudonodule small, set on the border, not surrounded by a hyaline area. Found in Australasian Expedition Nos. 6, 7, 23, 68 and 71–73. Diam. 0·090 to 0·145 mm.

ACTINOCYCLUS ROPERII (Breb.) Kitt.

V. H. Syn., 125/5–6; H. L. Sm. Types, No. 96; Cast. Chall. Exp., 17/18.

This oval diatom is an aberrant number of this genus and was named by Roper *Coscinodiscus ovalis*.

It is not strange that Roper and even Cascatrane, with his superior microscopes, failed to notice the pseudonodule which determines its *Actinocyclus* character. In number 96 of Smith's Types made from material from Cateret, France, nearly one half the specimens in the strewing are without a discoverable pseudonodule; and in the Australasian Antarctic material, where it is very abundant in dredge No. 3, the pseudonodule is not only obscure but sometimes clearly lacking; but every species has a short, rod-like fleck situated in the line of the long axis of the oval and well back from the margin of the valve. Hence it would be equally possible to refer this odd form to the genus *Micropodiscus* proposed by Grunow for forms displaying this rodlike fleck or foot.

ACTINOCYCLUS TORTUOSUS n. sp. Pl. 1, fig. 9; pl. 2, fig. 1.

Valve slightly convex, increasingly so near the margin; markings of closely set, radiating rows of beads, tortuosus over their entire length, the rows crowded but with long, evident, hyaline spaces continuous inward from the ends of the shorter rows, thereby producing a circular band of sunburst effect strongest near the centre, decreasing outward and disappearing near the rim where the beading becomes closer and smaller; central area evident, about 1/7 of the valve radius in width, crowded with irregularly placed beads; pseudonodule minute, hardly larger than the beads, touching the rim; rim distinct, narrow and hyaline; small, rounded, beadlike processes evenly placed just within the rim at the ends of the major radii. Diameter 0·082 mm.

This resembles somewhat the very indefinite *A. obscurus* Ratt. in Rev. Actin., p. 187, 11/5, but is distinctly beaded not areolate, has a well defined rim and also small but evident marginal processes. Rattray's figure is very small and indistinct.

ACTINOPTYCHUS *Ehr.*

ACTINOPTYCHUS SPLENDENS Ralfs.

Sch. Atlas, 153/16; V. H. Syn., 119/3 (fig. 1 deceptive).

Hardly any examples of this cosmopolitan and prolific marine genus were discovered; of this species only 3 or 4 specimens, and of the next only a single specimen.

ACTINOPTYCHUS UNDULATUS E.

Sch. At., 1/1–4.

A solitary dwarf example of this species was found; it was in Australasian material No. 27. This is noteworthy, because this species probably shares with *Melosira sulcata* (E.) K., the distinction of being the most abundant and wide-spread of all marine diatoms, both fossil and recent.

AMPHIPRORA *E.*

(Exclusive of those species now classified under Cleve's *Tropidoneis*, which see.)

AMPHIPRORA GIGANTEA Grun., var.

Perag. Diat. France, 38/6; Cl. Nav. Diat., I, p. 18, 1/6; Grun. Neu & Ung. Diat., 6/4 (poor).

This is frequent in Antarctic material and the specimens are generally the variety that Grunow calls *kerguelensis* in Arct. Diat., p. 63. As Cleve states, Grunow's original figure is very bad. All specimens found were of moderate size, averaging 0·150 mm.

in length. In fact the measurements recorded by Cleve,—0·12 to 0·16—do not warrant the specific name, *gigantea*. In the above cited figures and in the descriptions the marking of the band next to the keel is represented as decussating. I am convinced this is a delusion, caused by the lines of the band on one side of the keel crossing those seen through the diatom and belonging to the band on the other side. The two halves of the valve adjacent to the keel are closely pressed together, forming a border while the remainder of the two halves flare apart. Careful focusing with high power objectives shows that these crisscross lines belong on opposite sides of the valve.

Amphiprora Oestrupii V.H.

V. H. Belgica, p. 15, 1/22–23.

Only one specimen of this rare species was found; Shackleton Exp., No. G, 13 fms.

AMPHORA *Ehr.*

Amphora angusta Greg.?

Sch. Atlas, 25/5, 15.

The specimens found agree with the above figures, which Cleve in his Nav. Diat. II, p. 135, makes varieties of *A. angusta*. He admits that Gregory's original figure in Diat. Clyde, pl. 12, fig. 66, is practically worthless, but thinks the type form is close to fig. 15 above. The assignment is not very satisfactory and Cleve seems to have had a rather foggy idea of the species, as he groups together a good many dissimilar forms, recent and fossil, from polar, tropical and inland waters. A new specific name for this form therefore might be advantageous.

Amphora crassa var. punctata Grun.

Sch. Atlas, 28/31.

Rather frequent.

Amphora laevissima Greg.

Sch. At., 26/3, 13, 14.

Amphora lanceolata Cl., var.?

Perag. Antrac. Exp. France., p. 62, 2/26.

The confusion mentioned under *A. angusta* includes this form and the apparently similar *A. ventricosa* Greg. Peragallo thinks the muddle can be simplified by restoring Cleve's *A. lanceolata*, as seems to be favoured by Schmidt in his Atlas, pl. 25, fig. 6. But as Gregory's three figures of *A. ventricosa* in Diat. Clyde, pl. 12, fig. 66, are hopelessly unlike and Cleve's original description and figure of *A. lanceolata* are worthless (Diat. Spitz., p. 667, pl. 22, fig. 2), a new specific name might here also be clarifying.

AMPHORA MEXICANA A. S.

Sch. At., 27/47–49.

Only a single specimen was found. It is also recorded from the Antarctic by Van Heurck in his Belgica.

AMPHORA PERAGALLORUM V. H.

V. H. Belgica, 1/2, 4.

Frequent, especially the slightly variant form called var. *robusta*.

AMPHORA PROTEUS Greg.

Sch. Atlas, 27/3, 7 (not 2).

AMPHORA RACOVITZAE V. H.

V. H. Belgica, 1/3.

AMPHORA SULCATA Breb.

Sch. Atlas, 27/12.

My specimens agree with the above figure, but not with that in Greg. Diat. Clyde, 13/92, as the girdle divisions are many and delicate.

ANAULUS (*E.*) *Grun.*

ANAULUS BIVITTATUS (Grun.) V. H.

Le Diat., II, 5/2–3; Gr. & St. Oam. Diat., 6/24.

Although Van Heurck in his Treatise, p. 450, points out the distinction between *Anaulus* and *Eunotogramma*, namely the slightly arcuate form of the valve, this trivial difference is ignored on p. 454, where he divides *Anaulus* into the two subgenera, *Euanaulus* and *Eunotogramma*. De Toni also gives both names, but admits their essential unity; and Grove and Sturt in the above reference follow *Eunotogramma* with double question-marks and use *Anaulus* in their manuscript. There is no advantage in retaining both names. This species has not been recorded hitherto, except in the fossil subtropical deposit at Oamaru, New Zealand.

ARACHNOIDISCUS *E.*

Arachnoidiscus indicus E.

Sch. Atlas, 68/6; 73/2.

This species is recorded by De Toni in Syll Alg., p. 1312, only in subtropical fossil deposits in Russia, Japan, Hungary and Monterey, California. The living species of this genus, especially *A. Ehrenbergii* Bail., although occurring sparingly on the coast of Devon, England, and rarely on the United States Atlantic seaboard (Woods Hole, Mass.), are essentially Pacific Ocean diatoms, *A. Ehrenbergii* being very common on algae along the coast of California. The genus therefore as a whole is indigenous to areas of warm temperature. Most of the Antarctic specimens of *A. indicus* are misshapen in form but not in sculpturing, an ovate contour being most common. The species is quite abundant there.

ASTEROLAMPRA *E.*

Asterolampra marylandica E.

Sch. At., 137/19–21 Trans. Mic. Soc., 1860, 5/3.

Both typical and dwarf specimens of this species were found.

ASTEROMPHALUS *E.*

Asteromphalus arachne (Breb.) Ralfs.

Sch. At., 38/3–4.

Asteromphalus areolatus Mann.

Mann P. I. Diat., p. 30, 6/5.

Asteromphalis Beaumontii E.

Pl. 2, fig. 2, var.? ; Sch. At., 38/6–8 (not 5).

Fig. 5 above is much better referred to *A. heptactis* (Breb.) Ralfs; see Prit. Inf., 8/21. Notice the mention of the characteristic lunate markings at the ends of the arms in Ratt. Cosc., p. 664. In addition to typical specimens, a dwarf form was found heavily marked and closely resembling the figure in Sch. At., 38/8, but having seven instead of eight arms; see pl. 2, fig. 2. This form also resembles somewhat *A. areolatus* Mann in. P. I. Diat., 6/5. Its best assignment seems to be to consider it as a dwarf of the above species, its one mark of difference being the too short and irregular base of the thin arm. It is abundant in Austral. Antarc. Exp., No. 56, and shows great uniformity; diameter 0·037–0·041 mm.

ASTEROMPHALUS BROOKEI Bail.

Sch. At., 38/21–23.

ASTEROMPHALUS DARWINII E.

Sch. At., 38/16.

Both Ehrenberg and Ralfs record this as occurring in the Antarctic.

ASTEROMPHALUS DIMINUTUS n. sp., pl. 2, figs. 3–4.

Valve very slightly ovate, sometimes circular; its central area covering two-thirds to three-quarters of the surface of the valve; radiating arms 9, short, stout, slightly tapered, each ending short of the rim in a strong rounded bead; bases of the arms (which unitedly compose the central area) heavy, that of the thin arm club-shaped, extending beyond the centre of the valve, as in *A. elegans*, *A. heptactis*, etc., of the other eight all but upper two arising from the sides of the club-shaped base; sutures between the bases sharply zigzag; sinuses between the arms closely set with heavy beading in quincunx order, their inner ends slightly convex or flat; little or no decrease in size of beads toward the rim. Diam. 0·040–0·041 mm.

This somewhat resembles *A. stellatus* (Gerv.) in Trans. Mic. Soc., 1860, 4/20, but the beading of that diatom is much finer and the sutures between the bases of the arms are not zigzag. It probably is the same as the unnamed figure in Sch. At., 38/9, which Grunow suggests may be a dwarf variety of *A. Brookei* Bail., an assignment that Schmidt rightly rejects. De Toni (Syl. Alg., p. 1415) assigns it to *A. Darwinii* E., a still worse disposal. If this and Schmidt's fig. 9 are the same species, it is another example of a subtropical diatom in the Antarctic flora, as that specimen came from Campeche Bay.

ASTEROMPHALUS ELEGANS Grev.

Sch. At., 38/1–2; Prit. Inf., 5/87.

ASTEROMPHALUS EMERGENS n. sp. Pl. 2, fig. 5.

Valve circular; central area excentric, relatively small; arms 7, unequal in length, narrow, slightly curved, reaching the rim of the valve, not enlarged at the end, terminating in a minute bead; sutures between the bases of the arms zigzag; base of thin arm short, truncate, not passing beyond the middle of the central area; sinuses between the arms closely set with small beads in imperfect quincunx order, becoming smaller toward the rim; a small and delicately formed species. Diameter 0·045 mm. Austral. Antarct. Exp., No. 26.

ASTEROMPHALUS EMINENS n. sp. Pl. 2, figs. 6–7.

Valve circular, but with its central area slightly excentric; arms 6, thin, slightly broadened at the tips, ending in an inconspicuous bead, gradually rising above the valve surface, so that at the ends of all but the thin arm a strong, shadowy, lunate arc curves around the ends; thin arm bent to one side and with a small wedge-shaped base barely reaching the middle point of the central area; sutures between the arms heavily marked with uniform sized beading in quincunx order, their inner ends concave; rim narrow but evident. Diameter 0·055–0·075 mm. Found in Australasian Antarctic material, No. 27.

The nearness of this to Van Heurck's figure in his Belgica, 11/150, suggests that these two antarctic diatoms may be the same species. But his suggestion that it belongs under *A. Hookerii* E. is wholly untenable; see Sch. At., 38/18–20, *A. Humboldtii* E. and *A. Hookerii* E. being generally recognised as synonyms. *A. Hookerii* has 9 arms, finer beading, a club-shaped or spathulate base to its thin arm and straight sutures between the bases of all the arms. Both Van Heurck's form and the present species are very close to Sch. At., 202/17, which, however, does not in any respect correspond to *A. senectus* T. & Br., as shown and described in T. & Br. Diat. Jap., p. 17, 3/2, the beading of which is strongly concentric, the sutures between the bases of the arms straight, not zigzag, the tips of the arms strongly capitate, etc. A variety with less pronounced lunate marks at the tips of the arms is here illustrated.

ASTEROMPHALUS FLABELLATUS (Breb.) Grev.

Quart. Jour. Mic. Sci., 1859, 7/4; Sch. At., 38/10–12.

ASTEROMPHALUS HEPTACTIS (Breb.) Ralfs.

Prit. Inf., 8/21; Quart. Jour. Mic. Sci., 1859, 21/7–8; Sch. At., 38/5 (not 6–8).

This species is frequently confused with *A. Beaumontii* E., which it only sparingly resembles. Its most marked characteristic is the lunate ridges surrounding the outer ends of the radiating arms, well illustrated in the figures above quoted. It may be added, that Schmidt's Atlas 38/6–8, above excluded, is, as Janisch points out, better referred to *A. Beaumontii*. The name *A. Ralfsianus* given by Greville is a true synonym, but should not replace the earlier specific name by Brebisson.

ASTEROMPHALUS HOOKERII E.

Sch. At., 38/18–20. Cast. Chall. Exp., 5/2 (misnamed).

This is identical with *A. Humboldtii* which was later bestowed by Ehrenberg. Castracane has in the above reference given this diatom the unnecessary name of *A. Challengerensis*.

ASTEROMPHALUS HYALINUS Karst.

Valdivia Exp., 8/5.

Diameter of my specimen 0·031 mm. Shackleton S. Pole Exp., No. G, 13 fms.; scarce.

ASTEROMPHALUS MORONENSIS (Grev.) Ratt. var.

Sch. At., 38/24. Quart. Jour. Mic. Sci., 1863, 9/8.

ASTEROMPHALUS ROPERIANUS (Grev.) Ralfs.

Sch. At., 38/15; Trans. Mic. Soc., 1860, 4/14.

This is one of the most easily distinguished species of this variable genus. It occurs only sparingly in the Antarctic.

AULACODISCUS RADIATUS (Bail.) Bright.

See *Eupodiscus radiatus* Bail.

BACILLARIA PARADOXA Gmel.

See *Nitzschia paradoxa* (Gmel.) Grun.

BIDDULPHIA *Gray.*

BIDDULPHIA ANTHROPOMORPHA V. H.

V. H. Belgica 10/137.

Several specimens of what is undoubtedly the above-named diatom have convinced me that this is nothing but a small variety of *B. Ottomulleri*, as given in figure 142 of the same plate. The shape and length of the horns, the character and marking of the girdle, and other characteristics are essentially the same in both.

BIDDULPHIA CONVEXA n. sp. Pl. 3, figs. 1–2.

Valve oval, very convex and deep, *i.e.*, subtubular; processes large, very short, truncate, and set at the extreme ends of the oval; valve marked with widely spaced, minute beading, irregularly arranged; in girdle view two long and stout setæ are seen near the centre between the short processes; the setæ sometimes bent midway at a sharp angle; valve where it joins the girdle indented by a shallow groove; girdle transversely marked with rows of minute beading; is generally narrow, but is sometimes

so greatly extended that the length of the frustule is three to four times the long diameter of the valve. Long diameter of valve 0·031–0·036; depth 0·031–0·036; width of girdle 0·005–0·056 mm.

This delicate species somewhat resembles some figures of *B. obtusa* (K.) Ralfs, except for its setæ, its decidedly truncate processes and the complete absence of any prickles scattered over the surface of the valve. It is particularly abundant in Shackleton S. Pole Exp., No. G, 13 fms.

Biddulphia dubia (Bright). Cl.

Sch. At. 78/32–35; Jour. Mic. Soc., 1859, 9/12.

This species is the same as *Triceratium bullosum* Witt, Jour. Mus. God., I, 8/4, and *B. bicornis* Cl. Sch. At., 78/24–25.

Biddulphia mobiliensis Bail.

V. H. Syn., 101/4–6.

Biddulphia mollis n. sp. Pl. 3, figs. 3–5.

This is what Van Heurck has called *B. obtusa* (K.) Ralfs in his Belgica 10/132, 133, 142. This is certainly an error. Authentic specimens of this last-named diatom make it impossible to confuse the two; in fact, Van Heurck's own figure in his Synopsis 100/11–14 shows that this Antarctic form cannot be crowded into *B. obtusa*. The same is made plain by reference to Prit. Inf., 13/30–32. The present species is of very much larger dimensions. It has entirely different horns or processes and has a finer and much more sparse beading. In many of the gatherings it is the most abundant diatom present with the exception of *Fragilaria antarctica*. The valves average in long axis between about 0·090 and 0·140, and are exceedingly delicate and thin.

Biddulphia Ottomulleri V. H.

See the next species.

Biddulphia paradoxa Petit.

Petit Antarc. Exp. Franc., 1/7; V. H. Belgica, 10/138, 142; 11/174–5, misnamed.

Petit's Report was published a few months before that of Van Heurck. Probably the latter had not seen it when his manuscript was being prepared. He consequently renames this identical form, *B. Ottomulleri* and falls into the same error with five out of the eight figures on Petit's plate.

BIDDULPHIA PULVERULENTA n. sp. Pl. 6, figs. 11–13.

Valve broadly elliptical, approaching circular, strongly convex with vertical sides, but somewhat depressed at its middle portion, thence gradually sloping upward to the apices of the two processes of horns; valve covered with delicate beading in radiating lines which are uniformly intermittent or broken into short dashes; no short, blunt spines, either pairwise, as in *B. levis* E., or more numerous, as in *B. socotrensis* Kitt.; on the vertical sides of the valve, midway between its upper surface and the line of its juncture with the girdle, is an internal row of small " carpet-tack " processes extending inward, just as in many species of *Actinocyclus*; in girdle view these processes, obscure in the valve view, are easily seen, as is also the central depression of the valve and its upward slope to the two horns; the latter are pointed, not blunt, and form the extreme ends of the ellipse. Length of valve 0·190–0·200; width 0·173–0·175.

This uniformly huge diatom of the *Cerataulus* group of *Biddulphia* resembles the above-named species of Ehrenberg and that of Kitton, and even more so the unnamed figure in Schmidt's At., 149/13; but it differs from all these in the extended and pointed horns, in the absence of blunt spines, in the concave profile of the upper valve, as seen in girdle view, and also in the intermittent lines of beading. Despite its large size, it is extremely delicate. Frequent in Austral. Antarc. Exp., Nos. 22, 51.

BIDDULPHIA PUNCTATA Grev.?

V. H. Belgica, 10/134, 135, 139, 140, 141.

My specimens agree perfectly with the above, especially with the last figure, to which Van Heurck gives the varietal name, *subaurita*. But that it or any of them are Greville's species is doubtful. That came from a fossil deposit at Barbados, and is illustrated in Trans. Mic. Soc., 1864, 11/10. However that may be, the figures in Sch. At., 141/2–3 and 172/8, cannot be brought into this combination.

BIDDULPHIA STRIATA Karst.

V. H. Belgica, 10/144, 147, 148; Karst. Valdivia, 17/2–3.

Karsten's figures show four setæ, Van Heurck's show 2, 3 and 4; the solitary specimens found by me had two.

BIDDULPHIA TRANSLUCIDA V. H.

V. H. Belgica, 10/145–6.

Several specimens were found. There is ground for suspicion that this is a delicate and large phase of *B. striata*, especially as Van Heurck states that they both came from the same sample of melted ice.

BIDDULPHIA TUOMEYI Bail.

Sch. At., 119/1–8, 15.

Apparently uncommon in the Antarctic. The variety called *B. elegantula* in Greville's New and Rare Diatoms, Trans. Mic. Soc., 1865, 6/12–14, from the fossil deposit at Barbados occurs as well as the type form.

BIDDULPHIA WEISSFLOGII Grun.

Sch. At., 141/12–25; V. H. Syn., 100/1–2.

Schmidt incorrectly credits this species to Janisch. There is some doubt whether this unique diatom belongs to the genus *Biddulphia*. It is abundant in the Antarctic.

CERATAULINA *Perag.*

CERATAULINA BERGONII Perag.

Gran. Nord. Plank., p. 101, fig. 132; Perag. Diat. France, 106/6–7; Meun. Microplank Flam., 9/34–36.

This delicate plankton diatom is common in the Antarctic.

CESTODISCUS *Grev.*

CESTODISCUS LEWISIANUS (Grev.) Mann, var. Pl. 3, fig. 6.

Trans. Mic. Soc., 1866, 8/8–10; Sch. At., 66/12.

This species has too long remained in *Coscinodiscus*, with which it has only slight affiliations. It is a widely distributed form, both geologically and geographically, and its shape and markings make it a very unsatisfactory member of the last-named genus. It is uniformly oval or lozenge shape; has a distinct and wide border which generally bears regularly spaced, blunt processes near the rim. Its beading is massive and generally is set loosely in widely separated rows which are sometimes truly radial, but frequently rather sigmoid. It makes about as poor an example of *Coscinodiscus* as that over-loaded genus could contain. It so closely agrees with the usual concept of *Cestodiscus* that I believe it will be an advantage to transfer it.

The particular variety found in the Antarctic in a single gathering of the Australasian material, No. 27, is smaller and more prismatic in outline than the type form, and the beads are unusually large in proportion to the size of the diatom, rather crowded together and almost destitute of orderly arrangement. Strange to say, a nearly identical variety occurs in a sample of the Miocene subtropical deposit known as Nottingham earth from Maryland. *C. rhombicus* Cast. in Chall. Exp., 22/11, is probably the same diatom.

CHAETOCEROS E.

Here are included the circular forms of this genus generally classified as *Bacteriastrum,* of which three species were found.

CHAETOCEROS (BACTERIASTRUM) DELICATULUM Cl.

Gran. Nord. Plank., p. 58, fig. 72.

CHAETOCEROS (BACTERIASTRUM) ELONGATUM Cl.

Gran. Nord. Plank., p. 58, fig. 73.

CHAETOCEROS (BACTERIASTRUM) VARIANS Laud.

Trans. Mic. Soc., 1864, 3/1–6.

This includes the variety *furcata,* which sometimes is written as a separate species. The foregoing three species of *Chaetoceros* are frequent in the Antarctic, and the last one is common. Those which follow are typical bilateral species of this genus.

CHAETOCEROS ATLANTICUM Cl.

Gran. Nord. Plank., p. 64, fig. 74.

In addition to the type form, what has been called variety *exigua* also occurs, but should not be included in this species; see *C. neapolitanum* Schrod.

CHAETOCEROS BOREALE Bail.

Perag. Diat. France, 127/2, 4.

CHAETOCEROS CONTORTUM SCHUTT.

Grand Nord. Plank., p. 78, fig. 39.

CHAETOCEROS CRIOPHILUM Cast.

Cast. Chall. Exp., p. 78; Gran. Nord. Plank., p. 71, fig. 85; p. 72, figs. 86, 86b.

This is one of the most abundant species in all of the Antarctic plankton gatherings.

CHAETOCEROS CRUCIATUM Karst.

See *C. radiculum* Cast.

Chaetoceros curvisetum Cl.

Cl. Plank. Diat., 1894, 1/5; Gran. Nord. Plank., p. 91, fig. 116.

Chaetoceros debile Cl.

Cl. Plank. Diat., 1894, 1/2; Gran. Nord. Plank., p. 92, fig. 117.

Chaetoceros dichaeta E.

Cast. Chall. Exp., p. 77; Gran. Nord. Plank., p. 66, fig. 77.

There is strong probability that what Karsten figures in his Valdivia, 15/6, as *C. Janischianum* Cast., is the same as this species. Both Gran and Cleve recognise their unity. I have found it very abundantly in dredging No. 27 of the Australasian Expedition. It might be well to note two facts regarding this species—the persistence of the chain of frustules, even after the investing cylinder is gone, puzzles Castracane; but is easily understood if we note that where the arms cross each other from adjacent individuals they are strongly fused; so much so, that frequently, when the cylinder walls are badly broken, the arms from adjacent diatoms still hold together. Another fact is that the name *dichaeta* is not given because of the two long spines sometimes called arms, sometimes bristles, but because of two minute spines midway between these on each valve. In most descriptions they are not mentioned, and are hardly shown in any of the illustrations. By careful lighting, however, they become quite evident, and it is doubtless this peculiar quality which induced Ehrenberg to bestow this name.

Chaetoceros didymum E.

Gran Nord. Plank., p. 79, figs. 94, 95.

Chaetoceros furca Cl.

See *C. messanense* (Cast.) Perag.

Chaetoceros Janischianum Cast.

See *C. dichaeta* E.

Chaetoceros laciniosum Schutt.

Gran Nord. Plank., p. 82, fig. 99.

Wherever possible it is advisable to confirm the identification of this species by means of its endocyst, shown in Gran's figure, as the species is easily confused with some others.

CHAETOCEROS LORENZIANUM Grun.

Gran Nord. Plank., p. 76, fig. 90.

This is the same as *C. cellulosum* Laud., as shown in Trans. Mic. Soc., 1864, 8/12.

CHAETOCEROS MESSANENSE (Cast.) Perag.

Sch. At., 322/4, 7; 325/3.

This is what Cleve calls *C. furca.*

CHAETOCEROS NEAPOLITANUM Schord.

Gran Nord. Plank., p. 65, fig. 76.

Cleve is quite right in separating this diatom from *C. atlanticum,* of which it has been known as variety *exigua.*

CHAETOCEROS RADICULUM Cast.

Cast. Chall. Exp., p. 79, with 5 figs.

There is much confusion over three apparently quite dissimilar diatoms: first, what Ehrenberg in his Mikro. Pl. 35A, group 21, fig. 10, calls *Dicladia bulbosa,* which is clearly a *Chaetoceros* and is so classed by Heiden in his Deutsch. Sudpol. Exp., p. 527; second, *C. radiculum* Cast. reference given above; and third, *C. cruciatum* Karst., as shown in Valdivia pl. 15, fig. 5. Heiden discusses at great length their possible union and, in fact, the probability of their being nothing more than an occasional end valve of *C. dichaeta.* My form agrees closely with Castracane's *C. radiculum*; and as Heiden's discussion is not at all conclusive, I retain this name as well as the perfectly valid *C. dichaeta,* typical specimens of which are abundant in the Antarctic.

CHAETOCEROS SEIRACANTHUM Gran.

Gran Norsk. Nord. Exp., 1876–1878, 3/39–41; Gran Nord. Plank., p. 85, fig. 103.

CHAETOCEROS TERES Cl.

Gran Nord. Plank., p. 77, fig. 91.

CHAETOCEROS WEISSFLOGII Schutt.

Gran Nord. Plank., p. 78, fig. 92.

Here again it is advisable to see the endocyst in order to confirm this somewhat obscure species. I have found it to be quite rare in the Antarctic, except in a single plankton haul of the Shackleton Expedition taken July 10, 1907.

CHUNIELLA ANTARCTICA Karst.

See *Tropidoneis lateralis* Mann.

CLIMACODIUM *Grun.*

CLIMACODIUM FRAUENFELDIANUM Grun.

V. H. Treat., p. 462, fig. 193.

One is tempted to question the classifying of this infrequent plankton organism as a diatom, because of its almost total lack of silica and the absence of any markings. Nor is it possible to see with any distinctness a girdle between the two valves. Admitting its diatom character, it is evidently very close to the genus *Eucampia*.

COCCONEIS (*E.*) *Grun.*

COCCONEIS ANTIQUA T. & Br.

Br. Diati Jap., 8/5; V. H. Belgica, 2/26–27; 2/31, 33, misnamed; Sch. At., 191/49–51.

That *C. Gautieri* V. H. in the second reference in Belgica above, belongs here as variety will be evident by a comparison between Van Heurck's own figures on the same plate with those given in Sch. At., 191/49–51.

COCCONEIS BALDJIKIANA Grun.

Sch. At., 190/7–10.

Although Cleve's contention that this robust species is merely a variety of the variable *C. scutellum* E. may be correct, I think the position of Schmidt in the above reference is commendable, namely, to leave this form where Grunow places it, especially as it differs materially from the type form of *C. scutellum*. This diatom has hitherto been considered a subtropical marine fossil species.

COCCONEIS COSTATA Greg.

Greg. Glenshira Diat., 1/27; Moeb. Taf., 12/27; Sch. At., 189/6–8.

The union of *C. costata*, *C. extravagans* Jan. and *C. imperatrix* A. S. as found in Cl. Nav. Diat., II, p. 189, is doubtless a matter of individual opinion. If we take Gregory's type form, as clearly shown in the first reference above, the large and dissimilarly marked *C. extravagans* and, more so, *C. imperatrix* are a very poor combination. In fact, here as elsewhere, Cleve in his valuable work on the Naviculoid Diatoms, becomes obsessed with a desire for condensation in taxonomy by obliterating as species all similar

forms. But confusion rather than simplicity sometimes results. Thus he adds to the foregoing Grunow's *C. pacifica* in Reise Novara, 1/10, and in Sch. At., 189/23, joining it to *C. imperatrix, Janischii, C. exoptata, C. praestans*, all grouped as *C. costata* var. *pacifica*. Neither Cleve nor anybody else can write out a species description to cover this hodge-podge. It is easier and better to retain these species as separate, while recognising their general resemblance,—a mental attitude that is necessary in very many well established diatom species.

Cocconeis distans Greg.

Greg. Diat. Clyde, 9/23; Sch. At., 193/29, 30, 32, 36, 37.

Whatever uncertainty there may be as to the union of the former species with *C. scutellum*, the union of this one with that species is wholly unacceptable. Such a combination would obliterate all workable boundaries from Ehrenberg's species.

Cocconeis extravagans Jan.

Sch. At., 189/28–32

The tendency of *C. extravagans* to produce malformations, mentioned by Schmidt, has been fully confirmed in these researches. More than half of the specimens found were more or less abnormal. See the remarks under *C. costata*.

Cocconeis Gautieri V. H.

See *C. antiqua* T. Br.

Cocconeis imperatrix A. S.

Sch. At., 189/10–15.

See remarks under *C. costata*.

Cocconeis litigiosa V. H.

See *C. Schuettii* V. H.

Cocconeis nitidula n. sp. Pl. 3, fig. 7.

Upper valve marked with subrectangular blotches, each having a dot in the middle like those on the dissimilar species *C. Grevillei* var. *regalis* as figured in Perag. Diat. France, 4/25–26. It somewhat resembles the much coarser *Raphoneis nitida* (Greg.) Grun., especially as it is figured in Perag. Diat. France, 83/32; also the questionable var. of *C. dirupta* as it is figured in V. H. Syn., 29/15. It is however impossible to consider this and any of the foregoing as the same. Its average length is 0·038 and width 0·027 mm.

Cocconeis paniformis Br.

Sch. At., 189/16–19.

This species stands or falls with *C. imperatrix*, and *C. extravagans* as valid species or mere varieties of *C. scutellum*. One should compare them with the type of the latter as it is given in Sch. At., 190/17, where there is no trace of a stauros.

Cocconeis Schuettii V. H.

V. H. Belgica, 2/28–29.

A very similar form, figured, but not named, in Sch. At., 195/2, is called *C. Schmidti* Hust. in that author's Deutsch. Sudpol. Exp., 1901–1903, p. 587. The forked tips of the angular hyaline area around the ends of the raphe, shown by Schmidt, should not alone justify the forming of a new species separate from Van Heurck's; nor the dim hyaline line parallel to the rim; as I have several specimens in which this latter mark is most obscure, and some in which it is wholly absent. So unique a diatom coming from the Antarctic, the locality of Van Heurck's species, and so closely resembling it, should be separated from it only on very strong grounds, which Husted does not make evident. It is also to be noted that Schmidt's specimen came from Santa Monica, Cal., presumably from the fossil deposit located there.

A species close to the foregoing and probably identical is the earlier named *C. Wienckensis* Petit, an Antarctic form described in Ant. Exp. Franc., 1903–1905, p. 2, 1/1. Included in this species is var. *litigiosa* (V. H.) which Van Heurck suggests may be a variety, although he gives it specific rank.

CORETHRON *Cast.*

Corethron criophilum Cast.

Castr. Chall. Exp., 21/12, 14, 15; Gran. Nord. Plank., p. 57, fig. 70.

This is a frequent, but not at all abundant diatom in the Antarctic. My specimens are mostly somewhat larger than the type.

Corethron inerme Karst.

Karst. Valdivia, 13/11–17.

Without careful study of actual specimens, one is forced to accept the specific differences between this and the next species, as they are stated by Karsten. This form seems to be merely a variety of the next species.

CORETHRON VALDIVIÆ Karst.

Karst. Valdivia, 12/1-10.

So far as my material is concerned, this is one of the most abundant of the plankton diatoms of the Antarctic.

COSCINODISCUS *E*

COSCINODISCUS ADUMBRATUS Ost. Pl. 4, fig. 1.

Ost., Ost-Gron. Diat., p. 461, 8/90; V. H. Belgica, p. 46.

This is the same diatom as the one called *C. atlanticus* Cast. var. in Chall. Exp., p. 158, 3/7. His type form is given on pl. 5, fig. 8. The two are not at all similar and Ostrup's name takes precedence. Castracane himself is doubtful of this assignment. A striking difference between his two forms is the evident border closely cross-lined with fine moniliform rows seen in 3/7. It also has a much smaller central area than the type, with the beading somewhat differently arranged, and, according to Rattray in Rev. Cosc., p. 30, it is much larger than the type. Although Rattray accepts this as a variety and gives to it the name var. *striatula*, Ostrup's claim that it is specifically different, should be accepted. In fact, Rattray has entirely overlooked Ostrup's report. It has some claim to be a minute variety of *Micropodiscus Oliverianus* (O'Me.) Grun. It also seems to be the same as *Halionyx undenarius* E. in E. Mikro., pl. 35a, group 21, fig. 12. It may be added that *C. Barbadensis* Grev. as figured in Trans. Mic. Soc., 1861, 4/9, also comes into this group of diatoms. The range of diameters in my specimens is from 0·053–0·075 mm.

COSCINODISCUS AFRICANUS Jan.

Sch. At., 59/24–25.

This small diatom is unique because of its lack of symmetry; it is only sparingly present in the Antarctic. Most of the species are dwarf forms, resembling fig. 25 in the above reference.

COSCINODISCUS ATLANTICUS Cast. var.

See *C. adumbratus* Ost.

COSCINODISCUS ANTARCTICUS Cast.

See *C. impolitus* Ratt.

Coscinodiscus asteroides T. & W. Pl. 4, fig. 2.

T. & W. Diat. Hayti, 3/2.

The specimens found were without the ring of light spots encircling the centre, which is emphasised in the species name *asteroides*. They are due to depressions in the surface of the valve which, being beyond the focus of the adjacent tissue, gives them a star-like resemblance. This phase of the species also occurs in the fossil Maryland deposit known as Nottingham earth. The species is rather close to *C. Argus* E. It was found only in one gathering No. 27 of the Australasian Antarctic material. It is essentially a subtropical form,—the two fossil deposits where it has previously been discovered, Maryland and Hayti, both being subtropical marine.

Coscinodiscus asteromphalus E.

Sch. At., 63/12.

Here is to be included what Ehrenberg considered a separate species, but which is now generally made var. *omphalanthus*, as figured in Sch. At., 63/2.

Coscinodiscus centralis E.

E. Mikro., 18/39; 22/1; H. L. S. Type No. 91.

If resemblance had any solid basis for being an indication of relationship,—which at present it has not—it would show such between the present species and *C. concinnus* W. S. Both are slightly convex and with a markedly radial areolation; both have a cluster of cells at the centre so much larger than the adjacent areolation of the valve that this rosette is the most conspicuous characteristic; and both have two short club-shaped processes on the margin invariably set 2/5 of the circumference from each other. Those of *C. centralis* are very small and were first discovered by Grove, but they are always discernible. See remarks under *C. concinnus*.

Coscinodiscus Chunii Karst.

Karst. Valdivia, p. 86, 7/10.

My specimens have much more inconspicuous processes, eight or nine of them, located on, not near, the border, and therefore not agreeing with Karsten's evidently idealised figure. In these respects it somewhat resembles *C. transversalis* Karst. in Valdivia, 5/2, but it is much coarser, shows no trace of the spiral lines of this latter species, and has no minute spines between the evident marginal processes. The two mechanically drawn figures, and especially the confusion caused by the drawing of chromatophores in many of Karsten's illustrations, make satisfactory identification very difficult. He gives as the diameter of this species 0·62–0·128 mm. The range of those I found was 0·92–0·154. They were found only in sample No. 26 of the Australasian material but were quite abundant there.

COSCINODISCUS CIRCUMSCRIPTUS n. sp. Pl. 4, fig. 3.

Valve circular, flat; markings of radiating rows of small, closely set beading, imperfectly fasciculate, all the rows slightly tortuous until near to the rim; central area minute, beaded, bordered by an irregular hyaline circle; a pronounced border next to rim, formed by a band of approximate cross-lines or bars, not replacing, but coincident with, the beading which continues outward to the rim; rim narrow, evident finely cross-hatched. Diam. 0·091 mm. Found in Australasian Antarctic material, No. 3 and No. E.

This species distantly resembles *C. circumdatus* A. S. in Sch. At., 59/3, so far as its border is concerned; also *C. corolla* A. S. in Sch. At., 58/32; also *C. hyalinus* Grun., in F. Jos. Land, 3/28, in which a row of strong apiculi crossing its " broad hyaline border " simulates the cross-barred border of this species.

COSCINODISCUS CONCINNUS W. S.

Q.J.M.S., 1858, 3/12; Prit. Inf., 589; H.L.S. Type No. 163.

As noted above, this species is sometimes confused with *C. centralis* E., but is generally very much larger and decidedly finer in its markings. The prevalent forms in the Antarctic are a little coarser than the type forms, and therefore seem to approach *C. centralis*.

COSCINODISCUS CONTENDENS n. sp. Pl. 4, fig. 4.

Valve quite convex, completely covered with relatively large and closely set beading in quincunx order, not becoming smaller toward the border; no central area or rosette; fine hair-like apiculi crowded in two or more rows near the border, the latter evident but its inner edge indistinct because of the superimposed rows of apiculi which cover it. Diameter 0·026 mm.

This very minute species is easily confused with other inconspicuous forms or passed by as dwarf specimens of larger species. Its two most prominent characteristics are its very closely set quincunx beading and the fringe of fine apiculi close to the rim. Found only in Australasian sample No. 112–113.

COSCINODISCUS CUNEISTRIATUS n. sp. Pl. 4, fig. 5.

Valve circular, very slightly convex, marked with closely set lines of very minute beads arranged radially in fascicles which are somewhat wedge-shaped near the border or reversed bottle-shaped; between these are interpolated smaller wedge-shaped markings; no central area or rosette; marginal processes obscure or wanting; rim a mere line. Diameter 0·175–0·020 mm.

I named this principally to identify an interesting specimen which is possibly somewhat abnormal and therefore may be a malformed example of some other species. In that view it might belong to *C. Chunii*, which occurs in the same gathering. It seems to have mere traces of the six to eight marginal bars which are so prominent in this last named species. However, it is not areolate but beaded. It is well also to compare this with the figure of *C. Whampoensis* Grove in Ratt. Rev. Cosc., 1/24. But Rattray says that the markings of this latter are hexagonal, that it has an elevated ring between the centre and circumference, and that it has apiculi, all of which disagree with the present species.

Coscinodiscus curvatulus Grun.

Sch. At., 57/33–35.

Rather common in the Antarctic in many of the dredgings.

Coscinodiscus decipiens Grun.

See *C. pectinatus* Ratt.

Coscinodiscus denticulatus Cast.

Castr. Chall. Exp., 3/8.

The diameter of my specimens ranges from 0·190–0·232 mm. They were found in a number of gatherings of both the Australasian and the Shackleton Expeditions.

Coscinodiscus elegans Grev.

Mic. Jour., 1865, 1/6; Sch. At., 58/7.

This diatom is recorded from the Antarctic by Van Heurck in his Belgica, 12/160, but is there misnamed *C. margaritaceus* Cast. Although neither my specimens nor Van Heurck's figure agree closely with Castracane's figure, Chall. Exp., 18/3, that also is probably only a variety of Greville's species. In fact, Rattray refers it to *C. elegans* in Ratt. Rev. Cosc., p. 137.

Coscinodiscus elegantulus Grev.

Sch. At., 58/4–5; Trans. Mic. Soc., 1861, 4/8.

This minute diatom is quite abundant in many of the Antarctic gatherings, especially in No. 53 of the Australasian material.

Coscinodiscus excentricus E.

Sch. At., 58/46–49.

Coscinodiscus fimbriatus-limbatus E.

E. Mikro., 19/4; Sch. At., 65/3.

This diatom undoubtedly resembles varieties of *C. marginatus* E. and is united with it by Rattray in Rev. Cosc., p. 61. It is, however, a much smaller diatom and invariably has a narrow rim, not at all agreeing with Ehrenberg's concept of *marginatus*. Grunow, in his Diat. F. Jos. Land, p. 72, recognises this species as distinct, as does also Schmidt in his Atlas, 65/3–6. He also gives a figure, pl. 62, fig. 1, which seems to be the same diatom but does not name it, thereby implying that it does not suggest to him *C. marginatus*, of which he gives many figures. Diameter of my specimen is 0·086 mm.

Coscinodiscus impolitus Ratt.

Ratt. Rev. Cosc., p. 453; Castr. Chall. Exp., 12/10.

Castracane's name, *C. antarcticus*, was pre-empted by Grunow in F. Jos. Land, 3/23. Consequently Rattray substituted the above name. Certain varieties of this diatom are hardly to be distinguished from *C. lentiginosus* Jan.

Coscinodiscus Janischii A. S.

Sch. At., 64/3–4.

The specific integrity of this diatom is practically destroyed by uniting it with *C. arafurensis* Grun., as is done in Ratt. Rev. Cosc., p. 96. The latter is finely illustrated in Jan. Gaz. Exp., 4/3, 5, and is much nearer to *C. praetextus* Jan. and *C. fulguralis* Br., as shown in Espec. Nov., 21/6. There is no excuse for confusing it with the present species.

Coscinodiscus kryophilus Grun.

Grun. F. Jos. Land, 3/21.

There is no doubt that this and the next species are difficult to keep separate. Rattray says that *C. kryophilus* has areolate markings and *lentiginosus* beaded markings, and that *kryophilus* has a prominent marginal process and *lentiginosus* a very minute marginal process. But Grunow suspects his species may be an Arctic variety of *lentiginosus*, which is undoubtedly a very variable species.

Coscinodiscus lentiginosus Jan.

Sch. At., 58/11; Jan. Gaz. Exp., 4/11; 5/7.

This species is one of the most abundant in most of the gatherings from the Antarctic examined for this report, and shows great variability both as to size and shape. In examining hundreds of specimens all satisfactory lines of demarcation

between this and the former species disappear. Even the difference in the size of the apiculi has no basis in fact, every gradation being discovered in the same gathering. But *lentiginosus* is always figured and considered to have pallid blotches upon the valve, especially when the specimen is dry and slightly out of focus, and these are never observed in good specimens of *C. kryophilus*. If eventually the two are proven to be variants of each other, the name given by Janisch on October 15, 1878, will replace that given by Grunow in 1884. Both names are provisionally accepted in this paper.

Coscinodiscus leptopus Grun.

Sch. At., 59/26–28.

The well developed marginal process and the large size of the valve are the only distinctions between this and *C. lineatus* E. Rattray, who shows a fondness for combining species of this genus, accepts this one as valid. I admit the name here, but remark that it may be easily classified as a variety of Ehrenberg's earlier species. Schmidt, in the above reference, shows the marginal process clearly, but curiously claims that it agrees in that respect with Ehrenberg's type figure of *C. lineatus* in Mikro., 22/6, in which there is no trace whatever of such a process.

Coscinodiscus Lewisianus Grev.

See *Cestodiscus Lewisianus* (Grev.) Mann.

Coscinodiscus lineatus E.

E. Mikro., 22/6; Sch. At., 59/29–32, not 26–28.

See remarks under *C. leptopus*.

Coscinodiscus marginatus E.

Sch. At., 62/2–6 (not fig. 1).

This species is widely distributed and very variable. Its areolation is coarse and the hexagons are strongly marked with a central bead or blotch. The margin is especially prominent (whence it is named) and coarsely cross-barred. It ranges through many differences in size, but even small specimens show the coarseness and strong margins of the type. Rattray seems to have been over-impressed by its variability and has grouped under this name too wide a diversity of forms. In contrast to this tendency, Schmidt and some other authors have named certain undeniable specimens of *C. marginatus* as *C. robustus* Grev. This latter diatom should be left out entirely, not only from this group, but from this genus. We have no clear idea of what Greville's species really was, for the original type specimen given to him by Hardman is now lost, and two specimens marked by Greville as *C. robustus* are evidently *C. marginatus*. It is

certain that, if we judge by the fine figure of *C. robustus* in Trans. Mic. Soc., 1866, 1/8, drawn by the master delineator, Tuffen West, we have a clear case of an *Endictya* and not of a *Coscinodiscus*. To give a strength to this, I have found repeatedly exact duplicates of Greville's illustration in the fossil marine material from Monterey, Cal., the locality where Hardman obtained the type specimen which Greville named. They are ideal examples of the genus *Endictya*.

COSCINODISCUS MINIMUS Karst. Pl. 4, fig. 6.

Karst. Valdivia, p. 78, 4/8.

The specimens agree in size and general aspect with the above. There is, however, a difference as to the margin and a photograph is therefore supplied to illustrate this. A number of strong processes evenly spaced on the inner side of the wide rim, and lines from each of these, run outward across the rim, but are very obscure, not at all as they are represented in Karsten's figure and description. This species resembles somewhat *C. gracilis* Karst. in Valdivia, p. 78, 3/4, which the author admits, is very similar to this species. It is possible that *C. minimus* and the two foregoing species are variants of one species. The name *C. minimus* was earlier applied by Schuman to what Rattray claims is *Cyclotella* (Rev. Cosc., p. 152).

Karsten gives diameters from 0·016–0·023 mm.; mine run from 0·018–0·029.

COSCINODISCUS NODATUS n. sp. Pl. 4, fig. 7.

Valve circular, barely convex until close to the margin, then more so; its markings strongly excentric, consisting of nine broad and pronounced fascicles, all radiating from a minute subcentral ring, all composed of heavy, strictly parallel, costal lines (not beaded rows), joined to each other at uneven intervals by cross lines; the fasciculate lines ending close to the rim in irregular tortuous tips, which thereby produce an apparent outer band; rim narrow, hyaline. Diameter 0·082 mm. Found only in Australasian Expedition dredging No. 26, and there scarce.

This is a very anomalous member of the present genus and has almost equal claim to a place in *Stictodiscus*, resembling as it does in its interlacing lines *S. Eulensteinii* (Grun.) Cast., as figured in Chall. Exp., 1/7 and in T. & W. Diat. Hayti 5/12; also to a less extent *S. Buryanus* Grev. in the latter work at 5/1–3. But these have a definite border of beads, their radiating lines are subordinate to the other markings, none are excentric, and the fasciculate arrangement, so strongly emphasised in this species, does not appear on any *Stictodiscus*. Its individuality almost calls for a new genus to accommodate it. All its affinities are subtropical or tropical. Original *Stictodiscus Eulensteinii* came from Nankoori, those figured by Cast. from Java and Philippines and those by T. & W. from Hayti.

Coscinodiscus nodulifer A. S.

Sch. At., 59/20–22.

Coscinodiscus Normanii Greg.

Sch. At., 56/10, misnamed; Ratt. Rev. Cosc., p. 500; Q.J.M.S., 1859, 6/3; Sch. Nord. See, 3/41.

In Gregory's type figure, as Rattray points out, the fascicles are greatly over emphasised by retouching. The name given by Schmidt in the above references is replaced by Rattray, as *fasciculatus* was pre-empted by O'Meara. The fascicles are obscure in all of my specimens, and perhaps are generally so, for Van Heurck in his Synopsis, 131/1, represents them as barely distinguishable.

Coscinodiscus oculus-iridis E.

Sch. At., 63/4, 6.

This species may well be taken as a delicate form of *C. asteromphalus* and is so classified by some writers. A somewhat similar diatom is sometimes placed under the above with the variety name *pacifica* Grun. It is better to classify this as *C. pacificus* Ratt., which see.

Coscinodiscus pacificus Ratt.

Grun. F. Jos. Land, p. 77; Sch. At., 60/13, no name.

I have found this in a living state in Monterey Bay, Cal., not in the fossil material from that place.

Coscinodiscus Payerii Grun.

Grun. F. Jos. Land, 3/12, 13.

Fig. 15 in the above reference hardly seems to belong to this species.

Coscinodiscus pectinatus Ratt.

Sch. At., 59/18, misnamed; V. H. Belgica, p. 46, 12/169, misnamed.

Rattray in Rev. Cosc., p. 519, says that *C. decipiens* Grun. used in the above references is pre-empted and he therefore substitutes the name here given. Compare V. H. Syn., 91/10, a form with beaded not areolate markings. Van Heurck is hardly justified in uniting with this species *C. antarcticus* Grun. His figure, Belgica, 12/169, agrees with that in Sch. At., 59/18, and is, therefore, as he states, equal to *C. pectinatus*

Ratt. But their comparison with Grunow's own figure of *C. antarcticus* in F. Jos. Land, 4/23, certainly justifies Rattray in considering that form as different. Rattray includes here Sch. At., 59/19, as well as 59/18. They are not alike and Schmidt himself questions their union. I have samples of both from the Australasian material, No. 27. We have the option, therefore, of assuming that the species is very variable or of giving to figure 19 a new name. Rattray defines this species with areolation that increases from the centre and then decreases toward the margin, thus agreeing with Schmidt's figure 19, but not figure 18, nor with V. H. Syn., 91/10. There is no perceptible increase from the centre outward in any of the specimens I have found.

Coscinodiscus polygonus Cast.

See *Actinocyclus bifrons* (Cast.) Mann.

Coscinodiscus polyradiatus Cast.

Castr. Chall. Exp., p. 161, 3/4.

My specimen shows that the transverse striæ on the border are forked at their outer ends. No such arrangement is indicated in the above figure. Castracane gives no measurements for this diatom, nor is it referred to in Ratt. Rev. Cosc. The diameter of my specimen is 0·063 mm. It comes from approximately the original locality of the type specimen, being found in sample No. 56 of the Australasian material.

Coscinodiscus praetextus Jan.

Jan. Gaz. Exp., 3/4.

What appears to be the same diatom is called *C. fulguralis* Br. in Espec. Nouv., 21/6. If they are indeed the same, the name by Janisch is earlier, 1888–1889, than that of Brun, 1891. This also would imply that we have here another subtropical species. Brun's original specimen came from the fossil bed in Sendai, Japan, and he also records it from the Indian Ocean. No record of the locality of the Gazelle specimens is available.

Coscinodiscus radiatus E.

E. Mikro., 19/1; 22/3; Sch. At., 60/5–6.

In a living state this is a very cosmopolitan species and naturally affords a great many varieties. Its first appearances were in fossil deposits and these of a subtropical character such as Barbados, Maryland earth, Oamaru, New Zealand, Santa Monica, California, Oran, Africa, etc.

Coscinodiscus reniformis Cast.

Castr. Chall. Exp., 12/12; Jan. Gaz. Exp., 1/1–5; Sch. At., 140/17.

Although this is a striking form of this genus, it should not be made into a new genus, as was done by Janisch and followed by Schmidt in the two references above. It is there called *Stoschia admirabilis* Jan. In every particular but outline, it has the true *Coscinodiscus* characters; slightly convex valves, areolate and radiate marking, no horns, spines or other processes, no pseudo-nodule or other ocelli, and a typical *Coscinodiscus* girdle. To put such emphasis on its uniform outline as to change its genus would be to demand that other reniform diatoms should be separated from non-reniform species with which they are now classified. See, for example, *Surrirella reniformis* Grun., *S. Neumayeri* Jan., *S. Bertillonii* Mann, etc. I therefore feel that Rattray and De Toni are right in retaining the original name given above.

Coscinodiscus (symbolophorus var.?) signatus n. sp. Pl. 4, fig. 8.

Valve circular, minute but massive, very convex; markings of heavy beading, imperfectly radial, the entire valve being divided into four sectors, the middle of each forming a wide fascicle of 8-9 rows of parallel beading, little if at all smaller outward; an evident hyaline central area, somewhat quadrate, at the four angles of which are four prominent raised nodules or blunt erect spines; no marginal band or marginal processes. Diam. 0·048 mm. Found only in Australasian material No. 27, there scarce.

The heavy black border in the illustration results from a double girdle surrounding the valve and out of focus because of the valve's great convexity. A similarity between this diminutive, heavy diatom and *C. symbolophorus* Grun. is evident. Abundant specimens of the latter for comparison occur in most of the Antarctic material. The two contrast strongly under the microscope, and I therefore think it worth while to illustrate this form. If the two are specifically the same this may be a winter resting phase of Grunow's species, which supposition is strengthened by the double girdle above mentioned.

Coscinodiscus stellaris Roper.

Q.J.M.S., 1858, 3/3; Castr. Chall. Exp., 3/2 (not 5/9).

There is considerable similarity between this species and the later named *C. symbolophorus* Grun., and some authors make the latter a variety of this species. Although this is possible it is not advisable. Grunow's species is much larger, much more coarsely beaded, and shows a more pronounced fasciculate arrangement; and its star-like central scar is more due to interference in the beading of the valve than to radiating ridges, which are responsible for the star in *C. stellaris*. It seems best, therefore, to keep these two separate. Typical specimens of both occur in the Antarctic, and in many gatherings are very abundant.

COSCINODISCUS SUBLINEATUS Grun.

Grun. F. Jos. Land, 4/21–22; Sch. At., 138/7.

Grunow suspected this diatom might be a variety of *C. excentricus* E. and so notes it in brackets, but there is ample ground to doubt this. The specimen figured by Schmidt in the above reference came from the subtropical fossil deposit at Oamaru, New Zealand. It varies somewhat from the type form, having coarser markings and six to seven minute apiculi at the margin. Only two specimens were found in this investigation, both in the Shackleton Expedition, No. G. Their diameters were 0·051 and 0·053 mm.

COSCINODISCUS SUBTILIS E.

Sch. At., 57/11–16.

This is one of the most prolific and widely distributed of diatoms both geographically and geologically. It naturally affords, therefore, many variations. This has led Rattray to include in it several forms that I think should be otherwise assigned, as the figure in Grun. F. Jos. Land, 3/26, which is an unmistakable *C. denarius* A.S., as well as several unnamed figures in Schmidt's Atlas.

COSCINODISCUS SUSPECTUS Jan.

Sch. At., 59/2.

The locality given for the type is San Francisco, Cal. It resembles Karsten's *C. Chunii* in its areolation, but it is without the six or more rod-like processes set equidistant around the margin, which are found in the latter. Schmidt's figure represents a diatom of 0·103 mm. My specimens range from 0·098–0·119 mm. They were found in two gatherings of the Australasian material, No. 26 and No. 112–113.

COSCINODISCUS SYMBOLOPHORUS Grun. Pl. 4, fig. 9.

Grun. F. Jos. Land, 4/3–6; Sch. At., 138/1–3.

As was stated under *C. stellaris* above, this diatom is sometimes made a variety of the latter, a condensation which is not here favoured. Most of the specimens found in the Antarctic material were more convex than those given by Grunow, and in most cases one valve was more convex than the other. The convexity is so great that they might well be classed as *Podosira*, but the angular hyaline central area of 3–4 arms, which crudely represents a star, is exactly as in the type form. It seems as if there should be included here the figure in Castr. Chall. Exp., p. 158, 5/9, which the above author considers a variety of *C. stellaris*. He gives, however, a true figure of the latter in pl. 2, fig. 3, the markings of which are decidedly different, as well as the central star. The species was originally discovered in the Antarctic by Sir J. D. Hooker and named

C. symbolophorus Grun. Rattray gives for this species a range of diameters from 0·085–0·175. My specimens range from 0·050–0·065. It is exceedingly abundant in Australasian material, especially in Nos. 24 and 26. I here give an outline of the girdle view of this diatom to show the great convexity of my specimens.

COSCINODISCUS TRANSVERSALIS Karst.

Karst. Valdivia, 5/2.

My specimens seem to be very close to that of *C. Chunii* Karst.

COSCINODISCUS TUMIDUS Jan.

Jan. Gaz. Exp., 3/6; Sch. At., 59/38–39.

This diatom has a mere trace of from six to eight processes on the margin. The centre is decidedly tumid.

COSCINODISCUS UNDULOSUS Mann.

Mann Alb. Diat., p. 259, 49/1.

The type forms of this diatom were found in Bering Sea and had a range of diameters from 0·051–0·066. The one found in the Antarctic had a diameter of 0·058 and agreed exactly with the type in form and marking.

DACTYLIOSOLEN *Cast.*

DACTYLIOSOLEN ANTARCTICUS Cast.

Perag. Rhizo., 13/7; Karst. Valdivia, 9/10.

Heiden in his Deutsch. S. Pol. Exp., p. 510 and 511, claims that *D. levis* Karst. is only a local variation of the above species, and on pl. 8, fig. 163, he shows a typical form of this species united with the form of Karsten's species in the same chain, in fact, in part of the same diatom. In other words, this is only a local variation in marking, and the two are practically identical. It may be added that he proves the same thing regarding Karsten's *D. borealis*.

DETONULA *Schuett.*

DETONULA CYSTIFERA Gran.

Gran Nord. Plank., p. 21, fig. 19.

DETONULA SCHRODERI (Berg.) Gran.

Gran Nord. Plank., p. 22, fig. 21.

DITYLUM *Bail.*

Ditylum Brightwellii (West) Grun.

Trans. Mic. Soc., 1860, 8/1, 5, 8; Meun. Micro. Flam., 9/27–33.

This is frequently a very abundant diatom in certain warmer waters. In the Antarctic I have found it widely distributed but, as a rule, rather scarce in numbers.

Ditylum intricatum (West) Grun.

Trans. Mic. Soc., 1860, 7/5; V. H. Syn., 114/2.

EUCAMPIA *E.*

Eucampia antarctica (E.) Mann.

E. Mikro., pl. 35a, group 21, fig. 15, and group 22, fig. 15; Prit. Inf., 11/54; Grif. & Henf. Mic. Dic., 25/3.

This abundant antarctic diatom is a true *Eucampia* and is the same as *E. balaustium* Cast. in Chall. Exp., 18/5–6 and V. H. Belgica, 8/111–118. It is also the same as *Hemiaulus ambiguus* Jan. in Jan. Gaz. Exp., 20/30, and V. H. Belgica, 8/110, but all of these agree perfectly with the *Hemiaulus antarcticus* of Ehrenberg in the above references. The two figures by Ehrenberg represent the girdle views of valves intermediate in the chain, and correspond to Cast. Chall. Exp., 18/5–6, and V. H. Belgica, 8/115. The figures in Prit. Inf. and Grif. & Henf. Dict. are exactly like Cast. Chall. Exp., 21/9, 13, unnamed, and V. H. Belgica, 8/110–112, and also the two outer valves of his fig. 118. No one can compare these illustrations without seeing they represent the same species of *Eucampia;* still more, the hundreds of specimens of this prolific diatom examined for this report leave no doubt of the foregoing statements.

Eucampia balaustium Cast.

See *E. antarctica.*

Eucampia cornuta (Cl.) Grun.

V. H. Syn., 95/5.

Eucampia zodiacus E.

Sm. Brit. Diat., II, 60/299; V. H. Syn., 95/17–18; 95 bis/2; H. L. Sm. Type No. 653.

This is the type species of the genus and its poetical name is very descriptive. It is only moderately frequent in the gatherings examined for this paper and is far outnumbered by *E. antarctica.* Most of the specimens are deformed in a similar way to those illustrated in pl. 3, figs. 8–9 of this report.

EUPODISCUS *E.* char. emend. Ratt.

EUPODISCUS RADIATUS Bail.

V. H. Syn., 118/1–2; Mic. Jour., 1860, 5/10, misnamed; H. L. Sm. Type No. 164.

The above genus, of which this species is practically the type, was constituted by Ehrenberg in 1844, but was made up mainly of a lot of *Aulacodiscus* forms and was therefore abandoned. To this I agreed in my Albatross Diatoms. But unquestionably the genus is needed, for there were a few remnants left over which could not be assigned to *Aulacodiscus* nor to any other genus. The ocelli are never extended into horns as in *Aulacodiscus*, but are merely rings slightly or not at all raised above the surface of the valve. They show some relationship with the genus *Auliscus* and the subject of re-establishing *Eupodiscus* is taken up by Rattray in his Revision of that genus, p. 53. It is, however, quite distinct, as he there points out. It contains only four or five valid species, but is sharply marked from all the other round forms of diatoms.

FRAGILARIA *Lyng.* (not E.).

FRAGILARIA ANTARCTICA Cast.

Castr. Chall. Exp., 25/12; V. H. Belgica, 3/46–48; Karst. Valdivia, 17/7.

This species is one of the best marked in the antarctic diatom flora. At the same time it is enormously prolific. It varies considerably in size and outline ranging from a broad blunt oval to a long lanceolate form with sharp apices. Its unique marking,—double rows of beads separated by transverse costal lines,—marks it as sharply distinct from anything else.

FRAGILARIA CYLINDRUS Grun.

Grun. F. Jos. Land, 2/13; V. H. Belgica, 3/43.

So far as illustrations are concerned, there appears to be no specific difference between Van Heurck's figure given above and *F. linearis* Cast. But one must accord to Van Heurck the belief that he showed his usual care in naming his specimens. The present species is, as the name implies, quite convex and linear, so that in girdle view it resembles a cylinder. It has a peculiar mode of growth for this genus, namely, in loose fascicles or occasionally in zigzag chains. *F. linearis* and the other species grow normally in flat ribbons, as is seen in Castracane's illustration, Chall. Exp., 19/9. The present species was found abundantly in the Australasian gathering, No. 70.

FRAGILARIA LINEARIS Cast.

Castr. Chall. Exp., 19/9.

See remarks in the foregoing species.

FRAGILARIA OBLIQUE-COSTATA V. H.

V. H. Belgica, 3/38, 40.

The oblique directions of the cross lines, to which this species owes its name, I find to be extremely inconstant. In many cases it is difficult to detect, and there are some specimens having oblique lines at one end of the valve and perfectly transverse at the other. Leaving out this distinction, this species is too close to the next.

FRAGILARIA SUBLINEARIS V. H.

V. H. Belgica, 3/41.

This species is widely distributed and abundant in the Australasian material, less so in the gatherings made by the first Shackleton Expedition. A variety called *ambigua* is given in Perag. Ant. Exp. Franc., 3/4, which is a doubtful member of this species, as is implied by the varietal name given. It would easily form a new species.

GOMPHONEMA *Ag.*

GOMPHONEMA INTRICATUM K.

Sch. At., 206/1.

This diatom is included solely on the ground that it does sometimes flourish in brackish water. It is usually a fresh-water species and probably was accidentally present in the gathering, Austral. Antarct. Exp., No. E.

GRAMMATOPHORA *E.*

GRAMMATOPHORA ANTARCTICA Perag.

See *G. monilifera* T. & Br.

GRAMMATOPHORA ARCTICA Cleve.

See *G. monilifera* T. & Br.

GRAMMATOPHORA ARCUATA E.

Perag. Ant. Exp. Franc., 3/25.

This species is very infrequent.

GRAMMATOPHORA CHARCOTII Perag.

See *G. maxima* Grun.

GRAMMATOPHORA FLEXUOSA Grun.

V. H. Syn., 53 bis/22–23.

GRAMMATOPHORA ISLANDICA E.

V. H. Syn., 53/7.

As is suggested in the above reference, this diatom can be taken as a variety of *G. angulosa* E. It is, however, very much narrower both in valve and girdle view, and the septa are much more extended.

GRAMMATOPHORA MAXIMA Grun.

V. H. Syn., 53 bis/12–14; Perag. Ant. Exp. Franc., p. 71, 4/11.

No satisfactory reason appears, either in the illustration or remarks in the second reference above, to warrant the separation of *G. Charcotii* Perag. from Grunow's species. It is such a variety as is frequently found elsewhere in gatherings of *G. maxima*, somewhat more delicate and elongated than the type form and with very fine markings. As to the latter, De Toni in Syl. Alg., p. 754, says of *G. maxima*, "valde hyalina."

GRAMMATOPHORA MONILIFERA T. & Br.

T. & Br. Diat. Jap., p. 38, 7/9; Perag. Ant. Exp. Franc., p. 71, 4/12, misnamed; V. H. Belgica, 3/2.

It is certain that Peragallo's form is specifically the same as that of Tempere and Brun. Possibly Peragallo was unable to accept the name of a species found in the subtropical marine deposit at Sendai, Japan, for a similar one found in the Antarctic. But, as is brought out in this paper, this case is far from the only sample in which antarctic diatoms belong to the same species as subtropical fossil forms. The suggestion by Brun that his species may be a variety of Cleve's *G. arctica* is not good. Comparison of the above figures with that found in Cl. Diat. Spitz., 3/21, and V. H. Syn., 53 bis/3, shows that this arrangement is not advisable. We therefore have here combined *G. monilifera* and *G. antarctica*, but eliminated *G. arctica*.

GUINARDIA *Perag.*

GUINARDIA FLACCIDA (Cast.) Cl.

Gran Nord. Plank., p. 25, fig. 25; Castr. Chall. Exp., 29/4.

The remarkable similarity between the very long and imbricated girdle of this diatom and those found in the genus *Rhizosolenia* naturally led Castracane to place his new form in that genus. The valves, however, are radically different and imbricated

girdles are frequent in several genera of plankton forms. The specific name is well chosen, as this diatom is so nearly destitute of silica, that it is rarely seen in its cylindrical form. Gran's figure given above is poor, because, like all illustrations showing the cell contents, the true structure of the diatom frustule is practically lost.

HEMIDISCUS *Wall.*

HEMIDISCUS CUNEIFORMIS Wall.

Trans. Mic. Soc., 1860, p. 42, 2/3–4; Prit. Inf., p. 852, 8/22; H. L. Sm. Type No. 161.

Confusion seems to continue in diatom literature over the proper names of genus and species for this widely distributed diatom. Bailey's name, *Euodia gibba*, and that of Wallich, both appear to have been given in 1860, although Bailey's figure appears in the 1861 edition of Pritchard's Infusoria. I have never been able to find any valid reason for rejecting the far superior name given by Wallich for that given by Bailey, and I call attention to this confusion with the suggestion that Bailey's name be dropped.

HYALODISCUS *E.*

HYALODISCUS CICATRIX n. sp. Pl. 5, fig. 1.

V. H. Belgica, 13/171, no name.

Valve circular, very convex; umbilicus large, irregular, without sutural outline, its granulation coarse and obscurely radial; outside of the umbilicus the markings consist of somewhat coarse radial lines of beading imperfectly fasciculate, the beading being so dimly seen as to make the lines appear like striæ except under high magnification; rim robust, faintly cross-marked. Diameter 0·047. Diameter of umbilicus 0·030. This is probably the same diatom as indicated in the unnamed figure in the above reference. Van Heurck's specimen is somewhat larger, namely, 0·057, and the umbilicus is relatively somewhat similar. In some of my specimens and in the above illustration, the umbilicus is excentric in its position. That this central scar is not due to inclusion of air or any other accidental condition is shown by the fact that it is fully as evident in all dry specimens.

HYALODISCUS CREPITANS n. sp. Pl. 5, fig. 6.

Valve circular, slightly and evenly convex; umbilicus small, circular, not surrounded by a suture but clearly defined, its diameter about one-eighth that of the valve, coarsely and densely rugose; the rest of the valve marked with strictly radial rows of minute beads that become slightly smaller near the margin, the rows very closely set and not at all fasciculate; at the inner end of each of the shorter rows, interpolated

between the long ones, is an elongated hyaline spot like an exclamation point; these being very numerous and scattered over the entire valve surface produce an evenly distributed pyrotechnic effect, whence the specific name; rim narrow but strong, cross-barred with fine closely set lines. Found in only one gathering, Australasian No. 26, there fairly abundant. Diameter 0·182–0·301 mm.

Hyalodiscus Pantocsekii V. H.

V. H. Belgica, 13/107.

A strikingly peculiar member of this genus quite abundant in Australasian sample, No. 26.

Hyalodiscus radiatus (O'Me.) Grun.

O'Me. Diat. Kergue., 1/9; Grun. Diat. F. Jos. Land, 5/37; Petit, Trans. Roy. Mic. Soc., 1878, 14/7, misnamed.

There is no reason for the name suggested by Petit, as the heavy border and every convex valves which impressed him as different are not at all so.

Hyalodiscus subtilis Bail.

Bail. New Spec., 1/12; Prit. Inf., 5/60.

Hyalodiscus Van-Heurckii (Perag.) Mann. Pl. 5, fig. 3.

V. H. Belgica, 13/106, no name; Perag. Ant. Exp. Franc., 6/2.

It is impossible to assign this to *Podosira* as is done by Peragallo. Although that genus and *Hyalodiscus* probably merge into each other, a discussion of which is given in my Albatross Diatoms, p. 241 (but where *Podosira* was wrongfully preferred to *Hyalodiscus*), this present species is about as wide a departure from the *Podosira* type as could well be found. It is nearly flat, whereas *Podosira* valves are very convex; frequently hemispherical; it has a prominent umbilical area into which the radiating lines surrounding this area do not enter; and it lacks entirely the delicate beading and scattered dots or prickles so generally seen in *Podosira*. When dry, the valves are conspicuous because of their fine blue colour. Van Heurck's figure given above has an abnormally small umbilicus; in all my specimens it is prominent, as it is in Peragallo's illustration. The statement by Van Heurck that the somewhat ragged or worn appearance of the markings may be due to erosion is, I think, a mistake. All of my specimens show this, and they were plentifully scattered among other diatoms, in none of which was there any trace of erosion to be seen.

LAUDERIA *Cl.*

LAUDERIA ANNULATA Cl.

Cl. Phyto. Atlantic, 2/14, 15; Gran Nord. Plank., p. 23, fig. 22.

Gran's inclusion of this diatom under his *L. borealis* in the above reference is not justified. A comparison of the two will show wide differences. This species is, however, very close to that in Cast. Chall. Exp., 9/4, there called *L. elongata* Cast. The beading upon the cylinder is in fine double zigzag rows between the annular lines, as is shown in Sch. At., 180/47.

LAUDERIA BOREALIS Gran.

See the former species.

LAUDERIA GLACIALIS Gran (not Grun.).

Gran Nord Plank., p. 23, fig. 23; Cl. Diat. Baf. Bay, 2/17–20.

This diatom is united by Gran with *Podosira hormoides* var. *glacialis* Grun. I think this union is unfortunate. An examination of Grunow's remarks and illustration in F. Jos. Land, p. 108, 5/32, will show that there is little similarity between them. The same is shown by an illustration of Grunow's form in V. H. Syn., 84/3–4. Gran points out that the species of this genus all have a single marginal process similar to the one found in *Thalassiosira*, but it is hardly advisable to unite these two.

LICMOPHORA *Ag.*

LICMOPHORA ANTARCTICA Perag.

Perag. Ant. Exp. Franc., p. 70, 4/10.

The above author admits that his species is apparently like *L. Kamtschatica* Grun. in V. H. Syn., 46/5, but states that there is no valve view given there. Unfortunately the lack of any text reference by Van Heurck to that species leaves the question open. I am disposed to think the two figures adjacent in Van Heurck are of the same diatom, but in the absence of any proof Peragallo's name is here accepted.

LICMOPHORA BELGICA Perag.

Perag. Ant. Exp. Franc., 4/5–6.

This is suspiciously close to *L. Reichardtii* Grun. as given in V. H. Syn., 47/5–6, and is also so named in his Belgica, 3/51, but with a question mark. Peragallo's claim that the two are separate probably deserves acceptance. No locality is given for Grunow's species, but the assumption is that it is not antarctic.

LICMOPHORA LYNGBYEI (K.) Grun.

V. H. Syn., 47/15–21.

LICMOPHORA REICHARDTII Grun.

See *L. Belgica.*

MELOSIRA *Ag.*

This large and cosmopolitan genus contains subgeneric groups that differ somewhat in the shape of the individual diatoms when seen in girdle view. But they have a marked unity in that they all grow in strongly attached chains like long strings of beads, and are all circular in valve view. Some authors break up the genus and thereby greatly confuse its valuable distinction from other genera. De Toni, who has gone far in this respect (Syl. Alg., p. 1327) offers the following genera for members of this one : *Lysigonium* Link, *Gallionella* Bory, *Melosira* Ag., *Paralia* Heib. The last has the best claim for separation, but I believe that nothing is gained by these divisions. Some of the groups are without any trustworthy marks of difference, as e.g., *Lysigonium* and *Gallionella.*

MELOSIRA ALPHABETICA Mann nom. nov. Pl. 5, figs. 4–5.

V. H. Belgica, 7/95, misnamed.

Van Heurck naturally considered this unusually marked diatom to be a deformed specimen of some normal *Melosira.* His selection of *M. sol* E. is as good as any to fit this assumption. I have found it repeatedly in material remote in time and place from that of Van Heurck's specimen. The only conclusion possible under these circumstances is that it represents a true species. The name here selected refers to the resemblance of its marginal markings to letters in the Greek alphabet. Diameter 0·072–0·082.

MELOSIRA ANTARCTICA V. H.

V. H. Belgica, 7/94.

It is very close to *M. oamaruensis* Gr. St. as figured in Sch. At. 179/7. The radii are not interrupted but are continuous to the border. However, the question between what is a new species and what is a wide variety, is here one of personal preference. See remarks under *M. omma.*

MELOSIRA BORRERI Grev.

Sm. Brit. Diat., 50/1–8; V. H. Syn., 85/5–8; H. L. Sm. Type, 217.

I have found this exceedingly scarce in the Antarctic.

MELOSIRA CASTRACANEI Br.

Espec. Nouv., 22/9; V. H. Belgica, 7/101 ?

MELOSIRA DEBLOCKII V. H.

V. H. Belgica, p. 32, 7/93, 96.

MELOSIRA DEWILLDEMANII V. H.

V. H. Belgica, 7/98.

This is extremely close to *M. subhyalina* V. H., which see.

MELOSIRA HUNGARICA A. S.

Sch. At., 179/9–12.

Several specimens corresponding to the above illustrations are far too close to *M. Oamaruensis* Gr. St. as shown in fig. 7 on the same plate. It is not improbable that both of these are only variations of *M. antarctica*, as has been suggested under that species.

MELOSIRA OMMA Cl.

Sch. At., 179/23.

The confusion between certain species of this genus found together in several of the antarctic samples has been mentioned under *M. antarctica* and *M. hungarica*. There is room to doubt that the present species is anything but a phase of *M. sol*, perhaps an inner valve. In fact Peragallo in Ant. Exp. Franc., p. 87, 5/6–8, not only claims that this is *M. sol*, but shows a portion of the chain of diatoms in which he thinks it belongs. A similarity between this and *M. antarctica* V. H. is certainly striking, especially as both aspects are found intimately mixed in the same gatherings. Certainly the girdle view is that of *M. sol* as given in V. H. Belgica, 8/102. See remarks under *M. sol*.

MELOSIRA POLARIS Grun.

V. H. Belgica, 8/105; 8/104 misnamed; Grun. F. Jos. Land, 5/133.

This approaches some forms of *M. sol*.

MELOSIRA SIMPLEX n. sp. Pl. 5, fig. 6.

It is possible that this diatom is the same as *M. hyalina* Jorg. as given in Karst. Valdivia, 1/1, although my specimen is not hyaline, but is covered with a faint cross-hatching visible only under high magnification. If, however, the two are the same, a new name is necessary as *M. hyalina* has been twice pre-empted. Diam. 0·027, average. The ring-like girdle excludes it from the much larger and coarser *M. Borreri*, and its delicate and obscure marking from *M. distans*.

Melosira sol E.

V. H. Belgica, 8/102–104 (not 7/95).

It should be further stated regarding the confusion between this species and *M. antarctica* and *M. omma* that the girdle views of the others do not at all agree with that of the present species as given in Sch. At., 179/21, or the very carefully drawn figures in Karst. Valdivia, 1/3–6. It is therefore probable that both Van Heurck and Peragallo have given to the girdle view of *M. antarctica* the name of *M. sol.*

Melosira subhyalina V. H.

V. H. Belgica, 7/97; 8/99.

The above two figures differ in that the latter entirely lacks the marginal processes shown in the former. *M. DeWilldemanii* is certainly close to the type, though unlike the variety.

MICROPODISCUS *Grun.*

Micropodiscus Oliverianus (O'Me.) Grun.

Grun. F. Jos. Land, p. 79; V. H. Syn., 118/5; Ratt. Actino., p. 148; Cast. Chall. Exp., 4/4 (not fig. 7).

Several authors express dissatisfaction in assigning this diatom to the genus *Actinocyclus*. Its strikingly distinct border and the absence of a true pseudo-nodule are against the assignment. What Castracane accepts as a pseudo-nodule does not at all resemble that unique body, which is circular and has a distinct lens-like form. The process in the present species is long and rod-like, and the outer end is enlarged like the head of a nail. The fact that it is located near the rim of the valve has no significance. It much more closely resembles such marginal processes as occur on certain species of *Coscinodiscus*, like *C. leptopus* Grun., and on all members of the genus *Thalassiosira*. Both Grunow and Van Heurck have suggested the need of a new genus for this diatom, and Grunow has offered the above, *Micropodiscus*, which is here adopted. The name refers to the little foot or marginal process mentioned above.

NAVICULA *Borg.*

Navicula algida Grun.

Grun. F. Jos. Land, p. 56, 1/31.

Beside the type form, I have found a variety with a narrow but distinct hyaline stauros extending from the centre to close to the sides of the valve. The length of this variety is 0·065 which is slightly below the minimum recorded for the type form by Cleve in Nav. Diat. II, p. 40, namely 0·07.

NAVICULA ASPERA E.

Sch. At., 48/2–6, 8–9 (not fig. 7).

Quite a number of varieties of this widely dispersed and prolific species were found, the variety called *antarctica* in Perag. Ant. Exp. Franc., p. 59, 2/5, var. *oblonga* (Bail.) as in Sch. At., 48/16, and a variety that seems to be intermediate between this species and *N. clepsydra* Donk. as given in Sch. At., 48/39. There is some reason for retaining as a specific name the variety here called *oblonga*.

NAVICULA BOMBUS (E.) K.

Sch. At., 13/4–6; 69/30, misnamed; Sch. Nord See, 1/1, misnamed.

This diatom I found to be very scarce in the Antarctic.

NAVICULA BOTTNICA Grun.

Cl. & Grun. Arct. Diat., 2/32; V. H. Syn., 7/33.

NAVICULA CALIFORNICA Grev.

Sch. At., 3/16.

NAVICULA CANCELLATA Donk.

Donk. Brit. Diat., 8/4.

In addition to the typical form a variety was found similar to the unnamed figure in Sch. At., 46/40, and also near to that in Sch. Nord See, 2/36, both from Australasian material No. 50.

NAVICULA CRISTATA Perag.

See *N. Mauriciana* V. H.

NAVICULA DIRECTA W. S.

Sch. At., 47/4–5.

NAVICULA EUDOXIA A. S.

Sch. At., 8/39–40; 70/71; Sch. Nord See, 2/10, misnamed.

Schmidt corrects the last reference to *N. eudoxia*. Cleve in Nav. Diat., I, p. 83, places this under *N. contigua* A. S. as given in Sch. At., 8/43. Such a union is most confusing and unnecessary. Were it correct, the above name would have preference over *N. contigua*. Cleve adds to this unwarranted assignment the fantastic opinion that these are probably small and corroded specimens of *N. gemmata* Grev.

NAVICULA FRIGIDA Grun.

Jord. Prot. Plank., 7/21.

I found this diatom very scarce. Its length was 0·073 and width 0·017 mm.

NAVICULA INCURVATA Greg.

Donk. Brit. Diat., 7/4; Sch. Nord See, 1/10–11.

This diatom was found in only one gathering, No. 74, of the Australasian material.

NAVICULA JEJUNOIDES V. H.

V. H. Belgica, 1/12, 20.

NAVICULA LONGA (Greg.) Ralfs.

Sch. At., 47/6–10.

NAVICULA MAURICIANA V. H.

V. H. Belgica, 2/182; Perag. Ant. Exp. Franc., 2/11, misnamed.

No distinction between this and Peragallo's *N. cristata*, shown in the second reference above, can be drawn. The length given by Van Heurck is 0·075 and by Peragallo 0·100 mm., a difference well within the range of any *Navicula* species. Van Heurck's report was published in 1909, Peragallo's in 1921. I found only a single specimen, in Australasian material, No. 26. Its length was 0·094 mm.

NAVICULA NITESCENS (Greg.) Ralfs.

Sch. At., 7/38–41.

NAVICULA OCEANICA Karst.

Karst. Valdivia, p. 126, 18/4.

I am not certain that my specimens are this diatom. They are perfectly translucent like the above, and they agree also in general dimensions, being about in length 0·135 and width of frustule 0·092 mm. The girdle is plain. In two of the specimens measured they fail to show the difference in width noted by Karsten. This identification is therefore open to question.

NAVICULA PRAETEXTA E.

Sch. At., 3/31–34.

Only one specimen found, Australasian material, No. 26.

NAVICULA QUADRATAREA A. S.

Sch. At., 260/1–8, 12–17, 25–28, 30–38.

This extremely variable diatom, of which Cleve names six varieties, was originally named by Schmidt in 1868, *N. pinnularia*, but finally dropped by him as untenable and given the name recorded in his Nord See, 2/26 (1874). The unimportant variety called *antarctica* in Perag. Ant. Exp. Franc., 2/9, is the most prevalent form found in Australasian material. It is also essentially what Cleve calls *N. floridana* in his New Diat., p. 6, 1/10. One of the many varieties is given in Heid. S. Pol. Exp., 1/8, and there called *Stauroneis parallela* Heid.

NAVICULA RHOMBICA Greg. Pl. 5, fig. 7.

Greg. Trans. Mic. Soc., 1888, p. 38, 5/1.

This species stands out well from other *Naviculae* because of the distance of the outer ends of its stout raphe from the valve apices, and because of the flare of its delicate cross-beading on either side of the central area. However, it has some close relatives, like *N. Grevillei* Ag. and *N. Schuettii* V. H., which see. The present species is essentially a small diatom; Cleve gives 0·055–0·125; my specimens range from 0·049–0·087. A variety with its raphe ends unusually distant from the valve apices is figured in Heid. S. Pol. Exp., 4/84, and there named *Libellus* (*Navicula*) *adnatus* Heid. I have its essential duplicate from Australasian gathering, No. E; see pl. 5, fig. 7. The length of Heiden's specimen is given as 0·054; mine is 0·087. Type specimens occur in Australasian material, Nos. 16 and 22.

NAVICULA SCHUETTII V. H.

V. H. Belgica, 1/10; 1/9, misnamed.

It is difficult to state satisfactory reasons for separating either of the above from *N. rhombica* Greg. In fact, Van Heurck assigns that name to his fig. 9. It is, however, nearer his type form than the present species. The difference between these and *N. rhombica* is that they have proportionally finer and less diagonal beading, and the raphe ends are not so remote from the apices of the valve, nor do they terminate there and at the centre in large prominent beads. This species, if it be one, averages larger, reaching to 0·170. My own specimens are about 0·160, whereas my specimens of *rhombica* are 0·051–0·056.

NAVICULA SOBRINA Mann nom. nov. Pl. 5, fig. 8.

This is the "*Schizonema apiculatum* Ag., var. *intermedia* Grun." as figured in V. H. Syn., 16/4. Cleve rightly transfers this to the genus *Navicula*, but he unites it with *N. Grevillei* Ag. which cannot be commended. The latter is very broad with

different raphe ends and marked by lines of beading much more closely set and not so strongly radiating at the centre of the valve. The now generally discredited generic name *Schizonema* must be replaced by *Navicula*. The one distinction, namely, the inclusion of these and many other kinds of diatoms, in a gelatinous tube during a period of their life history is so inconstant and applies to so many other genera, that it has no distinctive value. But the two earlier names, above referred to, cannot be transferred to *Navicula*, as they are already used in that genus. I therefore find it necessary to give to this particular diatom a new name. It was found only in Australasian material, No. 70, length 0·069 mm.

NAVICULA SPECTABILIS var. OAMARUENSIS Grove. Pl. 5, fig. 9.

Sch. At., 204/15.

This diatom is figured because its union with the above species is open to question, as is the specimen figured in the above reference. It shows disturbing analogies with the extreme variety of this species shown in Sch. At., 2/31, with *N. genifera* A. S., fig. 2, on same plate, and with the variety of *N. Hennedyi* W. S. in Sch. At., 3/5. Undoubtedly the *Lyra Naviculæ* are hopelessly intertwined and specimens hereafter discovered will only increase the tangle.

NAVICULA STIGMOSA Heid.

Heid. S. Polar Exp., p. 613, 2/56.

This species differs from *N. controversa* Mann in Can. Arct. Diat., 1/7, chiefly in having on each side only two instead of three to four rows of beads. It is very common in the Antarctic, occurring in Shackleton material, No. E, and Australasian, Nos. 16, 69, D and E. All my specimens exceed the maximum size recorded by Heiden, length 0·058–0·091 and width 0·021–0·029 mm.; mine measuring length 0·103–0·148 and width 0·033–0·044 mm. His specific name has no warrant in the structure of this diatom.

NAVICULA TREVELYANA Donk.

Donk. Brit. Diat., 10/6; V. H. Syn., A/6.

NAVICULA TROMPII Cl.

V. H. Belgica, 1/16–18.

This very delicate diatom would easily be mistaken for a narrow member of the genus *Pleurosigma*.

NAVICULA VITREA Cl.

See *Pleurosigma vitreum* Cl.

NITZCHIA *Hass.*

NITZSCHIA AMPHIPRORA (Cl.) Grun.

Cl. Arct. Diat., p. 20, 4/18; Cl. & Grun. Arct. Diat., p. 81.

This closely resembles *N. bilobata* W. S., but is more delicate and with finer cross-lines. It also is similar to *N. Mitchelliana* Green. from which it differs chiefly in the carinal markings which are all short instead of both long and short as in the latter. Its length is 0·112 with 5·2 carinal lines in 0·01 mm. The figure in Perag. Ant. Exp. Franc., 3/23, called *N. Mitchelliana* var. *australis* certainly belongs to the present species rather than to *Mitchelliana*, if the two are distinct. Heiden in S. Pol. Exp., 7/146, gives a wholly erroneous keel view of a *Nitzschia* to which he assigns this name, it being *N. australis* Mann. See remarks under the latter.

NITZSCHIA AUSTRALIS (Perag.) Mann. Pl. 6, fig. 1.

Perag. Ant. Exp. Franc., p. 65, 3/17–18; Sm. Brit. Diat., 13/112b; 14/112b.

To make this a variety of *N. dubia* W. S., as is done by Peragallo, is an error. See V. H. Syn., 59/9–12, where a similar keel view of that diatom is given. The same is suggested in the above references to the type figure by Smith. In fact, Peragallo's own figure of *N. dubia* in his Diat. France, 70/30, shows that the two are markedly different. Peragallo records for his specimen, length 0·090–0·100 with width 0·010–0·012 and with 20 striæ in 0·01 mm. My specimens have length 0·098–0·110, width 0·012–0·015 and with 19–20 striæ in 0·01 mm. Heiden, in S. Pol. Exp., p. 662, 7/146, has evidently made the same mistake. See under the former species.

NITZSCHIA CHALONII V. H.

V. H. Belgica, 3/53–56.

NITZSCHIA DISSIPATA (K.) Grun., var. ANTARCTICA Perag.

Perag. Ant. Exp. Franc., 3/14.

This variety distinction has very little importance.

NITZSCHIA KOLAIZECKII Grun.

Mon. Mic. Jour., 1877, p. 173, 194/10; Sch. At. 349/38–39.

Van Heurck also found this specimen in the Antarctic. The original forms described by Grunow came from Honduras and Australia. It is probably, therefore, a normally subtropical species.

Nitzschia laevissima Grun.

Grun. F. Jos. Land, 1/66a.

Grunow says that the lines are finer than those on *Amphipleura pellucida*. This I have confirmed, as only by the finest lighting and most powerful lens are the lines visible.

Nitzschia longissima (Breb.) Ralfs.

V. H. Syn., 70/1–2; 70/3; 70/5, 7, 8.

The second reference above is what is called by Van Heurck, forma parva, and the third is what has borne the name of *N. closterium* (E.) W. S. The latter is frequently fresh-water, but indistinguishable specimens are very frequent in marine gatherings. It is only a diminutive and delicate phase of the present species.

Nitzschia marina Grun.

V. H. Syn., 57/26–27.

Antarctic specimens are large with a length of 0·198 mm. and over, and the beading of the transverse lines is more zigzag than in the type. Samples from two dredgings in the Gulf of California contrast with them strongly in this respect.

Nitzschia mediterranea Hust.

Sch. At., 331/22.

This differs from *N. constricta* (Greg.) Grun. as figured in V. H. Syn., 58/7, in having a band of much larger beading running longitudinally through the middle of the valve which is closely beaded, but appears in one focus to be areolate. This Hustedt considers to be a specific difference. The transverse lines on either side of this middle area are in finely punctate rows. Accidentally my single specimen has the exact length represented by Hustedt's figure in Schmidt's Atlas, namely, 0·078 mm. His type came from the Bay of Naples, hence this is another of the subtropical forms found in the antarctic diatom flora.

Nitzschia palea (K.) W. S.

V. H. Syn., 69/22b and c.

This is a fresh-water diatom and properly does not belong in this paper. It occurs in a gathering that came with the Australasian material and was obtained at Maitland, N.S.W. It is mentioned here because it is a curious modification of the normal *N. palea*, the valves being serpentine, like the well-known serpentine phase of *N. scalaris* W. S. found in the fossil deposit at Crane Pond, Mass. Its measurements are length 0·123, width 0·061 with 14·5 carinal beads in 0·01 mm. The transverse lines are extremely fine.

NITZSCHIA PUNGENS Grun.

Cl. Phytoplank., p. 24, 2/23; Gran Nord Plank., p. 130, fig. 175.

It may be questioned if this is not a *Synedra*, as the carinal markings, if present, are the same number as the cross-striæ and practically indistinguishable from them. Gran thinks it may be a delicate phase of *N. seriata* Cl. with acute apices.

NITZSCHIA SALINARUM Grun.

V. H. Syn., 67/12.

Van Heurck suggests that this may be a var. of *N. vitrea*, which see, the difference between the two being in the greater fineness of the lines of this species, namely, 28–30 in 0·01 as against 17–22 in 0·01 in *N. vitrea*.

NITZSCHIA SERIATA Cl.

Cl. Vega Diat., 38/75; Gran Nord Plank., p. 130, fig. 174.

NITZSCHIA VITREA Norm.

Cl. & Grun. Arct. Diat., p. 94, 6/106.

This is the form which Grunow calls var. *Kerguelensis*.

PLANKTONIELLA *Schuett.*

PLANKTONIELLA SOL (Wall.) Schuett.

Gran Nord Plank., p. 44, fig. 48; Wall. Trans. Mic. Soc., 1860, 2/1; Karst. Valdivia, 39/7.

This diatom was originally found in the Bay of Bengal and also in the West Indies. It is recorded by several authors from the Antarctic, but seems to be, in its affiliations, a subtropical species.

PLEUROSIGMA *W.S.*

PLEUROSIGMA ACUS Mann.

Mann P. I. Diat., p. 132, 29/4–5.

The deceptive general resemblance of this species to *P. intermedium* W.S. is discussed in the above reference. It is easily to be seen as only superficial when two specimens in the same gathering are compared, which is frequently possible in a number of the Shackleton samples. They are very easily separated on a dry strewing because

of the strong brownish colour of this species as compared with the pale straw colour of *P. intermedium*. This diatom is rigidly straight with sharp pointed ends and an entire absence of the lunate ridge around the outer ends of the raphe which is always observable in *P. intermedium*. By comparison of this species with typical specimens of the latter in H. L. Sm. Type, No. 405, from the original source of that species, namely England, these differences are readily noted. As doubt of the validity of my species, where one deals merely with the illustration, would be quite natural, I here offer these confirmatory statements.

PLEUROSIGMA ARCTICUM (Cl.) Mann.

Cl. Nav. Diat., I, p. 119; II, 1/3–4; Cl. Arct. Diat., p. 18, 3/16; Perag. Pleuro., 10/16.

This diatom was removed by Cleve and placed in *Gyrosigma*. The lack of necessity for this genus is fully discussed in my P. I. Diat., p. 131, 132. The removal indicates that Cleve did not hold to the idea that this was a normal *Rhoicosigma*. Numerous specimens lead me to believe that this is the case and that therefore we are dealing with a somewhat unusual phase of the present genus. Cleve states that the bend in the diatom is often wanting and mentions a specimen found by Grunow in Kerguelen, which is straight and which Grunow named *Donkinia subflexuosa*.

PLEUROSIGMA DELICATULUM W. S.

Sm. Brit. Diat., 21/202; Perag. Pleuro., 5/22.

My specimens fully duplicate the second illustration given above, but not well the original figure of Smith. There is, therefore, some doubt about my specimens and Peragallo's illustration rightly belonging to this species.

PLEUROSIGMA DIRECTUM Grun.

Perag. Pleuro., 5/29.

Several of my specimens are considerably larger than that of any recorded, which give a maximum 0·243. One measured from the Australasian material gave a length of 0·282, width 0·046, with 22 lines in 0·01 mm. This species, which Grunow also found in the Antarctic, occurs at Yeddo and in the fossil bed at Sendai, Japan. It is therefore both a subtropical and an antarctic species.

PLEUROSIGMA FRIGIDUM n. sp. Pl. 6, fig. 2.

Valve strongly sigmoid, narrow, tapering evenly, with rounded apices; raphe more strongly sigmoid, approaching close to the opposite sides of the valve near the two apices, its ends slightly hooked; central area small, lozenge-shaped; markings longitudinal and transverse, very delicate.

Length 0·189–0·195, width 0·018–0·019. Transverse lines 26–27 in 0·01 and longitudinal lines 30 in 0·01 mm. The general sickle-like swing of this graceful species is like that of narrow specimens of *P. formosum* W. S., but is a much more delicate diatom, and its marking is not quincunx but longitudinal-transverse. It bears a slight resemblance to the coarser *P. arcticum* (Cl.) Mann, above mentioned, and to the so-called *P. Thumii*, in Perag. Pleuro. 7/28, a name preempted by Castracane.

PLEUROSIGMA GLACIALE Cl. var.

Cl. Vega Diat., p. 476, 34/13; Perag. Pleuro., 7/15.

The specimens found were slightly coarser than those quoted in the above, being 22 instead of 28 lines in 0·01. The apices were also slightly less acute than the figure given by Peragallo, but close to the type figure given by Cleve. They are probably an antarctic phase in these respects. The length was about normal, namely, 0·150. They were found in the stomach of a tunicate, Shackleton material, bottle E.

PLEUROSIGMA INTERMEDIUM W. S.

Sm. Brit. Diat., 21/200; Perag. Pleuro., 5/27–28; H. L. Sm. Type. No. 405.

Peragallo's illustrations are much too sharply pointed. See remarks under *P. acus* above.

PLEUROSIGMA LONGISSIMUM Cl.

Cl. New Diat., p. 6, 1/8; Perag. Pleuro., 7/16.

Cleve in Nav. Diat., I, p. 120, makes this a synonym of *P.* (*Rhoicosigma*) *lineare* Grun. Grunow's description in Cl. & Grun. Arct. Diat., p. 59, is rather indefinite but clearly it does not fit this species. It is true Cleve was a co-author with Grunow and shared the naming of *P. lineare*, but he subsequently puts this into a separate species in his New Diat. (published in 1881). We may therefore assume that he finally did not consider the two to be the same. They do not appear so in Perag. Pleuro., 7/16 and 9/11, and that author classifies this species as a probable *Rhoicosigma*, but refers to its close resemblance to *P. longissimum*. There are certainly no *Rhoicosigma* characters in my specimens. I have two specimens from False Bay, California, which I have marked *P. lineare* and in which the raphe is as figured in Peragallo. I am therefore convinced that both these species should be held as valid.

PLEUROSIGMA (LITTORALE var.?) LONGITUDINALE n. sp. Pl. 6, fig. 3.

Valve narrow with nearly parallel sides, not perceptibly tapering until over half way to the apices; only slightly sigmoid, not rostrate; central area very small, transversely extended, like a minute stauros; longitudinal lines heavy, obscuring the transverse lines.

Length 0·350–0·460, width 0·045–0·046, 6·6 longitudinal lines in 0·01 mm.

It is barely possible this in a huge antarctic variety of *P. littorale* W. S. as given in Sm. Brit. Diat., 22/214, and in H. L. Sm. Type. No. 406. The uncertainty is due to the fact that all the specimens found lacked perfect tips of the apices. It however differs so markedly from that species that their union is not justified. *P. littorale* is a very broad short diatom, strongly sigmoid and with somewhat rostrate ends. This one is narrow, its width being only one-tenth its length, nearly straight, both as to outline and raphe, until near the apices. The central area of *P. littorale* is longitudinally extended and is lozenge-shaped; in this it is laterally extended, very minute and stauros-like. *P. littorale* is a much smaller diatom, its length 0·11–0·19 as compared with 0·35–0·46. Its width is 0·022-0·045 and this 0·040–0·046. In general shape this markedly resembles the fresh-water and smaller species *P. attenuatum* W. S. It was found in only one Australasian gathering, No. 27, and was scarce there.

Pleurosigma naviculaceum Breb.

Perag. Pleuro., 4/19–23.

Pleurosigma nicobaricum Grun.

Grun. Reise Nov., 1a/20; Perag. Pleuro., 4/9 (not 10 or 11).

I place my specimens as a variety with some doubt, as they differ from Grunow's type in having sharper apices, coarser oblique lines and apparently a more rigidly straight raphe; it is in the Australasian material perfectly straight except that the extreme ends curve into a slight hook. It agrees with the two figures above cited, but Grunow states that *P. nicobaricum* is closely allied to his *P. affine* and Cleve remarks that it may be the same as his *P. galapagense*, both of which have sigmoid raphes. In general shape it closely resembles *P. directum*, as it does in size, the latter being 0·243 in length and with a width of 0·04 and my specimens 0·214–0·221 with a width of 0·04. But the oblique lines of *P. directum* are 18 1/2 and mine are 13 in 0·01 at the middle of the valve. The most striking difference from *P. directum*, and one strongly suggesting *P. nicobaricum*, is that the oblique lines at the middle of the valve are quite prominent, almost to the exclusion of the transverse ones, while beyond the middle the transverse ones become more evident to the gradual suppression of the oblique ones. This curious variation is shared by *P. sagitta* Br. and *P. hamuliferum* Br. Brun states of the former that the oblique lines grow finer and at a more acute angle from the coarsely marked central portion outward toward the ends; namely 12–14 passing into 17–20 in 0·01. He also notes, what is shown in these antarctic forms, a striking difference in colour in the dry specimens, which are light brown at the middle portion and pass into pale straw colour toward the apices. I find that this is also associated with a more fragile structure, so that strewings often contain many specimens with the middle portion intact but without the ends. It may also be stated that the coarse oblique lines near the middle in my

specimens are not straight but concentrically bowed around the central nodule, like the watch-case milling seen on *Actinocyclus*. Cleve has placed under this species the very dissimilar *P. hamuliferum* Br. and *P. sagitta*, because they also show this variation in sculpture. Nothing is gained for taxonomy in uniting such strikingly unlike diatoms. I have specimens of undeniably *P. sagitta* from Santa Monica and they do not correspond closely with this species.

PLEUROSIGMA VITREUM Cl.

Cl. & Grun. Arct. Diat., 4/76; Perag. Pleuro., 8/9.

The length of my specimen is 0·170, width 0·021 with 20 lines in 0·01. Cleve is wrong in having transferred this species to the genus *Navicula*. Its marking, its lack of an open central area, and its delicacy all suggest the present genus. Furthermore although many specimens are generally straight, they are not more so than the previous species and there are number of specimens found in the Australasian material with a slight but unmistakable sigmoid shape. The minute and lozenge-shaped central area is also unlike what is found in *Navicula*.

PODOSIRA *E.*

PODOSIRA FEBIGERII Grun.

V. H. Syn., 84/22–23.

With Van Heurck, I recognise the convenience of retaining this illogical genus, which is undoubtedly the same as *Hyalodiscus* except for the greatly reduced or suppressed umbilicus. This is fully discussed in my Albatross Diatoms, p. 240.

PODOSIRA HORMOIDES Mont.

V. H. Syn., 84/3–4.

PSEUDOEUNOTIA *Grun.*

PSEUDOEUNOTIA DOLIOLUS (Wall.) Grun.

V. H. Syn., 35/22.

PSEUDOEUNOTIA LARVA Mann.

Mann Can. Arct. Diat., p. 26, 1/12.

Length 0·033, width 0·007. The type form found in the Arctic has a length of 0·037, width 0·007 with 11·2 lines in 0·01 mm. Found in Australasian Expedition, No. 16.

PSEUDONITZSCHIA *Perag.*

PSEUDONITZSCHIA MIGRANS (Cl.) Perag.

V. H. Belgica, p. 23, 3/44; Gran. Nord Plank., p. 131, fig. 177.

It is very difficult to distinguish this from *Nitzschia salinarum* Grun., if one is limited to the figures and descriptions alone. They are closely similar in size, shape and markings. Theoretically *Nitzschia* should show a carinal row of strong beads on only one side of each valve, but such markings are often obscure. This diatom has a row of bright dots apparently along both sides. Gran puts this in *Nitzschia*. The forms found by me are more elliptical than the figures given above and therefore agree even better with *N. salinarum*. Compare with the foregoing V. H. Syn., 57/18. There is nothing in the valve view to exclude this from the genus *Fragilaria*, to certain species of which its presents a confusingly strong resemblance. I cannot, however, state whether or not it occurs in connected frustules, like the species of that genus. The natural habitat of this species seems to be in polar waters. Gran reports it from the Arctic and Van Heurck from the Antarctic.

PYXIDICULA *E.*

PYXIDICULA WEYPRECHTII Grun.

Grun. F. Jos. Land, p. 92, 5/5; V. H. Belgica, 6/92, misnamed.

The acceptance of this genus is one merely of convenience, for we have no clearly distinctive boundaries by which it can be separated from *Coscinodiscus* on the one hand and *Stephanopyxis* on the other. Van Heurck in his Treatise, p. 510, distinguishes it from the latter by the absence of central teeth by which the frustules are united to each other. But we have examples of *Stephanopyxis* which lack such teeth entirely and yet agree perfectly with other specimens of that genus. See figs. 14, 18 and 20 in the above reference to Grunow. In that work Grunow states the great difficulty of holding this genus. There could be no better example of this confusion than Van Heurck identifying this antarctic species as *Stephanopyxis Brunii* A. S., because of its close resemblance to that species in Sch. At., 164/5, which latter however has a few strong spines near the centre, and furthermore Schmidt's species comes from the fossil deposit at Sendai, Japan.

On the other side of this genus is *Coscinodiscus* from which it differs somewhat on account of the coarseness of its areolation and the nearly hemispherical form of its valves, but we have many highly convex and coarsely areolated species in that genus. *Pyxidicula* is therefore here accepted entirely as a convenience.

PYXILLA *Grev.*

PYXILLA PROLONGATA Br.

Le Diat., I, 24/7.

This was found only in the Australasian gathering, No. 27.

RHIZOSOLENIA (*E.*) *Bright.*

RHIZOSOLENIA ALATA Bright.

Perag. Rhizo., 5/11–12.

Both the type form and the variety called by Cleve *gracillima* were found.

RHIZOSOLENIA BERGONII Perag.

Perag. Rhizo., 3/5.

RHIZOSOLENIA BIDENS Karst.

V. H. Belgica, 4/64.

This is very abundant in one gathering of the Australasian material, No. 26.

RHIZOSOLENIA IMBRICATA Bright.

Sch. At., 315/13; H. L. Sm. Type. No. 449.

RHIZOSOLENIA INDICA Perag.

Perag. Rhizo., 5/16.

This was found only in one of the Shackleton Expedition gatherings and was scarce there.

RHIZOSOLENIA INERMIS Cast.

Perag. Rhizo., 5/13.

This is rather close to both *R. alata* and *R. obtusa*.

RHIZOSOLENIA POLYDACTYLA Cast.

Cast. Chall. Exp., p. 71, 24/2; V. H. Belgica, 4/70, 71, 75, misnamed; Perag. Rhizo., 4/7.

One would infer that the placing of this diatom as a variety of *R. styliformis* by Van Heurck in the above reference was a typographical error, were it not repeated in the text on p. 28. His fig. 65 may indeed be an endocyst phase of that species, but to consider 70 and 75 as belonging to *P. styliformis* is incomprehensible. Castracane's own type figure agrees fully with these illustrations of Van Heurck and the endocyst in fig. 75 agrees with the other figures above enumerated. Castracane's type came from the Antarctic.

Rhizosolenia rhombus Karst.

Karst. Valdivia, 10/6.

Rhizosolenia robusta Norm.

Perag. Rhizo., 2/1; 3/1-2.

Only the cone-shaped valves, *i.e.*, the calyptra, were found.

Rhizosolenia semispina Hens.

Karst. Valdivia, 10/44a.

Gran claims that this is only a summer phase of *R. hebetata* Bail. This may be correct, but Bailey's type is strikingly unlike it, and De Toni and Van Heurck retain the present name.

Rhizosolenia setigera Bright.

Perag. Rhizo., 4/12–16; H. L. Sm. Type, No. 450.

Rhizosolenia Shrubsolei Cl.

Perag. Rhizo., 5/8–9.

Rhizosolenia Stolterforthii Perag.

Perag. Rhizo., 1/17–18.

This curious species has a dome-like valve instead of the conical valve which is common to the genus. In this respect and in its delicate structure it suggests a transition to the genus *Guinardia*.

Rhizosolenia styliformis Bright.

Sch. At., 316/5–6.

Both the type form and what Hustedt calls var. *longispina*, were found.

RHOICOSIGMA *Grun.*

Rhoicosigma mediterraneanum Cl.

Perag. Pleuro., 9/31.

My specimens range in length from 0·190–0·210 with 21–24 lines in 0·01 mm. They are slightly more sigmoid than normally.

RHOICOSPHENIA *Grun.*

RHOICOSPHENIA MARINA (W. S.) A. S.

Sch. At., 213/28–39.

ROPERIA *Grun.*

ROPERIA TESSELATA (Roper) Grun.

V. H. Syn., 118/6; Mann P. I. Diat., 31/3.

Both the type form, as shown in the first reference above, and the ovate form, as shown in the second reference, were found.

SKELETONEMA *Grev.*

SKELETONEMA COSTATUM (Grev.) Cl.

V. H. Syn., 91/4, 8; Sch. At., 180/45; Trans. Mic. Soc., 1866, 8/3–6.

This diatom is very frequent in nearly all the plankton gatherings examined. The type form was found on the east coast of England. It occurs abundantly at Hongkong, Java, in the West Indies and in Peru guano. It is therefore both subtropical and antarctic.

STEPHANOPYXIS (*E.*) *Grun.*

STEPHANOPYXIS PALMERIANA (Grev.) Grun.

Sch. At., 130/44.

This is essentially the same as *S. Kittoniana* Cast. in Chall. Exp., 9/5.

STEPHANOPYXIS TURRIS (Grev.) Ralfs.

Sch. At., 130/20–22, 31–32.

There are no satisfactory marks of distinction between this species and *S. appendiculata* E.

STICTODISCUS *Grev.*

STICTODISCUS CALIFORNICUS Grev.

Sch. At., 74/1–7.

There are many varieties of this widely distributed and inconstant species. One of these like fig. 7 in the above citation is close to *S. Hardmanianus* Grev.; others approach the original figure of *S. Buryanus* Grev. as figured in Trans. Mic. Soc., 1861, 4/1–2. All are native to subtropical waters as well as in the Antarctic.

STICTODISCUS GELIDUS Mann.

Mann Alb. Diat., 50/5.

This massive and glassy diatom was originally found in Bering Sea. It is exactly duplicated in all respects by the antarctic specimens. The small disk close to the centre in which there is an evident opening passing inward occurs in all of the antarctic specimens; so that this curious character can be taken as specific.

STIGMAPHORA *Wall.*

STIGMAPHORA ROSTRATA Wall.

Trans. Mic. Soc., 1860, 2/5–6; Moeb. Taf., 31/5–6.

This is essentially a tropical diatom. It was originally found in the stomachs of Salpæ in the Bay of Bengal, also in the Indian Ocean, and among the Sargasso weed at Honduras. It was found only in one plankton gathering of the Shackleton Expedition and was there very abundant.

SURIRELLA *Turp.*

SURIRELLA SPLENDIDA (E.) K.

Sch. At., 22/15–17.

Of this well-known species a single specimen was found. It is normally fresh-water, although the species occasionally is recorded in brackish water. As the single specimen found was in material washed out of seaweed, Shackleton sample H, taken April 14, 1908, it seems necessary to list it as a possible member of Antarctic marine flora.

SYNEDRA (*E.*) *Kirch.*

SYNEDRA CLOSTERIOIDES Grun.

V. H. Syn., 70/10–11.

This delicate diatom is poorly figured in the above reference and is without description. However, under the name of *Nitzschia rostrata*, it is described by Grunow in Cl. & Grun. Arct. Diat., p. 101, but even there with no reference to its habitat. It very closely resembles *N. acicularis* (K.) W. S. It apparently has no carinal beading. The transverse lines become dim or disappear in the middle part of the valve and the slightly swollen tips of the long ends show a minute central bead. It therefore probably belongs to this genus. My specimens are from the Shackleton plankton material of 6, 10, '07. Its length was 0·089 and its width 0·006 mm.

SYNEDRA GELIDA (Perag.) Mann.

Perag. Ant. Exp. Franc., p. 69, 3/10.

The classifying of this by Peragallo as *Thalassionema gelida* is inadmissible. As Van Heurck points out, Grunow proposed this latter genus to accommodate his *S. nitzschioides*, but on very insufficient grounds. In the present instance there is no reason for considering this species other than a normal *Synedra*. The absence of markings along the central portion of each valve is in itself so characteristic of many species of *Synedra* that it has no distinctive value.

SYNEDRA NITZSCHIOIDES Grun.

Grun. Ost. Diat., 1862, 5/18; V. H. Syn., 43/7–10.

This has been variously placed in *Thalassiothrix* and a proposed new genus, *Thalassionema*. Its original assignment as above is the most consistent. V. H. Treat., p. 314, 10/434, gives the present assignment, but in a foot-note states that the new genus might be better. The restriction of the markings to a narrow line along the margin is shared by several other species of *Synedra*, as *S. affinis*, *S. tenella*, and *S. parva*. My specimens somewhat exceed the size given by De Toni in Syl. Alg., p. 673, but are otherwise typical.

SYNEDRA REINBOLDII V. H.

V. H. Belgica, 3/35.

There is quite a resemblance between this and *S. spathulata* Schimp. in Karst. Valdivia, p. 124, 17/11.

TABELLARIA *E.*

TABELLARIA sp.? Pl. 6, fig. 4.

This diatom found in Australasian material, No. 22, is left unnamed, because of doubt of the value of naming it. As will be noticed in the illustration, the margin is finely but strongly cross-hatched and there is a glassy bead at each end of the valve. It bears a certain resemblance to the secondary plates of members of this genus as, for example, the illustration in V. H. Syn., 52/6, but does not agree well with any known *Tabellaria*. A single specimen is insufficient to determine the value of this diatom.

THALASSIOSIRA *Cl.*

THALASSIOSIRA DECIPIENS (Grun.) Jorg.

Gran Nord Plank., p. 17, fig. 10; V. H. Syn., 91/10.

This diatom, which grows in chains, is, when separated, difficult to distinguish from *Coscinodiscus excentricus* E. The areolation in both Gran's and Van Heurck's

figures is poorly shown. The chief difference between a single valve of this and *C. excentricus* is in the heavier apiculi on the margin and in the single small marginal process that is found in all species of this genus.

THALASSIOSIRA GLACIALIS (Grun.) Gran.

See *Lauderia glacialis*.

THALASSIOSIRA GRAVIDA Cl.

Gran Nord Plank., p. 18, fig. 12.

This is exceedingly common in both the Arctic and Antarctic.

THALASSIOTHRIX (*Cl. & Grun.*) *Cast.*

THALASSIOTHRIX ANTARCTICA Schimp. Pl. 6, fig. 5.

Karst. Valdivia, 17/12; 46/10.

This species is large and robust and is invariably curved into a sigmoid line in both the type form and in the var. *echinata* Karst., shown in the second reference above. All of my specimens are somewhat widened at the middle portion, a fact neither mentioned nor figured in Karsten's report. In no other respect do they differ and therefore are probably a local variation. H. L. Smith's Type No. 594, marked *T. longissima*, is probably this diatom. It does not agree with *longissima* and it came from the Antarctic.

THALASSIOTHRIX FRAUENFELDII Grun.

V. H. Syn., 37/12, 14.

This species varies considerably as to its length. It is always straight and its two ends are unlike, one being more tapering than the other. In the type form the marginal markings are rounded beads rather widely separated. In the variety called *javanica* Grun., figured on the same plate of the above, fig. 13, the marginal markings are closely set lines and the diatom is narrower. This variety might well represent a separate species. See remarks under *T. heteromorpha*.

THALASSIOTHRIX HETEROMORPHA Karst.

Karst. Valdivia, 46/11.

Although this species is valid, it closely resembles the variety of the former species called *Javanica*; but, as there stated, that variety is too dissimilar from its type and might well be considered another species. At any rate, Karsten's form is clearly worthy of a special name.

THALASSIOTHRIX LONGISSIMA Grun.

V. H. Syn., 37/10.

No truly typical specimens of this diatom were found in my material, all of them being close to the var. *echinata* of *T. antarctica* as stated under that species. H. L. Smith's Type No. 594 bearing the name *longissima* appears also to belong to Karsten's variety of *T. antarctica.*

THALASSIOTHRIX NITZSCHIOIDES Grun.

See *Synedra nitzschioides* Grun.

TRIGONIUM *Cl.*

For a discussion of the need of this new generic name to replace the hopelessly confused name, *Triceratium*, see Cl. Diat. Spitz., p. 663, and Mann Alb. Diat., p. 289.

TRIGONIUM ARCTICUM (Brit.) Cl.

Sch. At., 79/5–8.

Nearly all the specimens found of this species are the massive and very large form which Janisch named *T. antarcticum.* In many of the gatherings it is exceedingly abundant. For a discussion of the boundaries of this species see Mann P. I. Diat., p. 163–165, under *T. diaphanum.*

TRIGONIUM CINNAMONEUM (Grev.) Mann.

Trans. Mic. Soc., 1863, 9/12; V. H. Syn., 126/1–2; Sch. At., 154/23, 24, 27.

This species is an anomalous member of the genus; and, as a consequence, Grunow has placed it in *Cestodiscus* and furthermore has proposed for it a new genus, *Pseudotriceratium.* Van Heurck follows Grunow's example. De Toni merely quotes both. I think the species better fits Greville's assignment, or at least Cleve's synonym *Trigonium* to replace the moribund *Triceratium*, than it does *Cestodiscus. T. cariosum* Cast. in Chall. Exp., 6/6, belongs to the present species. The original type form came from the fossil subtropical deposit, Moron, Spain.

TRIGONIUM OAMARUENSE (Gr. & St.) Mann, var. SPARSIM-PUNCTATA Grove. Pl. 3, fig. 10.

Sch. At., 159/4.

The specimens from the Antarctic are a very wide variety of this species; in fact, they show an interesting similarity to two clearly distinct species. They most closely resemble what is called var. *sparsim-punctata* Grove, as given in the above reference.

Their close affinity to the type form is seen in the two septa running in from each side, the closely beaded tips of the angles and especially the little circular hyaline blotch just at the inner edge of this beading. But in form and in the cross-barred margin and in the general marking of the valve by radiating watery lines the antarctic specimens closely resemble that phase of *T. balaniferum* Br. which is figured in Le Diat., I, 3/8, which Brun thinks is a secondary valve of the typical *T. balaniferum* shown in Br. Diat. Jap., 6/4, and in Sch. At., 159/1. It should be stated that both of these species, between which this antarctic diatom stands as a living bridge, are fossil subtropical marine forms; so that this is another example of the seemingly subtropical diatom flora of the Antarctic.

TRINACRIA *Heib.*

Trinacria excavata Heib.

Heib. Consp., 4/9; Sch. At., 97/6–10.

Trinacria Racovitzæ V. H.

V. H. Belgica, 9/119–120, 126–131.

Van Heurck gives several marks of distinction between this and the former species. Only two of them have real merit; the much greater convexity of one valve over the other, with the consequent curvature of the girdle between them; and second, the very short arms rising at right angles at the apices of the valves. This species was found only in Australasian material, No. 27.

TROPIDONEIS *Cl.*

Tropidoneis antarctica (Grun.) Cl.

Cast. Chall. Exp., 27/9 (not fig. 11), misnamed; Br. Diat. Jap., 9/14, misnamed.

As was the case with all members of this genus this diatom was originally put in *Amphiprora*, and is so named in No. 125 of Cleve and Moller's Type Diatoms. Grunow subsequently called it *Navicula Challengeri* in his Arctic Diatoms, p. 64. Cleve in Nav. Diat., I, p. 24, properly changes the preposterous classification of Castracane, namely, *Stauroneis glacialis*, to the above name, and unites with this, *Amphiprora fragilis* Br. But he is in error in referring to Castracane's type figure, No. 11, which is quite a different diatom from his variety figure, No. 9. Fig. 11 is smaller, narrower, hardly convex on its dorsal side, where it shows a sinus at the middle and has either a minute or no hyaline middle area, as contrasted with the semistauros of this species and with the one figured by Brun. Fig. 11 also has tapered and micronate ends and its beading is much coarser than that of fig. 9 or Brun's form. Although one or two of these differences might leave room for the union of Castracane's type and variety, their unlikeness as a whole,—especially when the diatoms themselves are compared,—makes it expedient to hold them

separate. I therefore recognise Castracane's var. 9 as properly included in *T. antarctica* excluding his fig. 11. This also occurs in the Antarctic and will be found in this genus under Castracane's specific name. See *T. glacialis* (Cast.) Mann. Karsten in Valdivia, p. 128, copies Cleve's error of writing fig. 11 instead of fig. 9 of Castracane's illustrations and gives on 18/7 his idea of this diatom. If it is a member of this combination, it is a very poor one.

TROPIDONEIS AUSTRALIS (Perag.) Mann.

Perag. Ant. Exp. Franc., p. 59, 3/13.

Peragallo assigns this to a new genus *Pseudoamphiprora* which has no distinctive differences from the earlier created genus *Tropidoneis*. Van Heurck points this out in his Treatise, pp. 263, 264. Cleve at first writes *Pseudoamphiprora* as a subdivision of the genus *Navicula* (1881); afterward (1891) he creates the present genus *Tropidoneis* in Nav. Diat., I, p. 22, and in the same work, p. 70, he advances *Pseudoamphiprora* to generic rank. But this and other similar forms fall naturally into Cleve's *Tropidoneis*, a much better classification than the later proposed and too narrow genus, *Pseudoamphiprora*. I have therefore modified Peragallo's name. This diatom is quite abundant in both the Shackleton and Australasian gatherings. It may be added that it somewhat resembles *T. stauroptera* (Bail.) V. H. but is narrower, more pointed and more delicate. Compare V. H. Treat., p. 264, and Perag. Diat. France, 28/6.

TROPIDONEIS CANDIDA n. sp. Pl. 6, fig. 6.

Valve narrow with rounded apices; raphe central and strong; markings heavy polished costæ, slightly radial, little wider than their interspaces; in girdle view the dorsal side is seen to be slightly indented at the centre, barely convex on either side, but toward the apices more strongly so; apices somewhat produced or rostrate; costæ extending from dorsal to ventral edge. Length 0·138, width 0·013,6·5 lines in 0·01 mm. This massive and beautiful species is rare and was found only in Shackleton Expedition material, bottle E.

TROPIDONEIS GLACIALIS (Cast.) Mann.

Cast. Chall. Exp., 27/11 (not fig. 9).

My specimens fully agree with the above illustration except that the hyaline area at the central nodule as seen from the girdle side is obscure. It is slightly convex on the dorsal side, where the central raphe is clearly seen, and has a narrow sinus at the middle; the ends are slightly convex and are mucronate, resembling the beak of a bird; the ventral side is straight; the markings are of closely set rows of beading which are strictly transverse and coarser than those of *T. antarctica*. Length about 0·185 with a width in girdle view of 0·025, lines 14–15 in 0·01. See remarks under *T. antarctica*. It somewhat resembles *T. solidula* Cl. in Nav. Diat., I, 2/19–21, but the ends are quite different and there is no trace of the undulating striæ that are noted in Cleve's specimen.

TROPIDONEIS LATERALIS n. sp. Pl. 6, figs. 7–9.

Valve very narrow, convex, evenly tapered to the sharp apices, unequally divided by the raphe, which is close to one side and is straight and strong; in girdle view also the valve is seen to be very narrow, with a slight indentation at its middle and gracefully rounded apices; no trace of hyaline area or stauros at the middle; markings of somewhat broken or interrupted transverse lines of varying length give to the valve a decidedly mottled appearance. Length 0·117–0·129, width 0·012–0·014, depth in girdle view 0·007, 13–15 lines in 0·01 mm. This species shows some resemblance to *T. adriatica* Cl. in Nav. Diat., I, p. 26, 3/22–23; but that form is larger (length 0·20 mm.), has a hyaline stauros-like middle area and a not-so-laterally placed raphe; also it has quite different markings. *Chuniella antarctica* Karst. in Valdivia, p. 130, 18/14, seems to be very similar, but it is practically indeterminate, as Karsten gives no intimation of its markings. Its size is larger than the present, being 0·180. It may be here remarked that I can find no reason for the creation of the genus *Chuniella*. See *T. approximata* Cl. in Nav. Diat., I, 3/20–22.

TROPIDONEIS STAUROPTERA (Bail.) V. H.

See remarks under *T. australis*.

WILLEMOESIA *Cast.*

WILLEMOESIA ELONGATA (Grun.) Mann.

Pl. 6, fig. 10: V. H. Syn., 125/14–15.

Although this specimen appears to be a slightly deformed example of the above diatom, it is possible to interpret it as a still more deformed and coarse valve of *Eucampia antarctica* (*E. Balaustium* Cast.), as that species shows a strong tendency to distortion in several of the antarctic gatherings where it is abundant. The slight shifting of the focal point of the markings to one side of the valve gives strength to that interpretation. On the whole it seems to better fit into the assignment here made, but the identification is doubtful.

Length 0·100 mm. Found in Australasian material, No. 26.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1. *Actinocyclus alienus* var. *arctica* Grun. × 325.
,, 2. *Actinocyclus bifrons* (Cast.) Mann × 950.
,, 3. *Actinocyclus bifrons* (Cast.) Mann × 1,000.
,, 4. *Actinocyclus bifrons* (Cast.) Mann × 920.
,, 5. *Actinocyclus coscinodiscoides* Mann, nom. nov. × 1,268.
,, 6. *Actinocyclus polysculptus* Mann, n. sp. × 515.
,, 7. *Actinocyclus polysculptus* Mann, n. sp. × 484.
,, 8. *Actinocyclus polysculptus* Mann, var. × 484.
,, 9. *Actinocyclus tortuosus* Mann, n. sp. × 940. See also pl. 2, fig. 1.

PLATE II.

Fig. 1. *Actinocyclus tortuosus* Mann, n. sp. × 545. See also pl. I, fig. 9.
,, 2. *Asteromphalus Beaumontii* E., var. × 1,360.
,, 3. *Asteromphalus diminutus* Mann, n. sp. × 1,287.
,, 4. *Asteromphalus diminutus* Mann, n. sp. × 1,268.
,, 5. *Asteromphalus emergens* Mann, n. sp. × 933.
,, 6. *Asteromphalus eminens* Mann, n. sp. × 1,000.
,, 7. *Asteromphalus eminens* Mann, n. sp. × 947.

PLATE III.

Fig. 1. *Biddulphia convexa* Mann, n. sp. × 557.
,, 2. *Biddulphia convexa* Mann, n. sp. × 935.
,, 3. *Biddulphia mollis* Mann, nom. nov. × 435, valve view.
,, 4. *Biddulphia mollis* Mann, nom. nov. × 509, girdle view.
,, 5. *Biddulphia mollis* Mann, nom. nov. × 402, girdle view.
,, 6. *Cestodiscus Lewisianus* (Grev.) Mann × 1,214.
,, 7. *Cocconeis nitidulus* Mann, n. sp. × 1,028.
,, 8. *Eucampia zodiacus* E. × 465, valve view, abnormal.
,, 9. *Eucampia zodiacus* E. × 465, girdle view, abnormal.
,, 10. *Trigonium oamaruense*, var. *sparsim-punctata* Grove × 314.

PLATE IV.

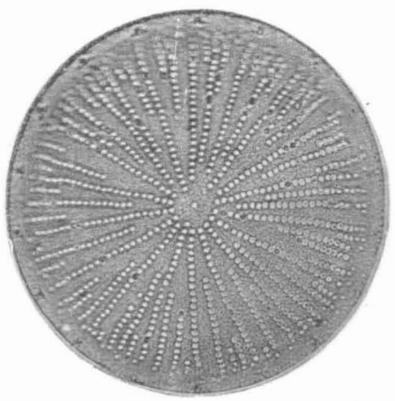
Fig. 1. *Coscinodiscus adumbratus* Ost., var. × 1,075.
,, 2. *Coscinodiscus asteroides* T. & W. × 360.
,, 3. *Coscinodiscus circumscriptus* Mann, n. sp. × 538.
,, 4. *Coscinodiscus contendens* Mann, n. sp. × 1,360.
,, 5. *Coscinodiscus cuneistriatus* Mann, n. sp. × 325.
,, 6. *Coscinodiscus minimus* Karst., var. × 1,214.
,, 7. *Coscinodiscus nodatus* Mann, n. sp. × 1,050.
,, 8. *Coscinodiscus signatus* Mann, n. sp. × 1,268.
,, 9. *Coscinodiscus symbolophorus* Grun., as seen in girdle view.

Plate V.

Fig. 1. *Hyalodiscus cicatrix* Mann, n. sp. × 775.
,, 2. *Hyalodiscus crepitans* Mann, n. sp. × 234.
,, 3. *Hyalodiscus Van-Heurckii* (Oreag.) Mann × 450.
,, 4. *Melosira alphabetica* Mann, nom. nov. × 556.
,, 5. *Melosira alphabetica* Mann, nom. nov. × 561.
,, 6. *Melosira simplex* Mann, n. sp. × 1,000.
,, 7. *Navicula rhombica* Greg., var. × 930.
,, 8. *Navicula sobrina* Mann, nom. nov. × 1,115.
,, 9. *Navicula spectabilis* var. *oamaruensis* × 700.

Plate VI.

Fig. 1. *Nitzschia australis* Mann, nom. nov. × 800.
,, 2. *Pleurosigma frigidum* Mann, n. sp. × 513.
,, 3. *Pleurosigma longitudinale* Mann, n. sp. × 440.
,, 4. *Tabellaria* sp. × 850.
,, 5. *Thalassiothrix antarctica*, var. *echinata* Karst. × 800.
,, 6. *Tropidoneis candida* Mann, n. sp. × 580.
,, 7. *Tropidoneis lateralis* Mann, n. sp. × 870, valve view.
,, 8. *Tropidoneis lateralis* Mann, n. sp. × 870, valve view with raphe.
,, 9. *Tropidoneis lateralis* Mann, n. sp. × 870, girdle view.
,, 10. *Willemoesia elongata* (Grun.) Mann × 830, abnormal.
,, 11. *Biddulphia pulverulenta* Mann, n. sp. × 260 diam., face (valve) view.
,, 12. *Biddulphia pulverulenta* Mann, n. sp. × 260 diam., side (girdle) view.
,, 13. *Biddulphia pulverulenta* Mann, n. sp. × 350 diam., detail, with secondary beading.



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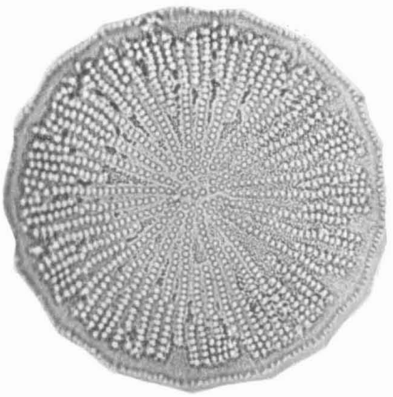

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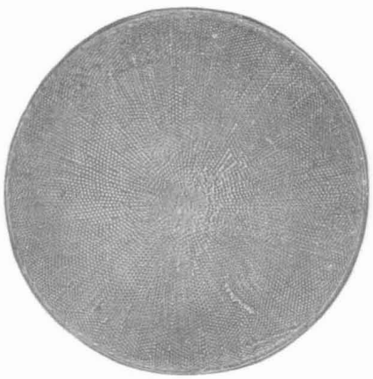

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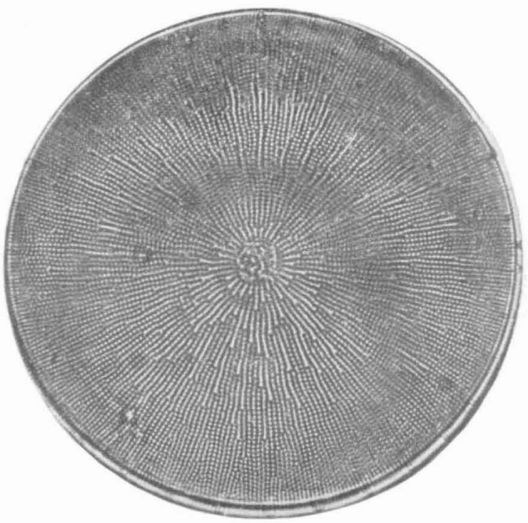

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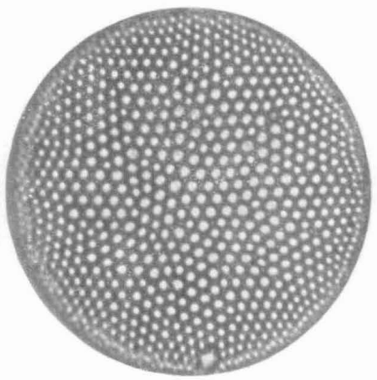

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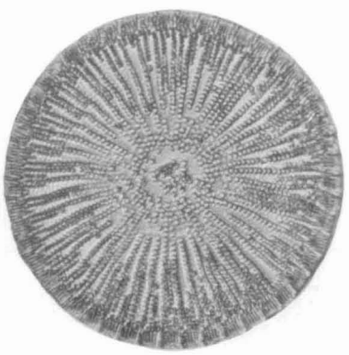

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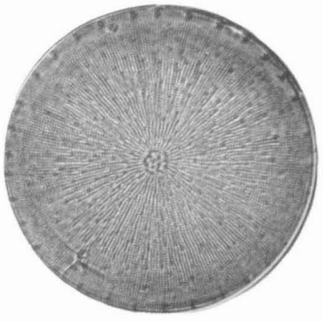

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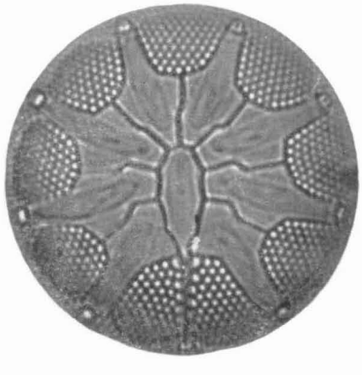

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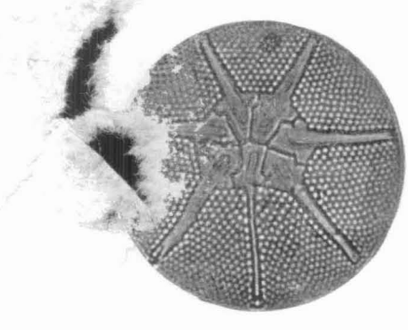

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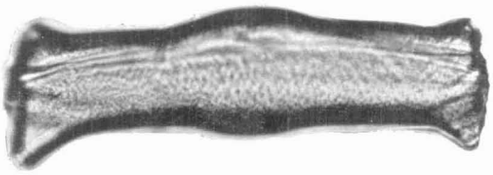

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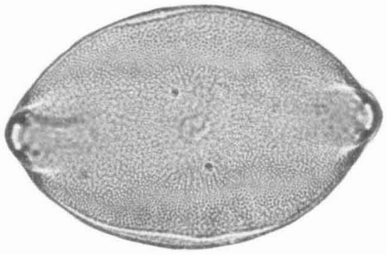

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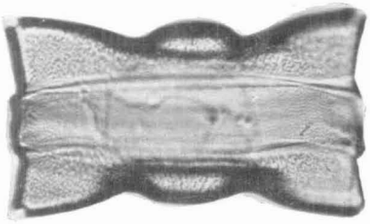

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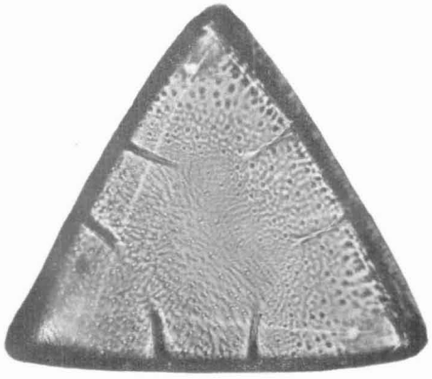

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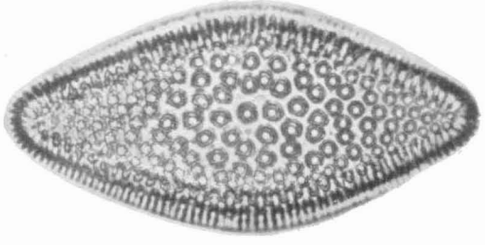

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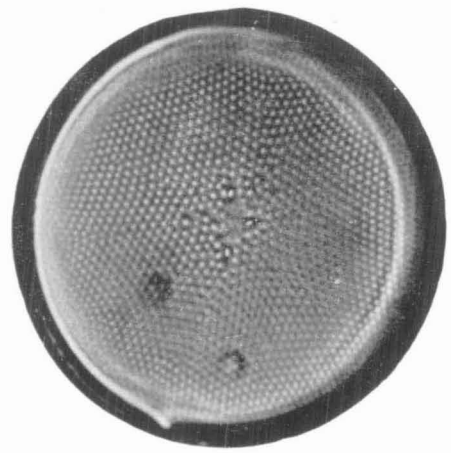

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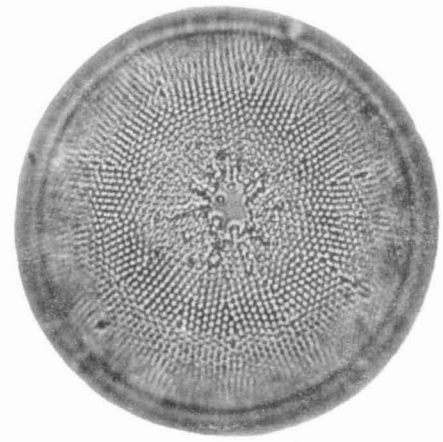

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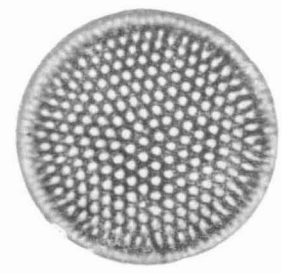

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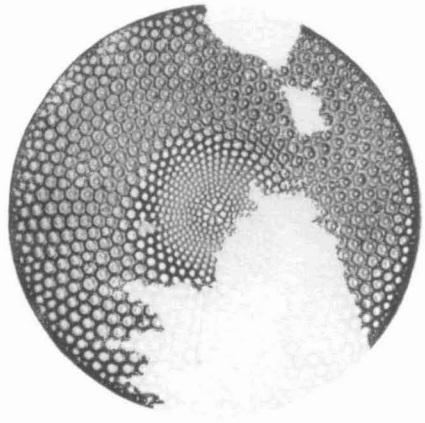

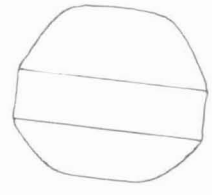

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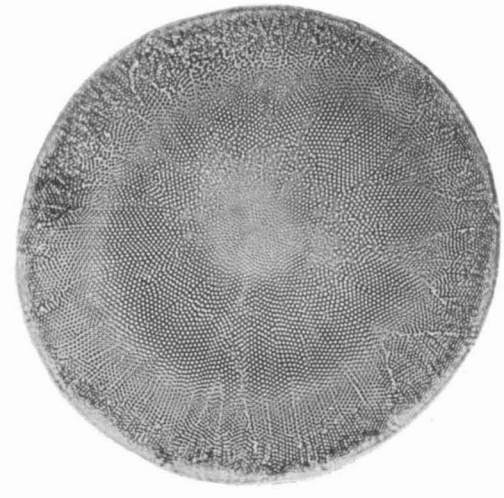

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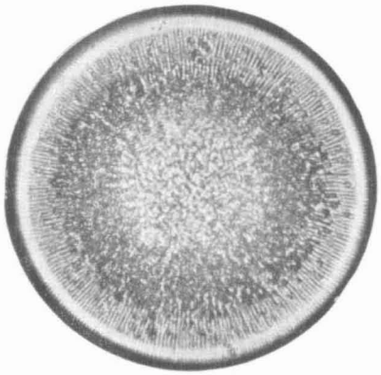

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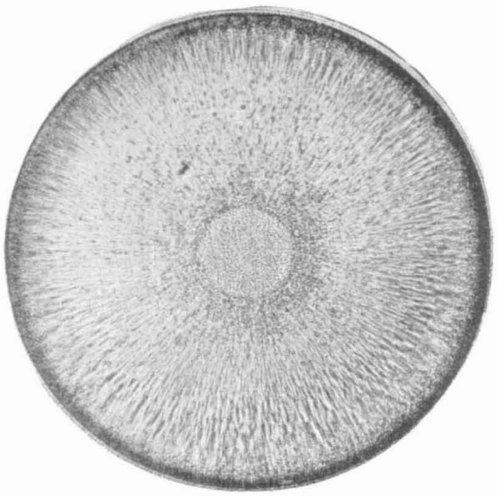

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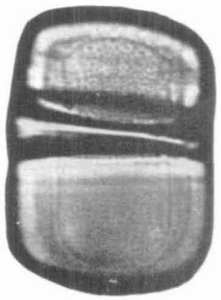

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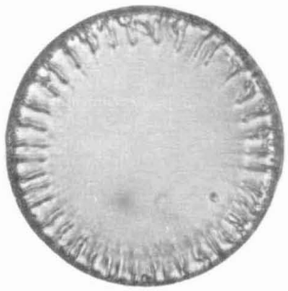

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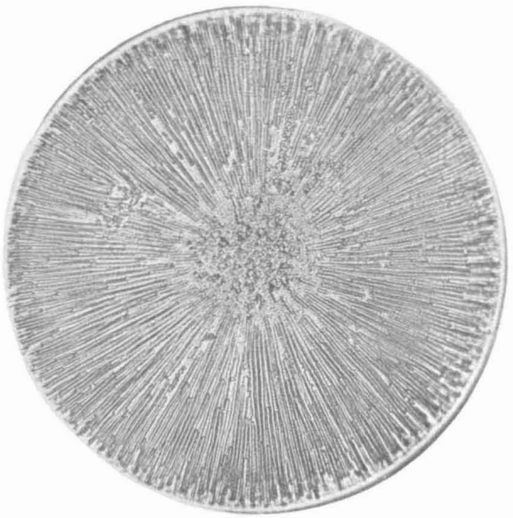

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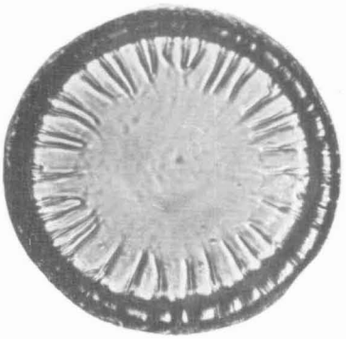

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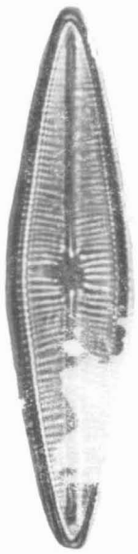

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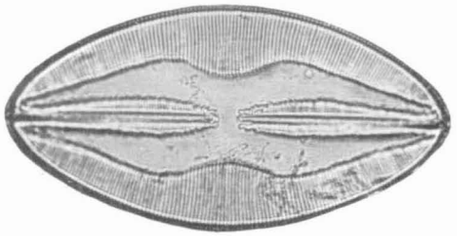

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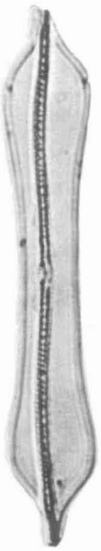

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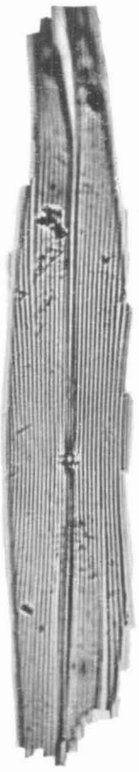

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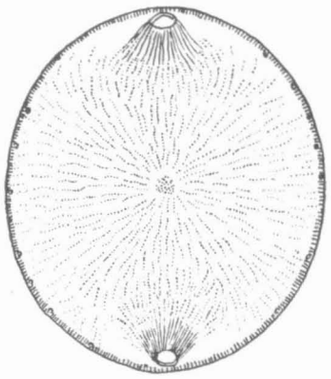

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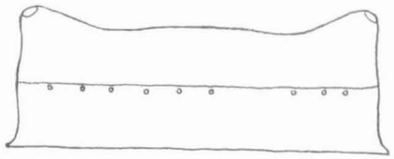

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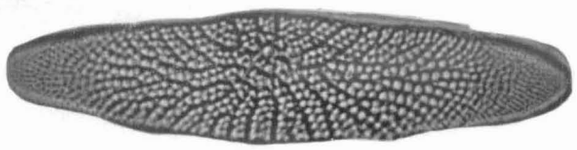

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