

I 85/99

*h. Grove* Fr. Hustedt  
*from the Au* Bremen.

ANALYSIS

OF THE

DIATOMACEOUS GENUS

CAMPYLODISCUS:

BEING THE PRELUDE TO A MONOGRAPH OF THE SAME.

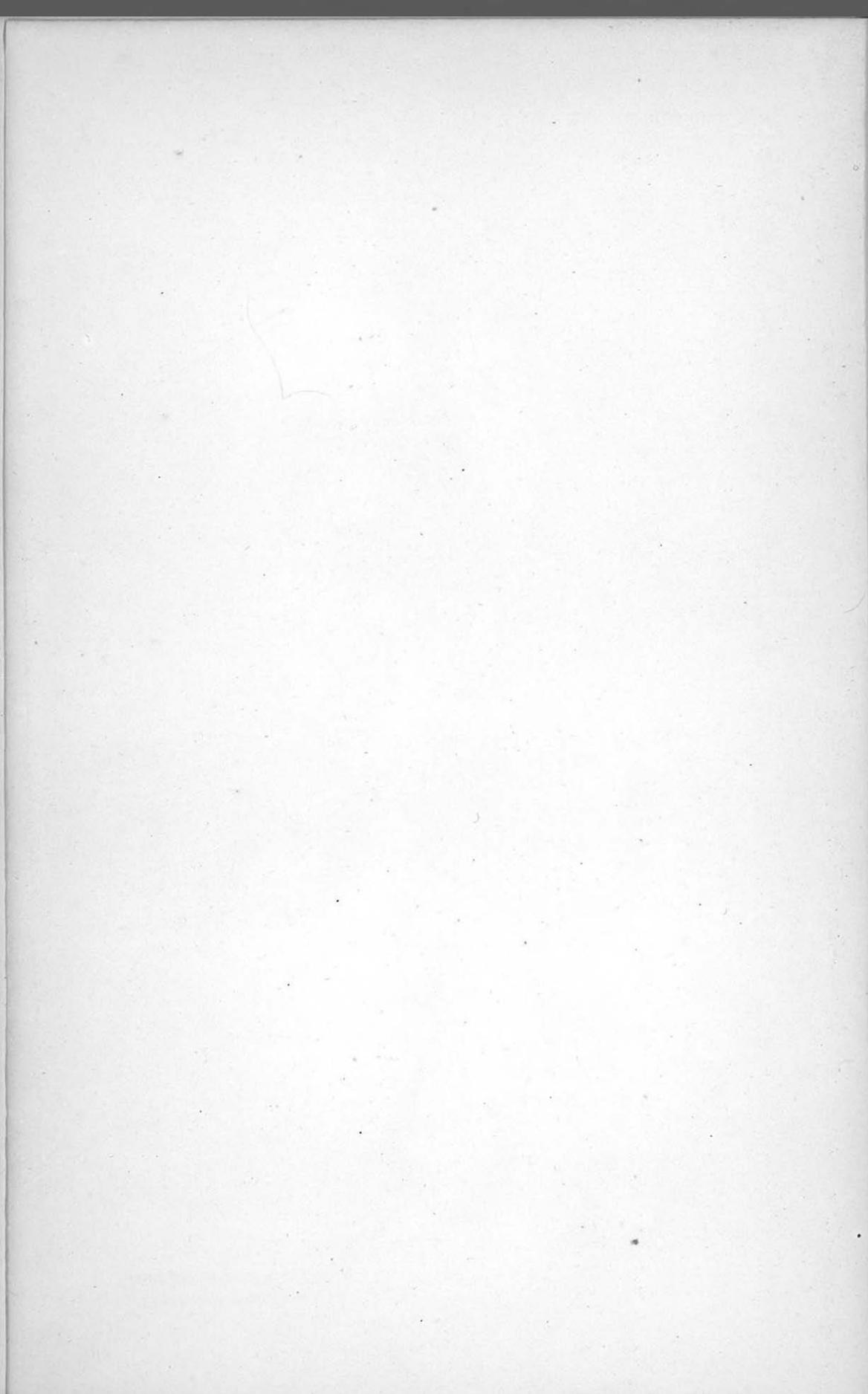
BY

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für Diatomeenkunde



## Final Corrigenda to Deby's Campylodiscus.

- Page 17. *C. Americanus*, for Weichs read Wachs.  
 " " " for pl. 3, f. 2, read pl. 3, 2, f. 1.  
 " 18. *C. argus*, after Obs. add plate 2.  
 " " *C. Balearicus*, pl. 18, f. 11, of A. S., Atlas, is called *C. undulatus*, Grev.  
 " 19. *C. bicostatus*, for Rop., M. J., read W. Sm., T. M. S.  
 " " " for pl. 10, f. 3, *a, b*, read pl. 10, f. 1, *b*.  
 " " " for vars. *parvulus* and *quadratus* read *parvula* and *quadrata*.  
 " 20. For *C. Brownianus* read *Browneanus*.  
 " " *C. chrysanthemum*, add pl. 2, f. 7.  
 " 21. *C. clypeus*, for Atl., pl. 54, f. 78, read pl. 54, f. 7—8.  
 " " *C. concinnus*, for Atl., pl. 16, 13, read Atl., pl. 18, f. 16—18.  
 " " " for T. M. S., plate 8, f. 2, read pl. 1, f. 2.  
 " " " for *C. marginalis* read *C. marginatus*, as per text in T. M. S., p. 13.  
 " " *C. clypeus*, for Weiss read Weisse.  
 " " *C. collectus*, for pl. 2 read pl. 1.  
 " " *C. crebrecoctatus*, for *C. Heufleuri* read *C. Heufferi*.  
 " " *C. cribosus*, for pl. 6 read pl. 7.  
 " 22. *C. decorus*, do away with the **C** before var. *pinnata*.  
 " 23. *C. Ehrenbergii*, for f. 12, 14, read f. 12, 13.  
 " 24. *C. fenestratus*, for pl. 9, f. 3, 4, read pl. 3, f. 4.  
 " " *C. fluminensis*, for *Quarenensis* read *Quarnerensis*.  
 " " for *C. graffii* read *C. graeffei*.  
 " " *C. grevillii*, for pl. 4 read pl. 5.  
 " " *C. flexuosa* read *C. flexuosus*.  
 " " *C. Grundleri* read *C. Gruendleri*.  
 " 25. *C. Heufleuri* should be *C. Heufferi*.  
 " " *C. Hodgsoni*, for pl. 6, f. 63, read pl. 6, f. 53.  
 " " *C. Horologium*, for pl. 6, f. 1, read pl. 6, f. 51.  
 " " *C. Humboldtii*, for f. 3 read f. E 3.  
 " 26. Fifth line from bottom, for *Centrali* read *Centralis*.  
 " " Fourth line from bottom, for *ambiguus* read *ambiguus*.  
 " 27. *C. limbatus*, for var. *Australis* read var. *Astralis*.  
 " " *C. lineatus*, for *C. marginalis* read *C. marginatus*.  
 " " *C. Margaritaceum* should be *C. Margaritarum*; for pl. 9 read pl. 4.  
 " " *C. Marginalis* should be *C. Marginatus*.  
 " 28. *C. noricus*, for U. K. insert V. II. Synop.  
 " 29. *C. oceanus* read *C. oceanicus*.  
 " " *C. orbicularis*, Castr., for pl. 11, f. 4, read pl. 16, f. 10.  
 " " " Cleve, pl. 38, f. 79, is *Surirella orbicularis*, Cl.  
 " 30. *C. Peragallii*, after pl. 1, f. 3, add (without name).  
 " " *C. pinnata* should be *C. pinnatus*.  
 " " *C. quarenensis* should be *Quarnerensis*.  
 " " *C. punctatus*, for Bleich read Bleisch; for f. 1—4, read f. 1—9.  
 " 31. *C. radians*, for pl. 4, f. 57 read pl. 5, f. 57.  
 " " [*C. Raenus* should be *Reanus*.]

- Page 31. *C. remora*, strike out from synonyms, Ehr., pl. 3 and 11, f. 14, which is *C. radiosus*.
- „ 32. *C. Sauerbeckii*, for Grundl read Gruendl.
- „ „ *C. Simulans*, for Nord, see, read Nordsee.
- „ 33. *C. stellula*, for pl. 3, f. 6, read second series, pl. 1, f. 6.
- „ „ *C. superbus*, for pl. 8, f. 8, read pl. 8, f. 10.
- „ 34. *C. taeniatus*, for *Graffii* read *Graeffei*.
- „ „ Two lines from bottom, for *Graffii* read *Graeffei*.
- „ „ *C. Thuretii*, Atl., pl. 16, f. 2. This is named *C. taeniatus* in Atlas.
- „ „ *C. undulatus*, for Clev. read Cleve.
- „ 35. *C. vermicularis* should be *C. vermiculatus*.
- „ „ *C. vulcanius*, add Mikrog., t. 38 A, 14, f. 8.
- „ „ *C. Wallichianus*, var. *Haitiensis*, should be var. *Thaitiensis*.
- „ 36. *C. Eulensteini*, var. *Australis*, should be var. *Astralis*.
- „ 55. Last line, *Pulchella* should be *C. Pulchellus*.

The following, which were figured in the Atlas, but not named by A. Schmidt, have been named by me:—

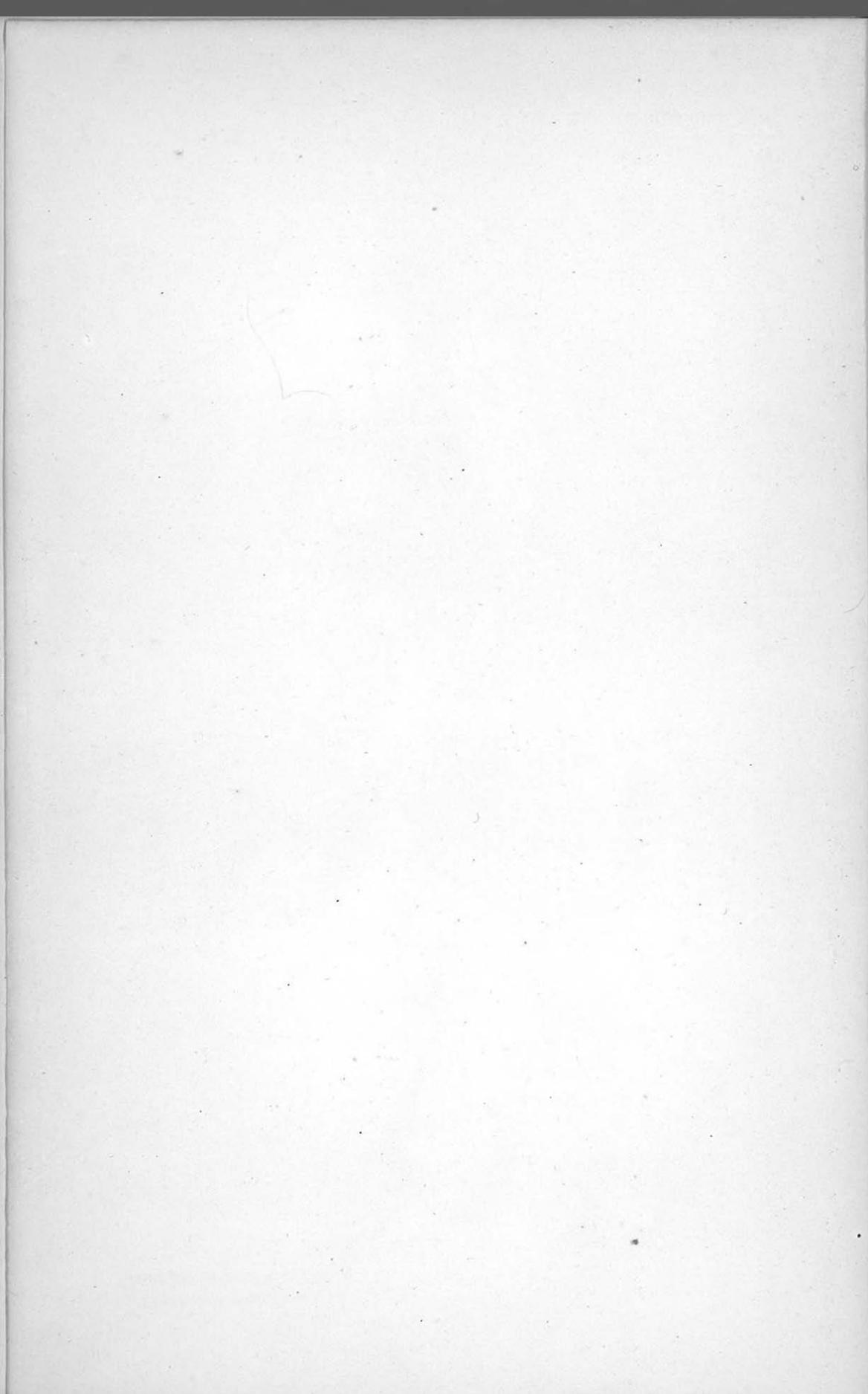
- C. birostratus*, p. 19, and Atl., pl. 14, f. 23; *C. biseriatus*, Atl., pl. 15, f. 11.
- C. Braziliensis*, Atl., pl. 14, f. 31, pl. 18, f. 8; *C. inconspicuus*, p. 26, Atl., pl. 51, f. 11, 12; *C. intermedius*, Atl., pl. 53, f. 8; *C. Raeanus*, p. 31, Atl., pl. 18, f. 5, 6?
- C. taenioides*, p. 34, Atl., pl. 16, f. 6; *C. Weissflogii*, p. 35, Atl. pl. 16, f. 4; *C. Campecheanus*, p. 36, Atl., pl. 53, f. 8; *C. Rattrayanus*, p. 36, Atl., pl. 18, f. 10.

In the Index to figures, p. 15 and following, and in the explanations opposite the plates, the following has to be noted:—

- Plate I, f. 11, top left hand corner, is *C. biseriatus*, Deby, copied from A. S. Atlas, where it is not named, pl. 15, f. 11.
- Page 77. *C. daemalianus* should be *C. daemelianus*.
- „ „ *C. de Tonianus*, read pl. XV. for XIV.
- „ „ *C. fluminensis*, for *Quarenensis* read *Quarnerensis*.
- „ 76. *C. Grevillii*, Leud., is identical with *C. Brightwellii*, Grun. (pl. II., f. 9). The last has priority.
- „ 77. *C. Kutzingii*, add pl. I., f. 10.
- „ „ *C. Rabenhorstianus* and *Robenhorstii* are synonyms.
- „ „ *C. Schmidtii* is not f. 63, pl. XIII., but pl. I, left hand bottom figure, which should have been numbered f. 12.
- „ „ *C. Robertianus* should be *C. Robertsianus*.
- „ „ *C. latus*, Shadb., add pl. IV., f. 30, a.
- „ „ *C. simulans*, to be inserted (pl. VII., f. 36).
- „ 78. *C. stellatus*, pl. XII. should be pl. VII.
- „ „ „ for f. 70 read 76.
- „ „ for *C. tabellatus* read *tabulatus*.
- „ „ *C. trapezoidalis*, for f. 66 read f. 72.
- „ „ *C. undulatus*, var., for f. 71 read f. 77.

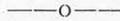
I.

INTRODUCTION.





## INTRODUCTION.



MONOGRAPHS, enabling the student to compass without loss of time the accumulated information regarding the species comprised in certain groups of organised beings, are imposing themselves every day more indispensably.

Descriptions of plants as well as of animals are at present scattered through such a vast heap of miscellaneous polyglot literature that no "common mortal" nor "beginner" in the science of natural history can possibly find his way in the perplexing chaos. The difficulties of "*erudition*" are so great that they explain the frequent recording of old species and facts as new by recent observers. It is much easier to give a new denomination to an organism than to hunt it up through many volumes, often difficult of access. My sole object now is to help the student of the Diatomaceæ who may wish to study the forms contained in the genus *Campylodiscus*. I hope I have been successful. The only use of discriminating forms or so-called "species" is to instruct the student as to the particular organism he may have under consideration at the time of his investigations on their biology.

The developmental history of these microscopic organisms, the Diatoms, is in a most backward state. None are more in need of an observer possessing good objectives and a bountiful

supply of patience ready to grapple with the difficulties of the subject. To such a one Nature will surely reveal some of its secrets, and fame will be forthcoming to the pioneer in these realms of the "*Infiniment petits*."

Others besides myself have understood the necessity for summary treatment of certain groups of the Diatomaceæ. In years gone by, Greville, Roper, Brightwell, H. L. Smith, and a few others led the way, and at the present time a new generation is following their lead. Among the latter I may mention Captain of Artillery, H. Peragallo, who, between the practical technology of breechloaders and melinite, has found time to prepare a valuable paper on the genus *Pleurosigma*, with outline figures of all the species and diagrams of the striation. Prof. P. T. Cleve, of the University of Upsal, is far advanced on a general work, to comprise the numerous and difficult *Naviculæ*. Dr. Leuduger-Fortmorel is giving his special attention to the curious but very perplexing *Chatoceri*; while Mons. J. Tempère promises a complete Monograph of the *Aulacodisci*, being a critical review and a supplement to John Rattrey's "revision" of this genus of beautiful microscopical gems.

I am grieved to have to state that English and Scotch botanists—who some years ago occupied the head of Diatomology under the brilliant phalanx of such men as Greville, Gregory, W. Smith, Brightwell, Roper, Norman, Walker-Arnott, C. Johnston, Ralfs, Tuffen West, Donkin, and others—have at the present day arrived at a minimum of working naturalists. It is true that we still have the satisfaction of possessing among the living such men as Mr. Grove, Mr. Fred. Kitton, and Mr. John Rattrey; but these, as well as many others, have become reduced to ubiquitous collectors and mounters of Diatoms, or have ceased publishing their observations. Many of these gentlemen excel in their specialties, and none more so than the venerable Mr. Laurence Hardman, who at the advanced age of 82 is still able to prepare admirable type-plates of Diatoms containing hundreds of forms arranged in symmetrical patterns with a precision which brings astonishment and envy to the posses-

sors of much younger eyes and hands. Many of our "collectors" have a very considerable knowledge of the various species of diatoms. Among these latter I can only name a few, and will quote Mr. Rae of Stirling, Mr. Doeg of Evesham, Mr. Macrae of London, Mr. Morland of Hounslow, Mr. Griffin, etc. Diatomology, as a *science* possessing *science-writers*, has emigrated principally to France, Germany, and the United States, with solitary votaries elsewhere—one in Hungary, M. Pantocsek; one in Belgium, M. Van Heurck; two in Italy, M. Castracane and M. Mateo Lanzi; one in Sweden, M. Cleve; and one in Switzerland, M. Brun.

Since Messrs. Grove and Sturt published their memorable papers on the Oamaru (New Zealand) fossil deposits in the *Journal of the Quekett Club* in 1886—87, I hear that M. Sturt has entirely given up the study of Diatoms. Mr. J. Rattray, after his arduous labours among the *Coscinodisci*, the *Aulacodisci*, the *Actinocykli*, and their allies, has retired from the field of active workers. The same may be said of the sympathetic veteran, Fred. Kitton. The cause of these defections is attributable in a great measure to the stern fact that the study of the Diatoms is not conducive to the obtention of the much-needed "daily bread," but leads, alas! rather to the opposite result and also to the difficulty of finding publishers among the learned societies, whose members are not generally diatomists, and who object to the expense of the printing of the plates explanatory of the text. Most persons, however, and whatever their occupations or pursuits, have occasionally a few leisure hours, and to these we must look forward hopefully for the developments of the future.

I am fully aware that the "professors" of Botany in this country—few of whom know more about diatoms beyond their use as test objects for the high powers of the microscope—have relegated our favourites (very erroneously, in my humble opinion) among the lowest forms of life, and classed them with the heterogenous mixture of so-called "Schizophytous Protophytes," hardly higher in organisation than the problematical

Bacteria, the next-of-kin to inorganic matter. I live in the expectation that some valiant champion may turn up who will carefully investigate the life-history of the Diatomaceæ in view of restoring them to their proper place in Nature—very high above the actual degraded position which has been assigned to them. This, I feel very confident, will eventually occur, as the sole fact of their conjugating is a sign of superior organisation, unknown among the other Schizophytes.

In the following tables I have made use of a few expressions not in general use, which need here a few words of explanation.

I call "Marginal Rays," or simply "*Rays*," the radiating lines (called by others *costæ* or *canaliculi*), which, starting from the outer margin of the valves, converge towards the interior of the disc. These Rays may be *simple*, which is the commonest occurrence; or they may be *moniliform*, constituted by beads either in single or double rows; or, finally, they may be *infundibuliform*, having the outline of a funnel with its lengthened outlet, or of an old-fashioned champagne-glass with a long, slender foot, or, finally—as suggested by my friend, Mr. Thos. Comber—of a *Lotus* flower and stalk. The upper broad portion I call the "*funnel*," while the slender part I name the "*stem*."

The central portion of the valve *inside of the internal termination of the Rays* I call the "*area*." This area may be smooth and hyaline,\* or it may be *striate* or distinctly *punctate* or dotted, the dots forming regular lines or else being irregularly scattered. In one division of the genus the area becomes reduced to a central median, linear, blank space or to a simple longitudinal line. This is called the "*Raphe*" or "*pseudo-Raphe*"; it shows neither the central nor terminal nodules of the *Naviculæ* proper.

All lines, bars, or smooth striæ *on the area* I call the *striæ* in contradistinction to the *Rays*, which have their origin at the margin of the valves, and which terminate before the areal striæ make their appearance.

\* In some cases, under very high powers and well-managed light, this smooth area shows minute or obsolete punctuation.

In some cases the area is surrounded by a concentric row of approximating beads or dots or of abbreviated lines. These collectively constitute the "*circlet*."

All other terms employed explain themselves. Further on I have enumerated about 80 forms of the genus *Campylodiscus*, which I consider as really distinct. The total number of names in the authors amounts to no less than 220 (see the Synonymic Catalogue); but synonyms, varieties, *nomina nudæ*, and undeterminable forms resting on absence of figures and insufficient descriptions have led me to reduce the number to the 80 above mentioned, which include 23 new ones. It is thus seen that I have done away with 197 names of previous authors and retained only 57 of them. Some diatomists will, I fear, accuse me of the wholesale "massacre of the innocents," while others will take me to task for creating too many new "species"! I have done my best not to run into extremes, and have acted with due consideration before eliminating anything, and then only after repeated examination of hundreds of types. I hope I may be forgiven by some of my friends for having taken the great liberty of "doing away" with some of their "offspring"! My conviction as to the "non-existence" of *species*, in the generally accepted meaning of that term, must be my excuse for the reduction of the number of "so-called" species created by divers authors. It follows, according to my mode of reasoning, that if *the species* does not exist in nature, no genuine *specific characters* can be claimed for it. I admit, however, the existence of numerous *transient forms* of life at the present time, and also that these forms may often be distinguished, and should have names given to them when differentiated by clear and readily-made-out characters; not by subtle, vague, obsolete distinctions, as is too often the case, which as a rule are proper to *individuals* only, the offspring of a single parent. Groups of forms may without inconvenience be called *Genera* for the purposes of memotechny, but not because of their existence in Nature, which does not admit them any more than that of the contained "so-called" species.

My definition of a species, which I commend to evolutionists and transformists of the Darwin school, is that "A species, as we know it, is the *transient* form of a living organism which differed from it in the past and will differ again from it in the future. All that lives, and, I may add, also all that has no life, on this earth is changing and being modified. Nothing is probably at a standstill, fixed or immutable, in the universe. The laws which regulate the gradual transformation of plants and animals are of the highest interest to the naturalist, and should be carefully observed and worked out by him whenever possible.

I stated before this digression that I had added twenty-three new forms to the list of *Campylodisci*. These comprise six which will shortly be published by Dr. Leuduger-Fortmorel in a catalogue of the Diatoms of the Malay Archipelago which he has prepared; one species was named by Greville in Mr. Hardman's collection, but has not been made public to this day, while several others have been figured by Ad. Schmidt in his Atlas without names having been given them. The remainder are of my own *manufacture*, based upon specimens kindly placed at my disposal by many friends of congenial tastes. Most of these have since been generously offered to me and are now in my cabinet.

#### THE GENUS *Campylodiscus*

was established as long ago as 1841 by Ehrenberg, and has been accepted by all subsequent naturalists. He characterised it by the twisted shape of the valves. Modern diatomists have, however, restricted it to such Diatoms as have a frustule formed of two saddle-shaped valves, which are placed at right angles to each other.

In side or valvular aspect the valves appear circular, rotundo-oval, or very broadly elliptical. The front view, or connective zone aspect, is little developed and perplexing to the microscopist until the crossed position of the valves has been fully comprehended.

A frustule of *Campylodiscus*, as stated, is formed by two saddle-shaped valves, these saddles being thrown across one another with their concave sides facing but not touching each other, so as to leave space for the soft, living contents of the diatom. The connective zones, as in other diatoms, telescope one in the other, and unite the two valves by their outer margins. Having to follow the curvatures of two valves bent in opposite directions, they thereby acquire a remarkable zig-zag or undulating appearance, which at first sight is often somewhat difficult of interpretation, especially when complicated with the re-duplication of the cells.

All the other characteristics of the genus are those of the family "*Surirellæ*," to which it clearly belongs, although in some forms of *Campylodiscus* the marginal wings seem to be obsolete or wanting, or turned upwards in such a manner as to obliterate them apparently from a side-view aspect.

The endochrome or coloured contents, as seen in the living diatom, places the *Campylodisci* among the *Placochromaticæ* of Pfitzer's and Petit's classifications, which comprise such Diatoms as have in life and health their endochrome forming lamellar plates or chromatophores, in contradistinction to the *Coccochromaticæ*, which have a granular endochrome. In *Campylodiscus* two layers of endochrome exist in each frustule, one applied to the inner surface of each of the valves. The re-duplication of the frustules, or vegetative cells, takes place in the ordinary way. Nothing is known relating to the formation of Auxospores or germs in the *Campylodisci*.

All *Campylodisci*, with the exception of one or two species, are marine or from brackish water. The majority of forms are tropical, although a few reach both the Arctic and Antarctic Seas. From the far north, Prof. Cleve has registered the following seven forms:—

<i>Campylodiscus angularis.</i>	<i>Campylodiscus clypens.</i>
„ <i>grenlandicus.</i>	„ <i>Thuretii</i> and varie-
„ <i>echeneis.</i>	„ <i>Hybernicus.</i> [ties.
„ <i>biangulatus</i> = <i>Lorenzianus.</i>	

Those reported as British to the present time are the following eleven:—

<i>Campylodiscus horologium.</i>	<i>Campylodiscus decorus.</i>
„ <i>Hodgsonii.</i>	„ <i>Ralfsii.</i>
„ <i>echeneis,</i>	„ <i>centralis,</i>
= <i>C. cribrus</i> , W. Sm.	= <i>latus</i> , Shadb.
„ <i>hibernicus,</i>	„ <i>angularis.</i>
= <i>C. costatus</i> , W. Sm.	„ <i>eximius.</i>
„ <i>Thuretii,</i>	„ <i>limbatus.</i>
= <i>C. parvulus</i> , W. Sm.	

It would be premature to attempt at present a geographical distribution of the genus, as many species, such as some of those which are local in the inland sea of Japan and elsewhere, will no doubt prove, after further explorations in little-known regions, to have a much wider range of distribution. At the “Antipodes” many new species will probably also yet be further discovered, as many coasts in the Southern hemisphere have never as yet been examined for Diatoms.

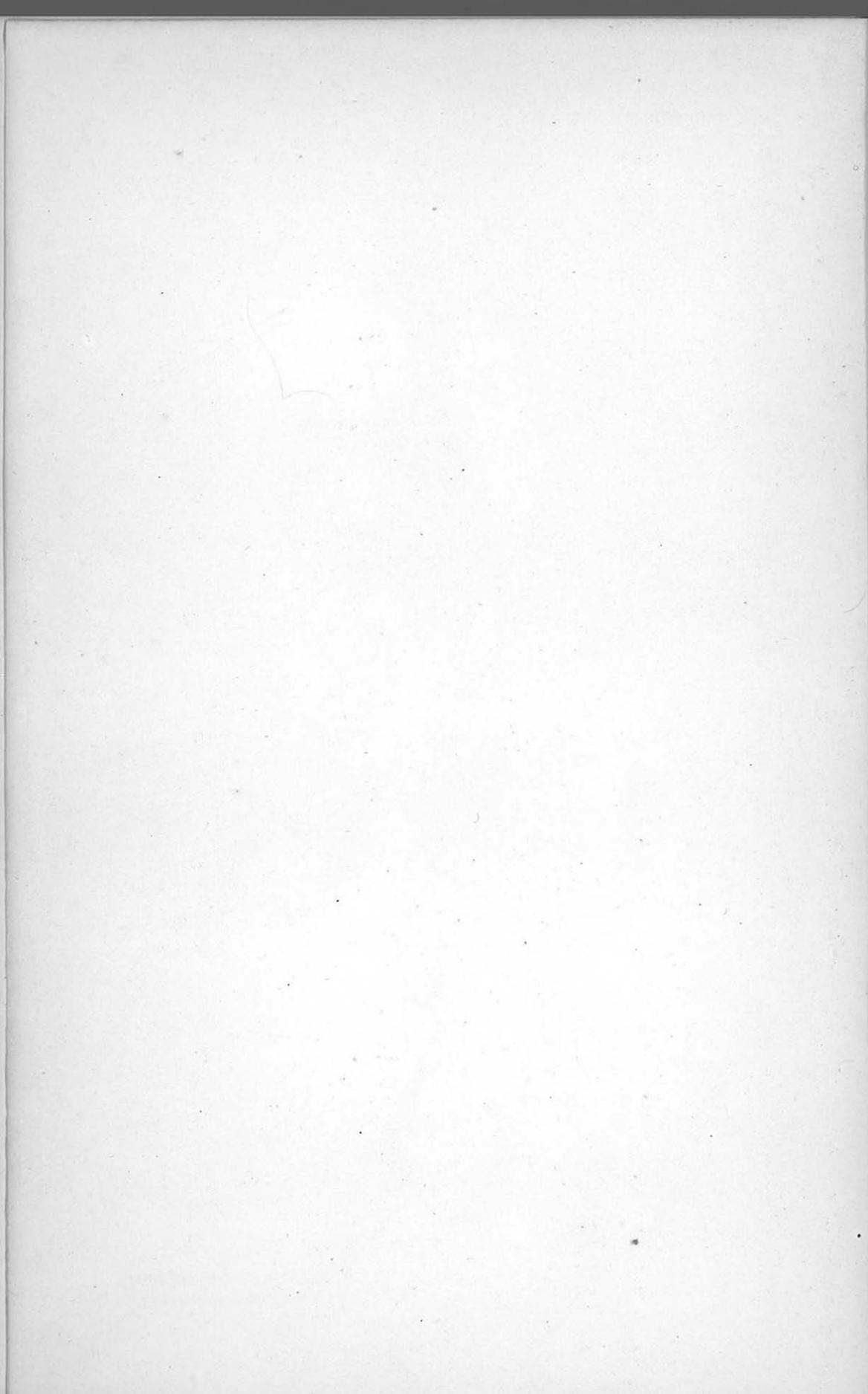
Contrary to what has taken place with the *Coscinodisci*, comparatively few species of this genus have been preserved in a fossil state in the tertiary formations. This I attribute to the single (not double) shell of the last and to their delicate structure.

Let me be allowed to repeat again that I attribute but very little importance to the “species” admitted in this paper. No one has less faith than I have as to their permanent existence, either on paper or in Nature. The actual *forms* known to us in a living state, or even in a fossil state, are, I sincerely believe, only transient or fleeting intermediaries between the “so-called” species of the past and the “so-called” species of the unknown future. A species, properly so speaking, should represent an organism from its beginning or first appearance on this earth until its final end, including all the forms, variations, and transformations it may have acquired or passed through during the whole of its existence in time and space. As such, the “species” is and must ever remain unknown to man, although its past history

may, within uncertain fragmentary limits, be occasionally "conjectured" and its future very hazardly "guessed" at. We know, unfortunately, nothing positive regarding the origin of any living being in Nature, and can have no hope of lifting the veil of the far future, which is probably one of the special attributes of the Creator, not of His creatures. This being the case, I consider that the history of a *species* is beyond the limits of human science. All we can do is to study *transient and variable forms*, not "*species*," in the general acceptance of the term.

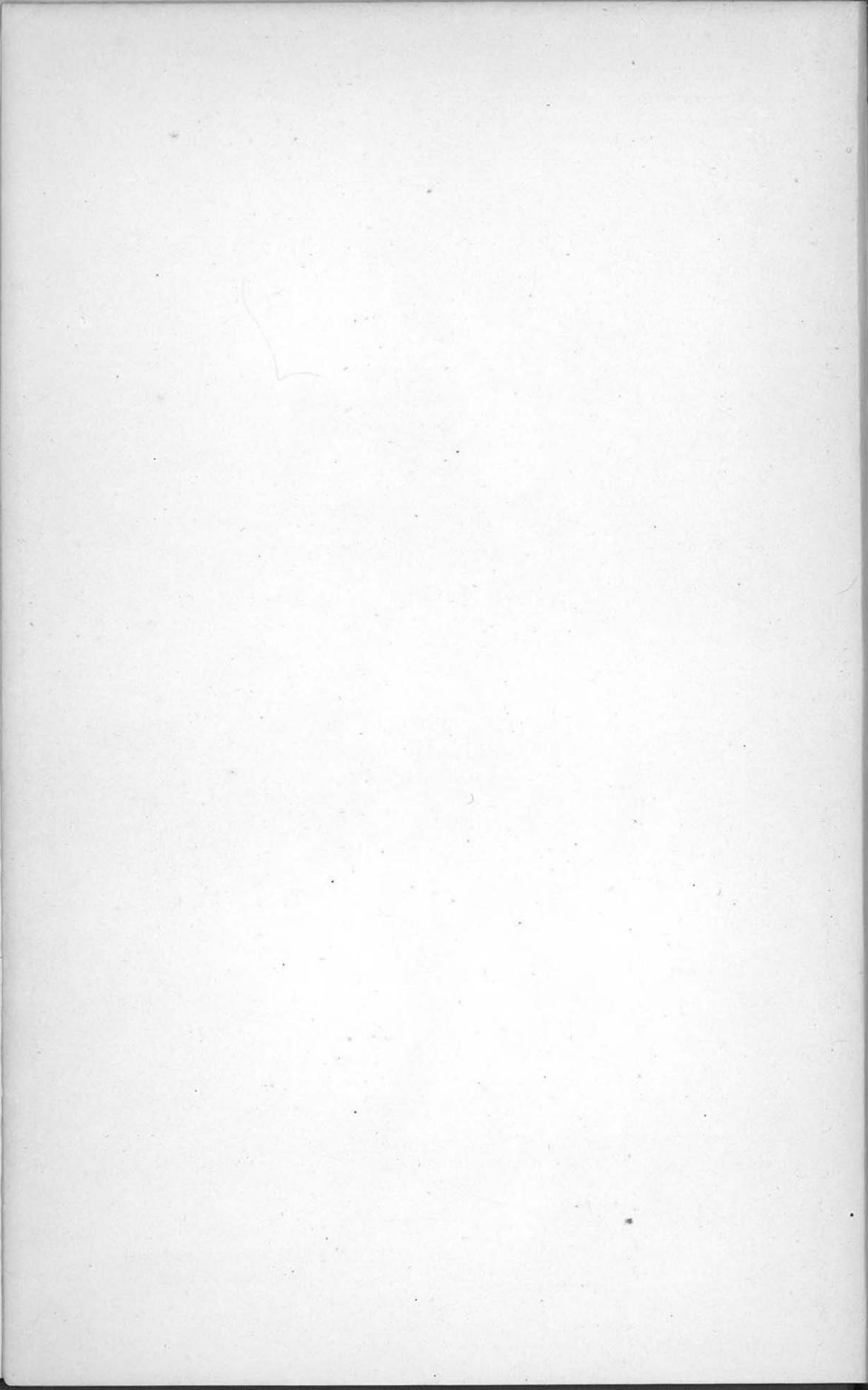
No attempt has been made by the author to establish the affinities of the *Campylodisci* mentioned in this paper. This, as well as full descriptions and a discussion of comparative characteristics, is reserved for a future complete monograph, to which these pages are only the prelude. Let me add that a verification of the names arrived at by the use of the analytical tables should be made by referring to published figures of the species as indicated in the Synonymic Catalogue which immediately follows this introduction.

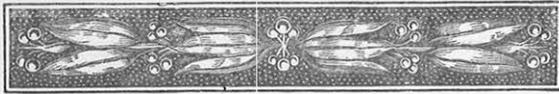
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II.

SYNONYMIC CATALOGUE.





*Synonymic Catalogue of all known  
Campylodisci.*

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**A**

- Campylodiscus adornatus.** A. S. Atl., pl. 51, f. 5, pl. 52, f. 3.  
= *C. Philippinarum*, Castr.
- C. Adriaticus.** Grun O. Diat., pl. 11, f. 8; A. S. Atl., pl. 16, f. 13.  
„ Var. Grun., A. S. Atl., pl. 16, f. 18.  
„ Var. *Massiliensis*, Grun., A. S. Atl., pl. 16,  
f. 14—16.
- C. albifrons.** Brun. Diat., esp. nouv., pl. 21, f. 2, = *C. marginosinuatus*, Deby, in litt.
- C. Altar.** Brun., Diat., esp. nouv., pl. 21, f. 1.
- C. ambiguus.** Grev. T. M. S. (1860), pl. 1, f. 5, = *C. latus*,  
Shadb. (1854), = *C. Kittonianus*, = *C. contiguus*,  
= *C. centralis*.
- C. Americanus.** Ehr. Wächs. Kennt. Calif., pl. 3, 2f. 4. Not  
determinable.
- C. Amstelodamensis.** Harting. Boden onder, Amsterdam,  
pl. 3, f. 9, = *Campyl. echeneis*, Ehr.
- C. amphileia.** Grun., A. S. Atl., pl. 51, f. 2, = *C. ornatus*,  
Grev. var.

- C. anceps.** Castr. Chall., pl. 16, f. 2, = *C. similis*, Jan. Gazel.\*
- C. angularis.** Greg. Clyde, f. 53; Jan. and R. Honduras, pl. 1, f. 10; A. S. Atl., pl. 18, f. 7. ≠ [*C. hypodromus*, *ist. eigene Art.* Brun.]
- C. Arabica.** Grun., A. S. Atl., pl. 55, f. 7, = *C. bicostatus*, Rop. var., ?
- C. arachnoides.** Harting. Banda See pl. 2, f. 38, = *Auliscus compositus*, A. S.
- C. areolatus.** Hart. Bod. o. Amsterdam, = Doubtful form; not a *Campylodiscus*.
- C. argus.** Bail., Micr. Obs., <sup>pl. 2</sup>f. 24, 25 (1854), = *C. echeneis*, Ehr. (1840).
- C. Australis.** Grun., A. S. Atl., pl. 51, f. 9, = *C. Crebrestrostatu* var.
- C. Aralensis.** Ehr. Abh., 1872, pl. 12, f. 16. Not determinable.
- C. Atlanticus.** Peragal. in T. et. P. Diat. Exicat., No. 11, *Nomina nuda*. In this slide I have found *C. ornatus*, *C. biangulatus*, *C. Dæmelianus*, *C. adornatus*, *C. contiguus*, and *C. Samoensis*; but no form I can refer to as a new species representing *C. Atlanticus*.

## B.

- Campylodiscus Baldjickianus.** Grun., A. S. Atl., pl. 51, f. 16—21, = *C. Thuretii*.
- C. Balearicus.** Cleve, A. S. Atl., pl. 53, f. 11; [pl. 18, f. 11, *C. undulatus* Grev.] = ? *C. undulatus*, Grev.

\* Belongs very doubtfully to *Campylodiscus*, as the valves seem not to be concavo-convex and have no apparent marginal wings.

- C. Balticus.** Cleve. In litt.
- C. biangulatus.** Grev., T. M. S., Vol. X., N.S., 1862, pl. 3, f. 2; A. S. Atl., pl. 14, f. 18—22, = *C. Lorenzianus*, Grun.; = *C. Sauerbeckii*, Grun., = *C. exilis*, Grun.
- C. bicinctus.** Castr. Chall., pl. 11, f. 2. Bad figure.
- C. bicostatus.** <sup>W. Sm. T. M. S.</sup> ~~Rop. M. J.~~, Vol. II., 1854, pl. 6, f. 4.  
 „ Grun., O. Diat., pl. 10, f. ~~34~~<sup>1</sup>, b; V. H. Synop., pl. 75, f. 2; A. S. Atl., pl. 55, f. 4—6; = ? *C. clypeus* var.  
 „ Var. *Arabica*, Grun., A. S. Atl., pl. 55, f. 7.  
 „ Var. *parvulata*, Grun., O. Diat., pl. 10, f. 2.  
 „ Var. *Peisoneis*, Grun., O. Diat., pl. 10, f. 1a.  
 „ Var. *quadrata*, Grun., O. Diat., pl. 10, f. 3a, b.
- C. bicruciatu.** Greg., T. M. S., 1857, pl. 1, f. 42, = *C. simulans*, Greg. Is a complete frustule seen through two valves *in situ*.
- C. bifurcatus.** A. S. Atl., pl. 52, f. 8.
- C. bimarginatus.** A. S. Atl., pl. 16, f. 7; pl. 18, f. 15.
- C. birostratus.** Deby, A. S. Atl., pl. 14, f. 23, = *C. impressus*, Grun., in part.
- C. biseriatus.** Deby, A. S. Atl., pl. 15, f. 11.
- C. Braziliensis.** Deby, Coll., A. S. Atl., pl. 14, f. 31; pl. 18, f. 8, = *C. Samoensis*, var. Grun., or *C. crebrecostatus*.
- C. Brightwellii.** Grun., 1862, pl. 9, f. 5; A. S. Atl., pl. 15, f. 6, 7, = *C. Grevillii*, Leud., 1879.
- C. Briocensis.** A. S. Atl., pl. 52, f. 1, 2, = *C. eximius*, Grev. var.

- C. Brownianus.** Grev., T. M. S., Vol. X., N.S. (1862), pl. 9, f. 2, = *C. rotula*, Grün. (1885), A. S. Atl., pl. 14, f. 10; = ? *C. Phalangium*, A. S. var.

## C.

- Campylodiscus calcar.** Leud., In litt., = *C. Wallichianus*, Grev., front view.
- C. Californicus.** (Grove) Deby (\*).
- C. canalisatus.** T. et B. Jap., pl. 2, f. 5, = ? *C. simplex*, T. et B.; = ? *C. vitricavus*, T. et B.
- C. carinatus.** Ehr. Abh. (1875), not figured. Not determinable.
- C. Caspius.** Ehr. Ber., 1840, Abh., 1872, pl. 12, f. 11, = *C. echenëis*.
- C. Castili.** Ehr. Abh., 1869, pl. 1 f, f. 9, = *C. clypeus*.
- C. Castracaneis.** Jan. Gazel., pl. 20, f. 1; but *C. Castracaneis*, Jan., pl. 19, f. 15, = *C. incertus*, A. S.
- C. centralis,** Greg. Clyde (1857), pl. 3, f. 51, = *C. latus*, Shadb. (1854), and others. See *C. latus*.
- C. Cesatianus.** Rabn. flor. Europ. Alg., p. 50, = *C. echenëis*, Ehr. var.
- C. Challengerensis.** Deby, coll.
- C. chrysanthemum.** T. et B. Jap. pl. 2, f. 7.
- C. circumactus.** A. S. Atl., pl. 14, f. 34—35, = *C. marginatus* Johnst., Grev., = ? *C. Imperialis*, Grev. var.
- C. circumdactus.** Leud., = *C. rotula*, Grün., 1885.
- C. clivosus.** B. et T. Jap., pl. 2, f. 11, = *C. contiguus*, A. S.

(\*) This is probably small *C. Coronilla*, Brun., without a "circlet."

- C. clypeus*. Ehr. Mik., pl. 10 I., f. 1; Weisse, Guano, pl. 1, f. 14; V. H. Synop., pl. 75, f. 1; A. S. Atl., pl. 54, f. 78, pl. 55, f. 1-3.
- C. cocconeiformis*. Cleve, Vega, pl. 38 f. 78 (\*).
- C. collectus*. L. W. Bail., Para River, pl. I, f. 38-40. Not determinable.
- C. comptus*. Jan. Gazel., pl. 19, f. 16, = *C. singularis*, A. S.
- C. concinnus*. Grev., Pritch., p. 800, Grev., T. M. S., 1860, pl. I, f. 2; A. S. Atl., pl. 53, f. 9; ? A. S. Atl., pl. 18, f. 16-18, = *C. imperialis*, Grev., = *C. lineatus*, Grun., = *C. marginatus* Johnst.
- C. contiguus*. A. S. Atl. (1885), pl. 18, f. 19-20, = *C. divosus* (1889), Brun., = *C. latus*, Shadb. (1854).
- C. coronilla*. Brun., Diat. Esp. nouv., pl. 21, f. 3.
- C. coruscus*. A. S. Atl., pl. 14, f. 17.
- C. costatus*. W. Sm. (1851), Synop., pl. 7, f. 52, pl. 6, f. 52, = *C. hibernicus*, Ehr. (1845).
- C. crebrecoatus*. Grev., T. M. S., Vol. XI., N. S., (1863), pl. 1, f. 6, = *C. crebrestriatus*, Grun., Atl., pl. 53, f. 18, = *C. singularis*, A. S., = *C. intermedius*, Grun., = ? *C. Heufleprri*, var., = ? *C. humilis*, Castr., = ? *C. Australis*, var. Grun., = *C. Braziliensis*, Deby coll., = *C. densecostatus*, Cleve, var.
- C. crebrestriatus*. Grun., Atl., pl. 53, f. 18, = *C. crebrecoatus*, Grev.
- C. cribrosus*. W. Sm. Synop., pl. 7, f. 55, = *C. echenëis*, Ehr.

(\*) This is not a *Campylodiscus*. Its valves are quite flat. It is either a *Survirella* or an internal valve of a *Cocconeis*. I have examined several specimens.

## D.

- Campylodiscus dæmelianus.** Grun., A. S. Atl., pl. 54, f. 1—2.  
 „ Var. ? *Sonderianus*, Grun. in litt., Möller Slides.  
 „ Var. *Comminuta*, A. S., pl. 17, f. 11.
- C. Debyi.** Leud., in litt.
- C. decorus.** Breb., Cherbg. (1854), f. 2; Grun., O. Diat., pl. 9, f. 7; A. S., Atl., pl. 14, f. 4, = ? *C. Ralfsii*, W. Sm. (1853), var.  
 „ Var. † *pinnata*, Peragal. Villfr., pl. 1, f. 1, = *C. exilis*, Grun.
- C. densecostatus.** Cl. Vega (1883), pl. 38, f. 76, = *crebrecostatus*, Grev. var.
- C. dentatus.** Deby (\*).
- C. de Tonianus.** Deby (†).
- C. diplostictus.** (Norm.) Grev., T. M. S., Vol. VIII., 1860, pl. 1, f. 6, = *C. Robertsianus*, var.
- C. divisus.** Leud., Ceylon, pl. 5, f. 58, = *C. Kittonianus*, = *C. latus*.
- C. Doegeanus.** Deby, in litt. (‡), = *C. Coronilla*, Brun.
- C. dubius.** Leud., Ceylon, pl. 4, f. 47ab, = ? *C. latus*, Shadb.

(\*) From the Phillipine Islands.

(†) From Mauritius and Madagascar, Tamatave.

(‡) Similar to *Californicus*, Grove in litt. (Deby), but smaller and without a "circlet."

## E.

- Campylodiscus ecclesianus.** Grev., M. J., 1857, pl. 3, f. 5;  
Pantoc., Vol. I., pl. 3, f. 26.
- „ Var. A. S. Atl., pl. 17, f. 16, = ? *C. Rabenhorstii*, A. S. Atl., pl. 53, f. 12—14.
- C. echenëis.** Ehr. Ber., 1840, p. 206; A. S. Atl., pl. 54, f. 3-6;  
V. H. Synop., pl. 76, f. 1, 2, = *C. cribrosus*,  
W. Sm.
- C. Ehrenbergii.** Ralfs. Prit., 1861, pl. 12, f. 12—14<sup>3</sup>, 22, 23.  
Not determinable.
- C. Eiowanus.** Ehr. M., 1856, not figured. Not determinable.
- C. Eisenii.** Grun., in litt. in Weissflog coll., = *C. Thuretii*, Breb.
- C. elegans.** Ehr. Kutz. Bac., tab. 28, f. 23, = *Surirella elegans*.
- C. emarginatus.** Deby (\*).
- C. erosus.** Castr. Chall., 1886, pl. 11, f. 3, = *C. Greenleafianus*,  
Grun.; = ? *C. undulatus*, Grev. var., etc.
- „ ? Var. Castr. Chall., pl. 11, f. 5.
- C. exiguus.** Grun., O. Diat., pl. 11, f. 4. Doubtful minute  
species.
- C. exilis.** Grun., A. S. Atl., pl. 18, f. 3, = *C. biangulatus*,  
Grev., f. minor, or *Ralfsii*, W. Sm.
- C. eximius.** Greg. Clyde, pl. 3, f. 54; Grun., O. Diat., pl. 11,  
f. 5.
- „ Var. *Briocensis*, A. S. Atl., pl. 52, f. 1, 2.

(\*) From the inland sea of Japan.

## F.

- Campylodiscus fastuosus*. Ehr. Ber., 1845, = ? *C. Simulans* or *C. Thuretii*, Grun., O. Diat., pl. 9, f. 8.
- C. fenestratus*. Grev., M. J., 1857, pl. ~~3~~<sup>3</sup>, f. ~~4~~<sup>4</sup>, = *C. ecclesianus*, Grev. Complete frustule seen through both valves.
- C. flammiger*. Leud., Ceylon, pl. 4, f. 53, = ? *C. Pacificus*, Grun. var.
- C. flexuosus* Ehr. Kutz. bacc., t. 28, f. 25; Ralfs. Prit. Inf., 1861, pl. 12, f. 11, = *Surirella spiralis*.
- C. fluminensis*. Grun., A. S. Atl., pl. 14, f. 6, = *C. Quarnerensis*, Grun.
- C. fortis*. Leud., in litt.

## G.

- Campylodiscus gibberosus*. Leud., Ceylon, pl. 4, f. 52, = ? var. *teniatus*, A.S., but doubtful.
- C. Gräffii* Grun., A. S. Atl., pl. 16, f. 1, = *C. teniatus*, A. S. var., = ? *C. ecclesianus*, Grev. var.
- C. granulatus*. Grun., in litt., = *C. latus*, Shadb. var.
- C. Greenleafianus*. Grun., A. S. Atl. (1885), pl. 15, f. 3, = *C. undulatus*, Grev., etc.
- C. Grevillii* Leud., Ceylon, pl. ~~4~~<sup>5</sup>, f. 54—56, = *C. Brightwellii*, Grun.
- C. Grønlandicus*. Cl. Artic D., pl. 2, f. 9. Doubtful species.
- C. Gründleri*. Grun. A. S. Atl., pl. 15, f. 1—2; pl. 51, f. 13, = *C. undulatus*, Grev. var.

## H.

- Campylodiscus Hardmanianus.** Grev. in litt. (1866), Hardman's Coll., Deby's Coll., Nos. 199, 200, = *C. Sonderianus*, Grun. in litt., Möller.
- C. Heufleyrii.** Grun. A. S. Atl., pl. 53, f. 19, pl. 14, f. 25, 26, = *C. crebrecoatus*, var. Grev.
- C. helianthus.** A. S. Atl., pl. 17, f. 15.
- C. heliophitus.** Ehr. Kutz., not figured. Not determinable.
- C. hibernicus.** Ehr. Mik., pl. 15a, f. 9; A. S. Atl., pl. 55, f. 9—16, = *C. costatus*, W. Sm., = *C. noricus* var.
- C. Hodgsoni.** Wm. Sm., Synop., pl. 6, f. ~~63~~<sup>53</sup>; R. and Jan. Hond., pl. 1, f. 8, = *C. imperialis*, Grev. not A. S. Atl., pl. 53, f. 5.
- C. horologium** (Williamson). W. Sm., Synop., pl. 6, f. 51, A. S. Atl., pl. 51, f. 7.  
 „ Var. *Mediterranea*, Grun., A. S. Atl., pl. 17, f. 7. var. ? *Pfitzneri*.
- C. humilis.** Castr. Chall., pl. 11, f. 8, = ? *C. crebrecoatus* var.
- C. Humboldtii.** Ehr. Abh., 1869, Mexico, pl. 1, f. ~~E3~~<sup>E3</sup>, = *C. clypeus*, Ehr.
- C. hypodromus.** T. and B. Jap., pl. 2, f. 10, = ~~*C. Angularis*, Grev.~~

## I, J.

- Campylodiscus imperialis.** Grev., T. M. S., 1860, pl. 1, f. 3 (not A. S. Atl.), = *Hodgsonii*, W. Sm., = ? *C. Concinnus*, Grev., = *C. marginalis*, Johnst.

- C. imperialis*. Var. *Media*, Grun., A. S. Atl., pl. 17, f. 20.  
 „ Var. Grun., A. S. Atl., pl. 15, f. 9, 10.
- C. impressus*. Grun., A. S. Atl., pl. 51, f. 10, = *C. birostratus*,  
 pars, Deby.
- C. incertus*. A. S. Atl., pl. 15, f. 13—15; Jan. Gazel, pl. 11,  
 f. 15, = *C. Samoensis*, Grun.
- C. inconspicuus*. Deby, A. S. Atl., pl. 51, f. 11, 12.
- C. Indicus*. Ehr. Ber. (1845), p. 362, R. S. A., p. 33, not  
 figured. Not determinable.
- C. insignis*. Leud., Ceylon, pl. 9, f. 104, = *C. adriaticus*, var.  
*Massiliensis*, Grun.
- C. intermedius*. Grun., A. S. Atl., pl. 18, f. 9; pl. 14, f. 30,  
 = *C. crebrecostatus*, Grev., = *C. Schmidtii*, var.  
 A. S. Atl., pl. 53, fig. 8.
- C. Japonicus*. Castr. Chall., pl. 11, f. 1.

## K.

- Campylodiscus Kerguelensis*. Deby.
- C. Kittonianus*. Grev., T. M. S., 1860, pl. 1, f. 7; A. S. Atl.,  
 pl. 16, f. 19—21, = *C. latus*, Shadb. (1854),  
 = *Centralis* Greg., = *C. contiguus* A. S. (1885),  
 = *C. ambiguus*, Grev.
- C. Kutzingii*. Bailey, Proc. Acad. Phil., 1853; Harv. and  
 Bail., U.S. Exped. (1862—74), Pl. 9, f. 20, =  
*C. striolatus*, Grun. (1885).

## L.

- Campylodiscus latus.** Shadb., T. M. S., Vol. II., pl 1, f. 13 (1854), = *C. Kittonianus*, Grev. (1860), = *C. ambiguus*, Grev. (1860), = *C. contiguus*, A. S. (1885), = *C. speculum*, Leud., = *C. radians*, Leud., = *C. signatus*, Leud. var.
- C. larius.** Castr. = *C. Noricus*, var. From Lakes of Como and Varese.
- C. lepidus.** Castr. Chall. (1886), pl. 11, f. 7, = *C. Pfitzeri*, A. S., 1885, = *C. horologium*, W. S. var. (1853), etc.
- C. limbatus.** Breb., Cherbourg, f. 1; Grun., O. Diat., pl. 9, f. 4; Peragal. Villfr., f. 4.
- „ Var. *Australis*, Eul., A. S. Atl., pl. 17, f. 1.
- „ Var. *Chilensis*, Grun., A. S. Atl., pl. 17, f. 2, 3.
- „ Var. *minuta*, Cleve, Vega, pl. 38, f. 77.
- C. lineatus.** Grun., A. S. Atl., pl. 18, f. 18, = *C. concinnus*, var., = *C. marginatus*, Johnst., M. J., Vol. VIII., pl. 1, f. 11.
- C. Lorenzianus.** Grun., A. S. Atl., pl. 18, f. 4, pl. 14, f. 24; O. Diat., pl. 11, f. 1, 2, = *C. biangulatus*, Grev.

## M.

**Campylodiscus Macassarensis** (Grov. in litt.). Deby.

**C. Margaritaceum.** Cl. New Diat., pl.  $\frac{4}{\beta}$ , f. 52. Doubtful form.

*tus* / **C. marginatus** Johnst., T. M. S., 1860, pl. 1, f. 2, = *C. imperialis* var.

- C. marginatus*. Ehr. Ber. (1845), p. 313; K. S. A., p. 33.  
Not figured. Not determinable.
- C. margo-sinuatus*. Deby in litt. = *C. Albifrons*, Brun..
- C. Massiliensis*. Grun., A. S. Atl., pl. 16, f. 14—16, = *C. Adriaticus* var.
- C. Mediterraneus*. Grun., In Cleve and Möll., Diat., Nos. 154—155, = *C. horologium*, Will. var.
- C. mesoleia*. Grun., A. S. Atl., pl. 51, f. 3, = *C. ornatus*, Grev. var.
- C. Mexicanus*. Ehr. Ber., 1861; Abh., 1872, pl. 5, f. 19,  
= *C. triumphans* var., ? Doubtful form.
- C. Micaultii*. Leud., Ceylon, pl. 9, f. 103, = *C. latus*, Shadb. ?
- C. minutus*. Grun., O. Diat., pl. 7, f. 27, = *C. radiosus*, Grun.,  
*forma minor*.
- C. mirabilis*. Leud, in litt.
- C. Mülleri*. A. S. Atl., pl. 14, f. 13.
- C. myodon*. Ehr. Kutz bacc., t. 28, f. 24, = *Surirella splendida*.

## N.

- Campylodiscus nanus*. Schum. Tatra, p. 56, pl. 1, f. 12. Not determinable.
- C. nitens*. Castr. Chall., pl. 11, f. 6. Not determinable.
- C. noricus*. Ehr. Ber., 1840, <sup>V.H</sup>~~U.K.~~ Synop., pl. 77, f. 4—6;  
A.S. Atl., pl. 55, f. 8; Grun., O. Diat., pl. 10,  
f. 4, 5, = *C. hibernicus*, var. Ehr., = *C. costatus*,  
W. Sm., Synop., pl. 6, f. 52.

- C. Normanianus.** Grev., T. M. S., Vol. VIII., pl. 1, f. 1,  
A. S. Atl., pl. 14, f. 14, = *C. Wallichianus*, var.  
without apiculi.
- C. notatus.** Grev., T. M. S., 1860, pl. 1, f. 4, = *C. Hodgsoni*,  
W. Sm.
- „ Var. *C. vitiensis*, Grun., A. S. Atl., pl. 51, f. 8.
- „ „ „ *forma minor*, A. S. Atl., pl. 53,  
f. 15, = *C. radiosus*, Ehr.

## O.

- Campylodiscus obsoletus.** Cleve, Tegel., pl. 12, f. 2.
- C. oceanus.** <sup>ic</sup> Castr. Chall., pl. 11, f. 4. Not determinable.
- C. orbicularis.** Castr. Chall., pl. 16, f. 16, = *C. horologium*,  
*forma minuta*.
- C. orbicularis.** Cleve Vega, pl. 38, f. 79, = ~~*C. Pacificus*~~,  
~~Grun. var.~~ *Surirella orbicularis Cl.*
- C. ornatus.** Grev., T. M. S., Vol. XI., N. S., pl. 1, f. 3; A. S.  
Atl., pl. 17, f. 17; O. Witt. Sudsee, pl. 15, f. 6.
- „ Var. *Amphileia*, Grun., A. S. Atl., pl. 51, f. 2.
- „ Var. A. S. Atl., pl. 51, f. 6.
- C. ovatus.** Ralfs. Pritch., Inf., 1861, p. 802, not figured,  
= *C. dypeus*.

## P.

- Campylodiscus Pacificus.** Grun., A. S. Atl., pl. 16, f. 12.

- C. panduriger*. A. S. Atl., pl. 14, f. 33.
- C. parvulus*. W. Sm., Synop., pl. 6, f. 56, = *C. simulans* Greg., or *C. Thuretii*, Breb.
- C. Peragallii*. Deby, = Peragal. Villefr., pl. 1, f. 3, <sup>(without name)</sup> = *C. decorus*, var. *pinnata*, Perag., = ? *C. rivalis*, A. S. = ? *C. Ralfsii*, var.
- C. peramplus*. Cleve, New Diat., pl. 4, f. 53.
- C. Pfitzeri*. A. S. Atl., pl. 17, f. 5, 6, = *C. lepidus*, Castr., = *C. horologium* var.
- C. phalangium*. A. S. Atl., pl. 14, f. 11, 12; A. S. Atl., pl. 53, f. 16, 17, = ? *C. rotula*, Grun. var., = *C. Browneanus*, Grev. var.
- C. Philippinarum*. Castr. Chall., pl. 11, f. 9, = *C. ornatus*, Grev., Castracane's figure bad.
- C. pinnata*<sup>us</sup>. Per., pl. 1, f. 1, = *C. decorus*, var. Perag., = *C. Ralfsii*, W. Sm. var.
- C. polaris*. Ehr., Nordpol., p. 21, pl. 3, f. 5. Not determinable.
- C. pulchellus*. Leud., in litt.
- C. punctatus*. Bleich.<sup>s</sup> Hedw., 1860, pl. 5, f. 1-9, = *C. noricus*, Ehr.
- C. punctulatus*. Grun., A. S. Atl. pl. 17, f. 4.
- C. productus*. Johnst., J. M. S., 1860, p. 12, = *Survivella lata*, W. Sm.

## Q.

- Campylodiscus Quarenensis*<sup>er</sup>. Grun., O. Diat., 1862, pl. 11, f. 3, = *C. fluminensis*, Grun., Atl., pl. 14, f. 6, 1885.

## R.

- Campylodiscus Rabenhorstianus.** J. and Rab., Honduras, pl. 1, f. 6; O. Witt. Sudsee, pl. 15, f. 9; A. S. Atl., pl. 53, f. 12.
- „ Var. J. and Rab., pl. 1, f. 7; A. S. Atl., pl. 53, f. 13.
- „ Var. A. S. Atl., pl. 53, f. 13, 14, = ? *C. ecclesianus*, Grev.
- C. radiatus.** Leud., Ceylon, pl. 4, f. 48, = *C. incertus*, A. S., = *C. samoensis*, Grun., A. S. Leuduger's figure not good.
- C. radians.** Leud., Ceylon, pl. ~~4~~<sup>5</sup> f. 57, doubtful form; near pl. 51, f. 12, A. S. Atl., unnamed.
- C. radiosus.** Ehr. Nordpol, pl. 3, f. 7, 8 = *C. vitiensis*, Grun. ?
- C. radiosus.** Brun. in litt., = *C. stellatus*, Grev. var. ?, without a circlet, if it is not a monstrosity of *C. rivulosus*, Brun.
- C. radiosus.** Grun., O. Diat., pl. 9, f. 9, = *C. minutus*, Grun., *forma major*.
- C. radiolatus.** Ehr., M., p. 12. Not figured; probably *C. noricus*.
- C. ~~Raenus~~<sup>2</sup>.** Deby, Coll., A. S. Atl., pl. 18, f. 5, 6, = *C. erosus*. Cast. var. ?
- C. Ralfsii.** W. Sm., Synop., pl. 30, f. 257 (supplement); A. S. Atl., pl. 14, f. 1-3, = *C. decorus*, Grev., var.; ? *C. scalaris*, T. and B. var., = *C. exilis*, Grun. ?
- C. remora.** Ehr., Amer., pl. 3, 7, F. f. 14, = *C. bicostatus*, W. Sm. *C. radiosus*
- C. rivalis.** A. S. Atl., pl. 18, f. 1, 2.
- C. rivulosus.** T. et Br. Jap., pl. 2, f. 9.

- C. Robertsianus.** Grev., T. M. S., Vol. XI., N.S., pl. 1, f. 5, A. S. Atl., pl. 17, f. 8—10, = *C. diplostictus*, var. (Norm.) Grev.
- C. rotula.** Grun. (1885), A. S. Atl., pl. 14, f. 10, pl. 53, f. 20, = *C. Browneanus*, Grev. (1862), = ? *C. phalangium*, A. S. var.

## S.

- Campylodiscus Sabini.** Ehr., Abh., 1872, Nordpol., pl. 3, f. 6. Doubtful species.
- C. Samoensis.** Grun., A. S. Atl., pl. 15, f. 19, 20; Jan. Gazel., pl. 19, f. 12, = *C. incertus*, A. S., = ? Peragal., Villefr., pl. 1, f. 2.
- C. Sauerbeckii.** Gründl., A. S. Atl., pl. 52, f. 6; A. S. Atl., pl. 53, f. 3, 4, = *C. undulatus*, Grev. var.
- C. scalaris.** T. et Br. Jap., pl. 2, f. 12, = *C. Ralfsii*, var.
- C. Schleinitzii.** Jan., A. S. Atl., pl. 52, f. 5; Jan. Gazel., pl. 19, f. 13.
- C. Schmidtii.** Grun., A. S. Atl., pl. 53, f. 10; Jan. Gazel., pl. 15, f. 12, = ? *C. Hodgsoni* var.
- C. signatus.** Leud., Ceylon, pl. 4, f. 50, = *C. radians*, Leud.
- C. similis.** Jan. Gazel., pl. 19, f. 8, = *C. anceps*, Castr.
- C. simulans.** Greg., T. M. S., Vol. V., pl. 1, f. 41; A. S. Atl., pl. 17, f. 12—14; A. S. Nordsee pl. 3, f. 10, = *C. parvulus*, W. Sm., = ? *C. Thuretii*.
- C. simplex.** T. et Br. Japon, pl. 2, f. 6, = ? *C. vitricavus*, T. et Br. var.

- C. singularis.** A. S. Atl., pl. 14, f. 29, = *C. crebrecostatus*, Grev.
- C. socialis.** O. Witt., A. S. Atl., pl. 14, f. 7—9.
- C. Sonderianus.** Grun., in litt., Möller slides, = *C. Hardmanianus*, Grev., in litt., 1866.
- C. speculum.** Leud., Ceylon, pl. 4, f. 49, = *C. signatus*, Leud., = *C. radians*, Leud., = *C. latus*, Shadb. vars.
- C. spiralis.** W. Sm., pl. 7, f. 54, = *Surirella spiralis*.
- C. stellatus.** Grev., M. J., 1859, pl. 7, f. 3.
- C. stellula.** Schum. Preus., Diat., ~~pl. 3, f. 6~~ <sup>second series, pl. 7, f. 6</sup>, = *C. clypeus*, Ehr.
- C. striatus.** Ehr., Amer., pl. 3, 7, f. 13; Bright, M. J., Vol. VII., pl. 9, f. 4, = ? *C. undulatus*, Grev.
- C. striolatus.** Grun., A. S. Atl. (1885), pl. 53, f. 1, 2, = *C. Kutzingii*, Harv. and Bail. (1862—1874), pl. 9, f. 20.
- C. Studeri.** Jan. Gazel., pl. 19, f. 9—10, = *C. Greenleafianus*, Grun., = *C. erosus*, Castr., = *C. undulatus*, Grev. var.
- C. subangularis.** Cleve and Möll., Diat., Nos. 154, 155, *Nomina nuda*. My slides only contain *C. simulans* and *C. circumactus*, from the Balearic Islands
- C. Sumatrensis.** Leud., in litt.
- C. superbus.** Rabn., Flor. Europ. Alg., p. 45, pl. 8, f. ~~8~~<sup>10</sup>; Susswasser, Diat., pl. 3, = *Calodiscus superbus*. Possibly not a *Campylodiscus*, as it is described as *flat* and immersed in mucus. This form, from "*paludosus submarinis terræ di Otranto Italiae Australis*," should be looked for by Italian diatomists, as it is a puzzle to algologists.

- C. Surirella.** Ehr. Ber. (1845), p. 305; K. S. A., p. 35. Not figured. Not determinable.

## T.

- Campylodiscus tabulatus.** A. S. Atl., pl. 52, f. 4.
- C. taeniatus.\*** A. S. Atl., pl. 51, f. 1, including var. *C. Gräffei*, Grun.
- C. taenioides,** Deby. A. S. Atl., pl. 16, f. 6.
- C. tener.** Ehr. Abh. (1872), p. 209. Not figured. Undeterminable.
- C. Thuretii.** Breb. Cherbg., f. 3; V. H. Synop., pl. 77, f. 1 (under *simulans*); A. S. Atl., pl. 16, f. 2, pl. 51, f. 15. } = *C. taeniatus*.
- C. trapezoidalis.** Deby.
- C. triumphans.** A. S. Atl., pl. 15, f. 4, 5; Jan. Gazet., pl. 19, f. 11.

## U.

- Campylodiscus undulatus.** Grev. M. J., Vol. III., N. S., pl. 9, f. 4; A. S. Atl., pl. 18, f. 11, = *C. Greenleafianus*, Grun., = *C. erosus*, Castr., = *C. oceanicus*, Castr., = *C. Balearicus*, Cleve, = *C. Grundlerii*, var. Grun., = *C. Sauerbeckii*, Grundl.
- „ Var. Leud., Ceylon, pl. 9, f. 102.
- „ Var. Leud., do. pl. 7, f. 69.

\* It is probable that *C. taeniatus*, A. S., and *C. ecclesianus*, Grev., including *C. Gräffei*, Grun., are extreme vars. of one species, while *C. fenestratus*, Grev., represents a view through the two crossed valves of a frustule.

- C. undulatus*. Var. ? *distinctus*. Deby. With inter-radials, faintly punctate, and a sharply outlined raphe.\*
- C. upolensis*. Grun., A. S. Atl., pl. 51, fig. 14 (doubtful).

## V.

- Campylodiscus vermiculatus* Temp. Diatomiste. Vol. I., pl. 2, f. 9.
- C. vitricavus*. T. and Br. Jap., pl. 2, f. 8, = *canalisatus*, T. and Br. var.
- C. vitiensis*. Grun., A. S. Atl., pl. 51, f. 8, = *C. notatus*, Grev. var.
- C. vulcanius*. Ehr. Ber., 1844; Kutz., Sp. Alg., p. 33. Not figured, not determinable. *Ehr. Mikrog. t. 38 A, 14. f. 8.*

## W.

- Campylodiscus Wallichianus*. Grev., T. M. S., Vol. XI., 1863, N. S., pl. 1, f. 4, A. S. Atl., pl. 14, f. 15, 16, pl. 18, f. 13, *C. Normanianus*, var. Grev.
- „ Var. A. S. Atl., pl. 18, f. 14.
- „ Var. *C. <sup>Th</sup> Haitiensis*, Castr. Chall., pl. 16, f. 6.
- C. Weissflogii*. Deby, A. S. Atl., pl. 16, f. 4.

## Z.

- Campylodiscus Zebuanus*. Castr. Chall., pl. 11, f. 10 (bad figure), = *C. biangulatus*, Grev.
- C. zonalis*. Phill. Ralfs, Prit., 1861, p. 802. Not figured. Not determinable from description.

\* In *Holothuria* from China, in Mr. Rae's collection.

## ADDENDA.

*The following forms have been identified since going to press.*

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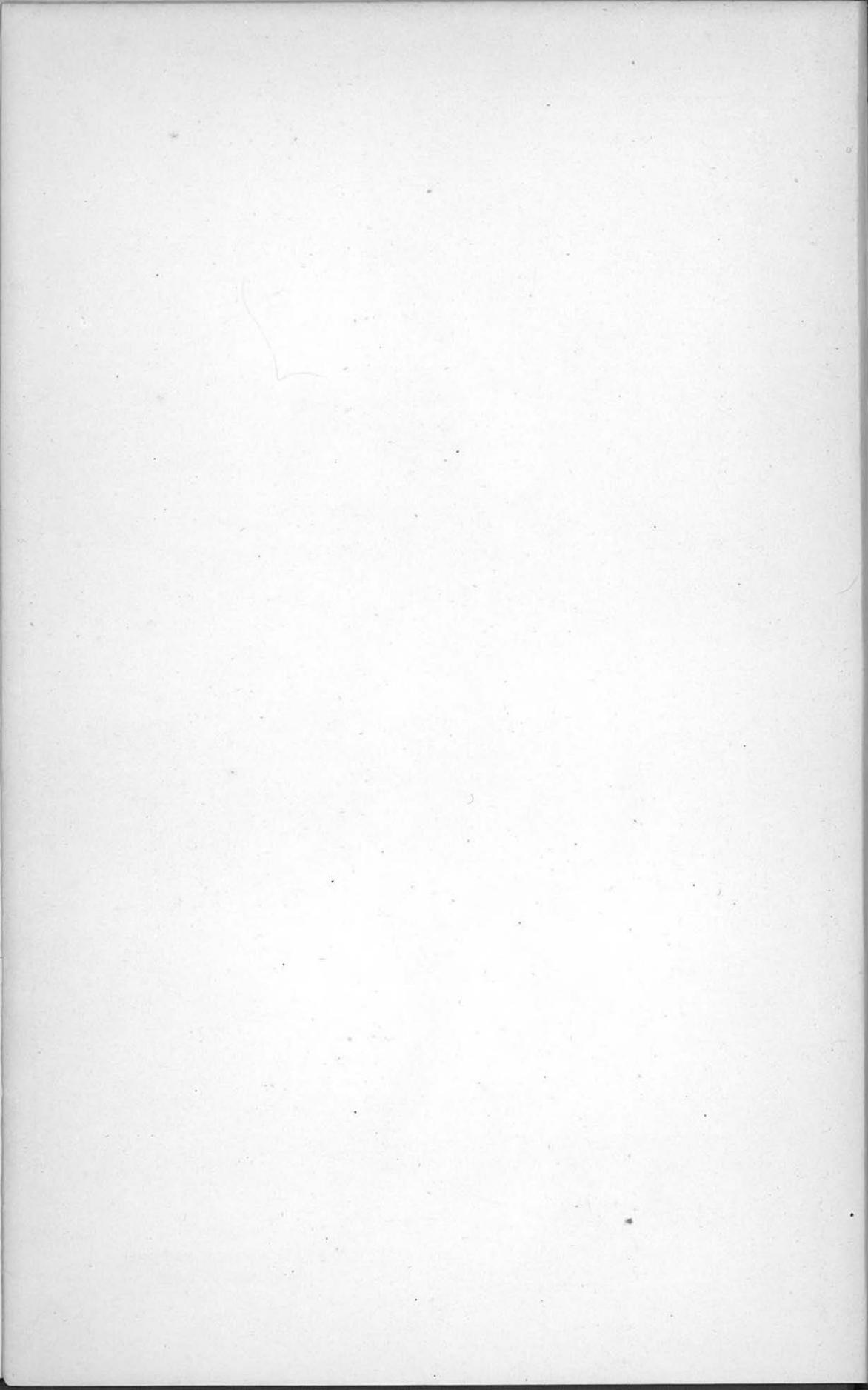
- Campylodiscus Bruneanus.** Deby.
- Campylodiscus Campecheanus.** Deby, A. S. Atl., pl. 53, f. 8.
- C. Eulensteinii.** Pantoc., Vol. II., p. 71 = ? *Limbatus*, Breb. var., *Australis*, A. S., pl. 17, f. 1.
- C. humilis.** Grev., South Pacific, Part III., pl. 3, f. 1. Doubtful form.
- C. Pantocsekianus.** Deby.
- C. Kidstonii.** Pant., Vol. II., p. 71. This is not figured, and the description is too imperfect to permit recognition.
- C. orbicularis.** Castr., Chall., pl. 16, f. 10, = *C. horologium*, *forma minuta*.
- C. Rattrayanus.** Deby, A. S. Atl., pl. 18, f. 10.

## Supplement to Part II.

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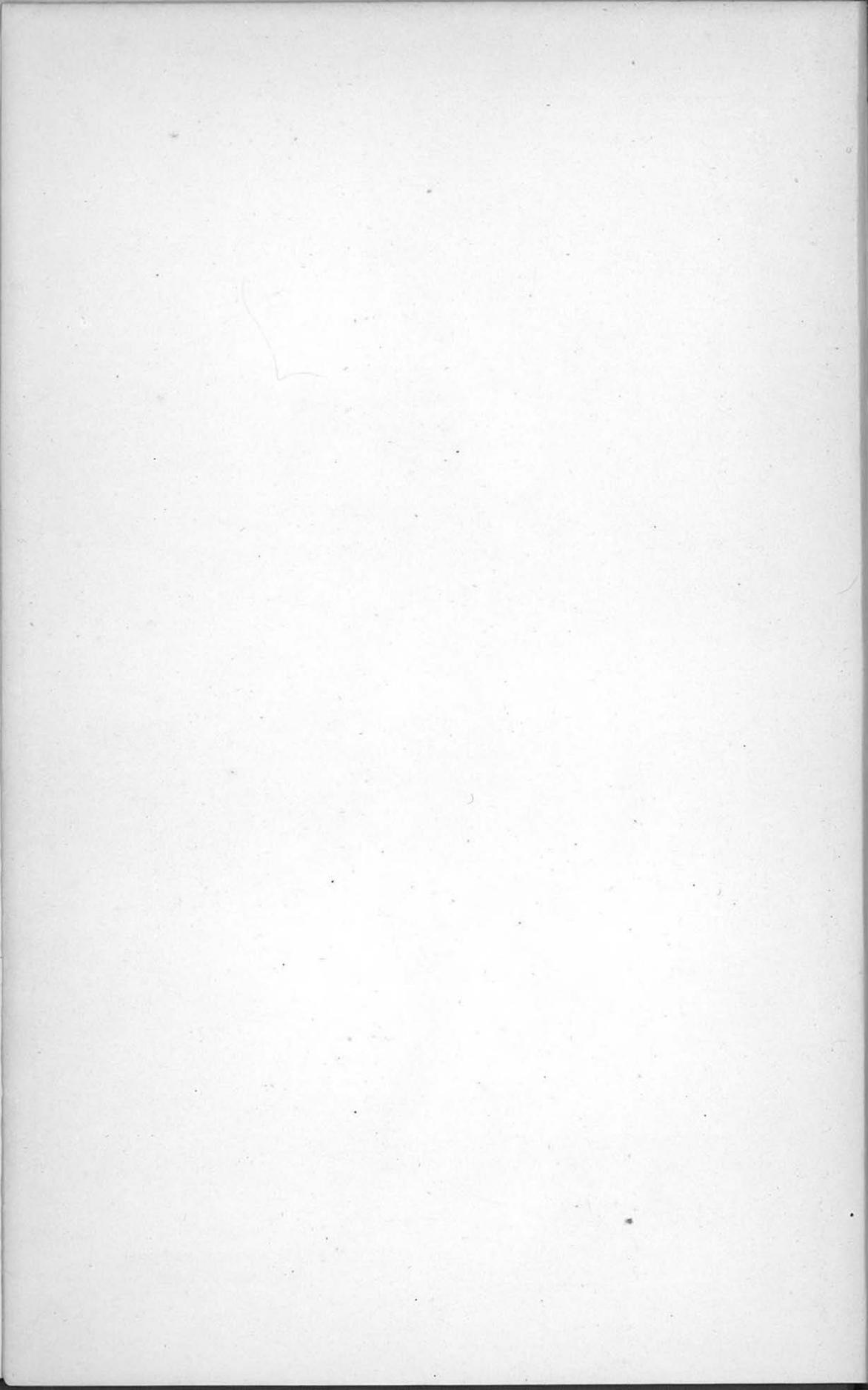
List of figures of Unnamed Doubtful Species of *Campylodisci*  
in A. Schmidt's "Atlas der Diatomaceen."

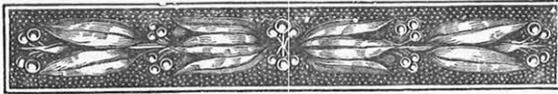
- Atlas, pl. 17, f. 18.—Reproduced from a small fragment.  
„ pl. 17, f. 19.—Ditto.  
„ pl. 14, f. 27.—Probably *Heufleurii*, Grun., var.  
„ pl. 16, f. 11.—According to A. S., *ecclesianus*, Grev.  
„ pl. 18, f. 21.—Intermediate between *C. latus*, Shadb., and  
its var. *C. contiguus*, A. S.  
„ pl. 51, f. 4.—Small fragment represented.  
„ pl. 16, f. 3.—Is a var. of *C. taniatus*, A. S.  
„ pl. 15, f. 17.—Is *Samoensis*, Grun. var., ?  
„ pl. 15, f. 18.—Ditto.  
„ pl. 16, f. 5.—Is *ecclesianus* var., ?



III.

CATALOGUE OF ACCEPTED  
DISTINCT FORMS.





*List of all the Forms of Campylodiscus  
which are considered as really  
distinct by the Author.*

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[The forms preceded by a \* are now in my cabinet from the localities indicated after their names. Those without the \* are desiderata in my collection which I desire to obtain by purchase, or by exchange.—J. D.]

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- 1.\* **Campylodiscus adornatus.** A. S., from Sta. Monica and from Nossi bé, Madagascar.
- 2.\* **C. Adriaticus.** Grun., from Villefranche, Mentone, Naples, the Adriatic Sea, and foss. from St. Peter, Hungary, and Macassar Straits (Grove). *recent*
3. **C. albifrons.** Brun.
4. **C. altar.** Brun.
- 5.\* **C. ? anceps.** Castr., from the Philippine Islands, Manilla.
- 6.\* **C. angularis.** Greg., from China, Singapore, various Challenger gatherings, and Australia.
- 7.\* **C. Balticus.** Cleve, from Kilwilken, Baltic Sea.
- 8.\* **C. biangularatus.** Grev. (*C. Lorenzianus*), from Manilla, Java, and Australia.

- 9.\* *C. bicinctus*. Castr., from the inland sea of Japan, Challenger station, 233.
- 10.\* *C. bicostatus*. W. Sm., from North Wales, from Northfleet, from Christianstadt, from Caen, and North Sea, and from Belgium.
11. *C. bifurcatus*. A. S.
12. *C. bimarginatus*. A. S.
- 13.\* *C. birostratus*. Deby.
14. *C. biseriatus*. Deby.
- 15.\* *C. Browneanus*. Grev., from Manilla.
- 16.\* *C. Californicus*. (Grove) Deby, fossil from San Redoubo and Sta. Monica.
17. *C. Campecheanus*. Deby.
- 18.\* *C. Challengerensis*. Deby, from Challenger station 233.
19. *C. chrysanthemum*. Brun.
- 20.\* *C. circumactus*. A. S., from Maghellan's Straits, Bay of Naples, and Balearic Islands.
21. *C. clivosus*. Brun
- 22.\* *C. clypeus*. Ehr. and var. ? *C. bicostatus*, Grun., from brackish water, from Belgium coast, from Norfolk, from Franzensbad, from Christianstadt, from Penan harbour, from Sierra Leone, from North Sea, and the var. from S. Africa.
- 23.\* *C. cocconeiformis*. Cleve.
- 24.\* *C. coronilla*. Brun., from various Californian deposits.
25. *C. coruscus*. A. S.
- 26.\* *C. crebrecostatus*. Grev. and var. *singularis*, A. S., from Manilla, from Porto Seguro, from Java, Singapore, and Samoa.

- 27.\* *C. daemelianus*. Grun., from Australia, from Madagascar, from Java, and Japan.
- 28.\* *C. Debyi*. Leud. From the Malay Archipelago.
- 29.\* *C. decorus*. Breb., from Manilla, from Japan, from Java, from Singapore, from Samoa, from Alexandria, from Naples, from the Adriatic, and from the Society Islands.
- 30.\* *C. dentatus*. Deby, from the Philippines.
- 31.\* *C. de Tonianus*. Deby, from Mauritius (Doeg) and Tamatave (Grove).
- 32.\* *C. ecclesianus*. Grev., from Yucatan, Vera Cruz, Campeche Bay, Colon, Rio Janiero, Java, and foss. from Elesd, Hungary.
- 33.\* *C. echeneis*. Ehr., from Britain, Australia, and Sierra Leone, Malay Archipel., North Sea, Sweden, and Caspian Sea.
- 34.\* *C. emarginatus*. Deby, from Japan.
- 35.\* *C. eximius*. Greg., Red Sea, Naples, Mentone, Adriatic, and Malay Archip.
36. *C. flammiger*. Leud.
- 37.\* *C. fortis*, Leud., Malay Archipelago.
- 38.\* *C. Grevillii*. Leud., from the Sandwich Islands.
- 39.\* *C. Hardmanianus*. Grev., from Hong Kong and from Carpentaria, var. from Caspian Sea.
40. *C. helianthus*. A. S.
- 41.\* *C. Hibernicus*. Ehr., from Toome bridge, Leipzig, etc.
- 42.\* *C. Hodgsonii*. W. Sm., with *C. Imperialis*, Grev., Java, etc.
- 43.\* *C. horologium*. From the Red Sea, Muntok, and from Mentone, Naples, and Adriatic.

- 44.\* *C. imperialis*. Grev., from Colon, Rio Janeiro, Porto Seguro, Isl. Nassau, Brazil, Campeche, and Vera Cruz.
45. *C. inconspicuus*. Deby.
46. *C. Japonicus*. Castr.
- 47.\* *C. Kerguelensis*. Deby, from Kerguelan's Land.
- 48.\* *C. Kittonianus*. Grev., from Manilla, Java, Japan, the Sandwich Islands, Tahiti harbour, and foss. from Sta. Monica.
- 49.\* *C. Kutzingii*. Bailey. Foss. from Karand, Hungary.
- 50.\* *C. latus*. Shadb., from Malacca, Japan, Manilla, and Rio Janeiro, Java, Australia, and Vera Cruz.
- 51.\* *C. limbatus*. Breb., from the Red Sea, Naples, Nice, Mentone, Alexandria, and Adriatic.
52. *C. Macassarensis* (Grove). Deby.
- 53.\* *C. Margosinuatus*. Deby. Challenger.
- 54.\* *C. mirabilis*. Leud., Malay Archipelago.
- 55.\* *C. Mülleri*. A. S., from Colon and Macassar Straits.
- 56.\* *C. Noricus*. Ehr., from various North European localities, the var. *C. Larius*, Castr., from Lake Varese.
- 57.\* *C. obsoletus*. Cleve, from tegel of Mähren foss.
- 58.\* *C. ornatus*. Grev., from Tamatave, Samoa, Java, and Manilla.
59. *C. Pacificus*. Grun., = ? *C. flammiger*, Leud.
60. *C. panduriger*. A. S.
- 61.\* *C. Pantocsekii*. Deby, from Karand, Hungary, foss.
62. *C. peramplus*. Cleve.

- 63.\* *C. Pfitzeri*. A. S., from Hong Kong, Java, Japan, Singapore, and Challenger gatherings.
64. *C. phalangium*. A. S.
- 65.\* *C. pulchellus*. Leud., from Singapore.
- 66.\* *C. punctulatus*. Grun., from Gulf of Mexico and Colon.
- 67.\* *C. Quarenensis*. Grun., from Adriatic.
68. *C. Rabenhorstianus*. Jan. et Rab.
69. *C. radiosus*. Ehr.
- 70.\* *C. Raeanus*. Deby, from Challenger.
- 71.\* *C. Ralfsii*. W. Sm., from Manilla, Naples, etc.
72. *C. rivalis*. A. S.
73. *C. rivulosus*. T. et B.
- 74.\* *C. Robertsianus*. Grev., from Manilla, Java, Samoa, and from Challenger.
- 75.\* *C. Samoensis*. Grun., et var. *incertus*, from Bahia.
- 76.\* *C. Schleinitzii*. Janish, from Kerguelensland.
77. *C. Schmidtii*. Grun.
- 78.\* *C. Simulans*. Greg. and forma *C. parvula*, W. Sm., from Naples, Adriatic, Manilla, Mentone, Nice, Loch Fyne, and North Sea.
- 79.\* *C. socialis*. O. Witt., from Samoa.
- 80.\* *C. Stellatus*. Grev., from Japan, China, Singapore, and Colon.
- 81.\* *C. Sumatrensis*. Leud., Malay Archipelago.
82. *C. tabulatus*. A. S.
- 83.\* *C. taeniatus*. A. S., from Colon and Java.

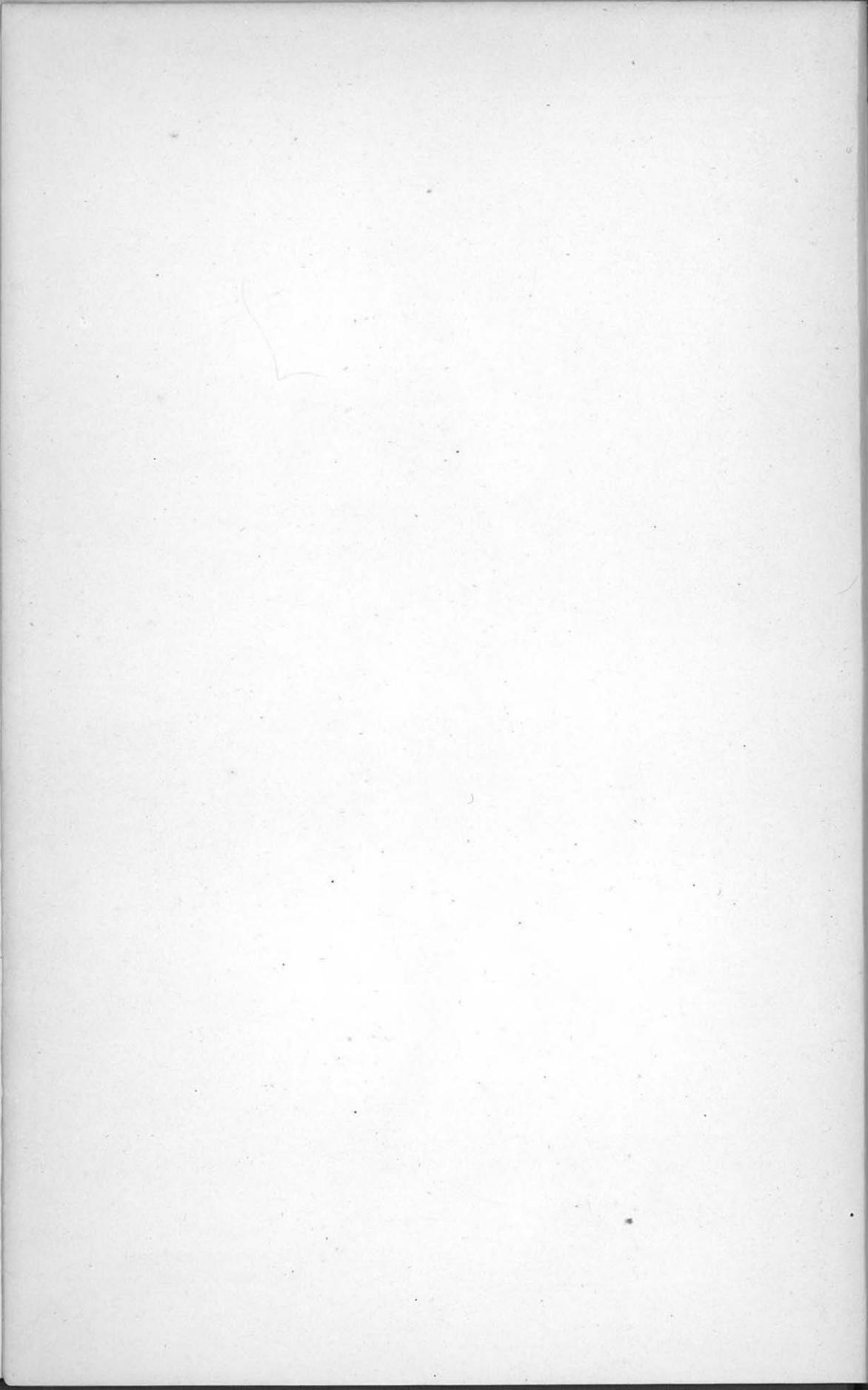
84. *C. taenioides*. Deby.
- 85.\* *C. Thuretii*. Breb., from Britain, Baltic Sea, Naples, Java, and Singapore.
- 86.\* *C. trapezoidalis*. Deby, from Sta. Monica.
- 87.\* *C. triumphans*. A. S., from Japan, Java, Bermuda, Campeche, Porto Seguro, and Colon.
- 88.\* *C. undulatus*. Grev. and vars. from Japan, Manilla, Nossi bé, Society Islands, Colon, Brazil, China, and Singapore.
89. *C. vermicularis*. Temp.
- 90.\* *C. vitricavus*. T. et B., fossil from Sendai, Japan.
- 91.\* *C. Wallichianus*. Grev., from Rio Janeiro, Bahia, Java, and St. Helena.
92. *C. Weissflogii*. Deby.

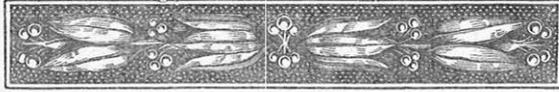
I consider the above, Nos. <sup>16, 39, 63, 64,</sup> ~~7, 22, 37, 62, 63,~~ 78, to be doubtfully distinct forms; and Nos. 5 and 23 <sup>probably</sup> as not belonging to the genus *Campylodiscus*.

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IV.

ANALYTICAL TABLES.





*Analytical Tables for the  
Determination of the Campylodisci.*

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Table for the arrangement into Groups of the forms  
of Campylodiscus.

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- 1.—Valves with a narrow, smooth, central space, or longitudinal line (Raphe). Group I. **Raphidæ.**
- 2.—Valves with a broad area instead of a linear blank space or line (3).
- 3.—Area clearly defined and limited by internal termination of the Rays (5).
- 4.—Area undefined (or null from absence of the Rays). Group II. **Vagæ.**
- 5.—Area smooth, unadorned.\* Group III. **Hyalinæ.**
- 6.—Area either striated or punctate (including punctato-striate). (7).
- 7.—Area bearing distinct striæ. Group IV. **Striatæ.**
- 8.—Area simply punctate or punctato-striate. Group V. **Punctatæ.**

\* Under very high powers, often very minutely dotted.

**Group I.—THE RAPHIDÆ.**

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- 1.—Area limited by a distinct line inside the termination of the Rays (3).
- 2.—Area not limited by a distinct line (19).
- 3.—Area terminating in subulate beaks reaching margin.  
*C. birostratus*, Deby.
- 4.—Area not ending in beak-like terminations (5).
- 5.—Striæ bearing minute apiculi. *C. circumactus*, A. S.
- 6.—Striæ without apiculi, smooth or punctato-striate (7).
- 7.—Striæ smooth, continuous (9).
- 8.—Striæ punctate (15).
- 9.—Striæ more numerous than Rays. *C. Samoensis*,\* Grun.
- 10.—Striæ in equal number to Rays (11).
- 11.—Area panduriform, punctate, *C. panduriger*, A. S.
- 12.—Area not panduriform (13).
- 13.—Inter-Striæ punctate, sub-moniliform. *C. Macassarensis*  
(Grove), Deby.
- 14.—Inter-Striæ smooth, or apparently so (49).
- 15.—Raphe, with blunt, thick, projecting angular apices. Striæ  
with scattered granules. *C. imperialis*, A. S.
- 16.—Raphe not ending in blunt, prominent, thickened ends (17).
- 17.—Disc, with a trapezoidal inserted line, with acute angles and  
rounded sides. *C. trapezoidalis*, Deby.
- 18.—Disc, without a trapezoidal inscribed line.  
*C. Hodgsoni*, W. Sm.

\* Including *C. incertus*, A. S.

- 19.—Rays interrupted by smooth or lunate spaces (21).
- 20.—Rays uninterrupted by smooth, transverse spaces (23).
- 21.—Areal striæ forming externally by their union an arched or convex line, limiting (internally) the blank spaces which interrupt the Rays (43).
- 22.—Areal striæ forming a straight or concave line, limiting internally the smooth, lunulate spaces. *C. Grevillii*, Leud.
- 23.—Rays very numerous, fine and close set, radiating and reaching to the pseudo-Raphe. Raph. very narrow, linear, parallel-sided. *C. Kutzingii*,\* Harv. and Bail.
- 24.—Raphe more or less developed, or else replaced by a mere line (25).
- 25.—Areal interstriæ, transversely lined. *C. Schmidtii*, Grun.
- 26.—Area without transversely-lined interstriæ (27).
- 27.—Raphe with a line of granules on each side.  
*C. biseriatus*, Deby.
- 28.—Raphe not bordered by granules (29).
- 29.—Rays showing distinct undulations. *C. biangulatus*,† Grev.
- 30.—Rays without distinct undulations (31).
- 31.—Rays 80 or more in number, valves quadrate.  
*C. fluminensis*, Grun.
- 32.—Rays much fewer in number (33).
- 33.—Raphe trapezoidal, with a granule in each obtuse angle.  
*C. socialis*, O. Witt.
- 34.—Raphe not trapezoidal (35).

\* This is the same Diatom as *C. Striolatus*, Grun., but *Kutzingii* must have priority.

† Synonymous with *C. Lorenzianus*, Grun.

- 35.—Rays apiculate. *C. rivalis*,\* A. S.
- 36.—Rays without apiculi (37).
- 37.—Valves emarginate top and bottom. Rays slightly infundibuliform, with very narrow funnel. *C. emarginatus*, Deby.
- 38.—Valves not emarginate at the ends (39).
- 39.—Striæ slightly wavy, inter-striæ moniliform or punctato-striate.† Large granules exist on each side of the Raphe, top and bottom. *C. rivulosus*, T. and Br.
- 40.—Striæ straight, not undulating, linear, smooth. No granules on sides of pseudo-Raphe (41).
- 41.—Raphe distinct. *C. decorus*, Breb.
- 42.—Raphe reduced to a mere line. *C. Ralfsii*,‡ W. Sm.
- 43.—Inter-radials formed by a marginal row of oblong beads, which are interrupted and followed by a second concentric row of smaller beads. On each side of Raphe a row of parallel, short, linear granules. *C. Raeanus*, Deby.
- 44.—Inter-radials not formed by a marginal row of beads; Rays after an interruption reaching the Raphe, which is not limited on each side by a row of parallel lines (45).
- 45.—Area tumid in the middle, with blunt terminations. *C. triumphans*, A. S.
- 46.—Area not tumid in the middle. Terminations of area acute. (47).
- 47.—Blank spaces continuous all round area, inter-radials finely punctate. *C. Schmidtii*, Grun.

\* Apiculate var. of *C. Ralfsii* most probably.

† The figure in T. and Br. Jap. does not show the true characters of the striæ in this species, of which I have had original specimens under my microscope.

‡ I am inclined to unite with *C. Ralfsii*, *C. decorus*, Breb., and *C. exilis*, Grun.

- 48.—Blank spaces <sup>not continuous, the</sup> all round area. Inter-radials smooth.  
*C. undulatus*,\* Grev.
- 49.—A distinct bead at point of intersection of each ray and stria.  
*C. Campecheanus*, Deby.
- 50.—No beads or knots at intersection of rays and striae.  
*C. crebrecoastatus*,† Grev.

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### Group II.—THE VAGÆ.

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- 1.—No distinct marginal Rays. *C. echeensis*, Ehr.
- 2.—Marginal Rays distinct (3).
- 3.—Inter-Radials, with 3 distinct rows of puncta. Small forms.  
*C. cocconeiformis*,‡ Cleve.
- 4.—No Inter-Radial dots. Large forms. *C. clypeus*, Ehr.

\* I include in this species *C. Greenleafianus*, Grun., *C. erosus*, Castr., and *C. oceanus*, Castr.

† This comprises as vars. or synonyms *C. singularis*, A. S., *C. intermedius*, Grun., *C. crebrestriatus*, Grun., *C. Heufleurii*, Grun., and possibly *C. humilis*, Castr., the drawing of this last being too bad for safe identification. Several other forms seen I consider as varieties, one remarkable one among them from Campeche Bay and from the Comoro Islands, in the collection of Mr. Kinker, has the striae distinctly punctate under a high power. I propose calling this form var. *Kinkerianus*.—D.

‡ Prof. Cleve gives Labuan, Borneo, as the locality for his species. I have seen it from Ning-po and from Elephant Point. The valves being nearly flat, and the long-oval shape seems to exclude it from the genus *Campylodiscus*, few of the characters of which it seems to possess.

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Group III.—THE HYALINÆ.

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- 1.—Rays moniliform (3). = *porolithumiformis*
- 2.—Rays not moniliform (11).
- 3.—Rays showing an interruption after the second or third double bead from the margin. Beads from eight to ten in number (5).
- 4.—Rays continuous, without interruption (7).
- 5.—Area quadrangular. About twenty rows of granules to each long side of area. Granules small or medium size.  
*C. Hardmanianus*, Grev. in litt.
- 6.—Area oval, with about forty rows of large, coarse granules to each long side of oval, encircling a central, oval, blank space.  
*C. daemelianus*,\* Grun.
- 7.—Rays short, tapering. Area very large, circular. Beads on rays small and delicate. Inter-Radials with three marginal beads. Length of rays 0.030 m.m.  
*C. de Tonianus*,† Deby.
- 8.—Rays long. Area central oval. Beads in the rays very conspicuous (9).
- 9.—All Rays reach the area. *C. Robertsianus*, Grev.
- 10.—Alternate Rays only reach the area, intermediate Rays shortened. *C. diplostictus*, Norm.
- 11.—Rays infundibuliform (13).

\* I am rather inclined to consider *C. daemelianus*, Grun., and *C. Hardmanianus*, Grev., as mere varieties of one species. I own the last named sp. from Hong Kong, and have seen it from Derbend in Mr. Grove's collection.

† This species occurs in the Mauritius and at Tamatave. I have it from Mr. Doeg's and have seen it in Mr. Grove's collections.

- 12.—Rays not infundibuliform (19). = *trichterförmig*
- 13.—A circllet (15).
- 14.—No circllet (17).
- 15.—Stems longer than funnels. *C. Horologium*, Williamson.
- 16.—Stems half length of funnels. *C. Pfitzeri*,\* A. S.
- 17.—Inter-Radials distinctly punctate. *C. Challengerensis*, Deby.
- 18.—Inter-Radials not punctate. *C. latus*,† Shadb.
- 19.—Rays reduced to short marginal apiculi or points, with ends pointed centrally towards the area (21).
- 20.—R. not reduced to small points (25).
- 21.—A circllet. *C. obsoletus*, Cleve.
- 22.—No circllet (23).
- 23.—Rays very short, bifid at internal apex. Inter-Radials each with two marginal beads. *C. dentatus*, Deby.
- 24.—Rays longer, not bifid, ending very acutely. Inter-Radials with three or four marginal beads. *C. anceps*, Castr.
- 25.—Margin of valve double formed by two concentric rows of large beads, separated by a narrow, concentric, smooth space. *C. bicinctus*,‡ Castr.
- 26.—Margin not formed by a double row of beads, separated by a blank circle (27).
- 27.—Inter-Radials, with three longitudinal rows of fine puncta. *C. pulchellus*,§ Leud.

\* This seems to be a var. of *C. horologium*.

† I unite under this name *C. centralis*, Grev., *C. contiguus*, A. S., and *C. ambiguus*, Grev.

‡ Seems very local and proper to the inland sea of Japan.

§ Under sufficient high power the area of *C. pulchellus* is finely punctate.

- 28.—Inter-Radial without three rows of puncta (29).
- 29.—Area large, occupying greater portion of disc (31).
- 30.—Area small, occupying only central portion of disc (45).
- 31.—A circllet (33).
- 32.—No circllet (35).
- 33.—Inter-Radial with three marginal beads. Circllet formed by short lines. Rays very fine, about 40 in number.  
*C. tabulatus*, A. S.
- 34.—Inter-R. without beads. Rays about 100 in number; circllet formed by large beads in which the Rays terminate.  
*C. adornatus*, A. S.
- 35.—Inter-Radials with one or two marginal beads (37).
- 36.—No inter-Radial beads (39).
- 37.—Marginal beads bifid internally at apex. *C. dentatus*, Deby.
- 38.—Marginal beads not bifid. *C. Adriaticus*, Grun.
- 39.—Area circular, or nearly so (41).
- 40.—Area elliptic, acute top and bottom (53).
- 41.—Inter-Radials very finely striate longitudinally.  
*C. Balticus*, Cleve.
- 42.—Inter-Radials not striate (43).
- 43.—Rays formed of one row of dots. *C Japonicus*, Castr.
- 44.—Rays not punctate (55).
- 45.—Rays from 40 to 50 (47).
- 46.—Rays 24 or less in number (49).
- 47.—Rays bearing apiculi. *C. Wallichianus*, Grev.
- 48.—Rays smooth. *C. Browneanus*, Grev.

- 49.—Area oval or reniform (51).
- 50.—Area elliptical, with acute apices. *C. phalangium*, A.S.
- 51.—Area reniform. Large, marginal inter-radial beads.  
*C. Mülleri*, A. S.
- 52.—Area oval. No marginal beads. *C. rotula*, Grun.
- 53.—Rays originating in large marginal beads.  
*C. helianthus*, A. S.
- 54.—No marginal beads. *C. angularis*, Greg.
- 55.—Rays long, very fine, close, and numerous. *C. radiosus*, Ehr.
- 56.—Rays very short, tooth-like (57).
- 57.—Rays with rounded ends internally. Inter-radial spaces rounded at base near margin. Inter-radials with one row of dots. *C. margosinuatus*, Deby.
- 58.—Rays bifid at apex internally. Inter-radials with four rows of dots. *C. albifrons*, Brun.

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#### Group IV.—THE STRIATÆ.

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- 1.—Area with a central stellate figure of fusiform, apiculate, moniliform striæ, which do not reach the margin.  
*C. coruscus*, A. S.
- 2.—Area not bearing a central star formed of fusiform striæ (3).
- 3.—Striated portion of Area limited to a narrow, parallel-sided, central, longitudinal band or zone (5).
- 4.—Striated Area not limited to a narrow, linear, central, parallel-sided, longitudinal zone (7).
- 5.—Striate area bounded on each side by a smooth, lunulate space.  
*C. Sumatrensis*, Leud.

- 6.—No clear space on each side of striate area.  
*C. simulans*, Greg.
- 7.—Area with radiating, somewhat undulate striæ.  
*C. vermiculatus*,\* Temp.
- 8.—Area without vermiculate design (9).
- 9.—Area elliptic, with short parallel striæ near its margins only.  
Rays 16 to 20. *C. Thuretii*,† Breb.
- 10.—Area circular, or oval, or sub-quadrate. Rays more numerous (11).
- 11.—Central portion of Area, with a double T marking.  
*C. bifurcatus*, A. S.
- 12.—No double T mark on Area (13).
- 13.—Striæ in part parallel horizontally (15).
- 14.—Striæ all radial (21).
- 15.—A circllet (17).
- 16.—No circllet (19).
- 17.—Striæ short, not reaching the circllet. *C. Weissflogii*, Deby.
- 18.—Striæ long, reaching the circllet. *C. taeniatus*, A. S.
- 19.—Area clepsydrate, with central dumb-bell marking.  
*C. taenioides*, Deby.
- 20.—No clepsydrate Area nor dumb-bell marking.  
*C. ecclesianus*, Grev.
- 21.—Valves, with small, terminal, sub-globular buttons.  
*C. vitricavus*, Brun.

\* An examination of the original specimen of this Diatom, which I have been able to make through the kindness of M. Tempere, shows that the Rays are indistinctly, though clearly moniliform. I have added a new description of this form in the descriptions of "New Species," so as to render it easier of identification.

† Probably *C. simulans*, Greg., is only a variety of *C. Thuretii*, Breb.

- 22.—Valves without terminal buttons (23).
- 23.—A circllet (25).
- 24.—No circllet (31).
- 25.—Circllet formed by short, distinct, paired lines.  
*C. Kerguelensis*, Deby.
- 26.—Circllet formed by rounded dots (27).
- 27.—Beads of circllet large. *C. adornatus*, A. S.
- 28.—Beads of circllet minute (29).
- 29.—Circllet interrupted at top and bottom. Rays few.  
*C. peramplus*, Cleve.
- 30.—Circllet continuous. Rays numerous. (41).
- 31.—Area nearly circular (33).
- 32.—Area oval or oblong (37).
- 33.—Valves with distinct double border. *C. bimarginatus*, A. S.
- 34.—No distinct double margin (35).
- 35.—Centrally a smooth, elliptical space. *C. Rabenhorstii*, Jan.
- 36.—No central, distinct, elliptical blank space.  
*C. Pacificus*, Grun.
- 37.—Inter-radials and inter-striæ finely punctato-striate. Central Area smooth. *C. bicostatus*, W. Sm.\*
- 38.—Inter-radials and inter-striæ smooth; central Area, if any, inconspicuous (39).

\* The typical *Campylodiscus bicostatus* of W. Sm. (Roper, Micr. Trans., Vol. II., pl. 6, f. 4). I have from North-fleet, including original specimens from W. Sm. and Roper's collections, from Mostyn, N. Wales, and from the Baltic Sea, where it occurs along with *Camp. Balticus*, Cleve, in litt, and *Camp. echeneis*. Many specimens in my collection, labelled *C. bicostatus*, represent a different Diatom, namely, the *Camp. bicostatus* of Grunow, of Van Heurck, and of the Atlas, as figured in Grun., Oest. Diat., 1862, pl. 10 (vii.), f. 1; Van Heurck, Synopsis, pl. 75, f. 2, and types No. 436; and A. S.

- 39.—One marginal bead between each pair of Rays.  
*C. Californicus* (Grove), Deby
- 40.—No marginal beads. *C. inconspicuus*, Deby.
- 41.—Inter-radials distinctly punctate. *C. Stellatus*, Grev.
- 42.—Inter-radials smooth. *C. Altar*, Brun.

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**Group V.—PUNCTATÆ.**

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- 1.—Rays moniliform (3).
- 2.—Rays not moniliform (5).
- 3.—Area quadrate. *C. Hardmanianus*, Grev.
- 4.—Area oval. *C. daemelianus*, A. S.
- 5.—Rays infundibuliform (7).
- 6.—Rays not infundibuliform (13).
- 7.—Margin beaded, two beads per inter-radial (33).
- 8.—Margin not beaded (9).
- 9.—Area with a broad circllet of longish, dark, sub-parallel lines.  
*C. Schleinitzii*, Jan.
- 10.—No circllet of any kind (11).
- 11.—Area small, central oval. *C. chrysanthemum*, T. and B.
- 12.—Area large, circular. *C. divosus*, J. Brun.
- See: C. Challengerensis, page 62!*

Atlas, pl. 55, f. 4, 5, 6. The true *C. bicostatus*, W. Sm., is a much more delicate form. Its inter-radials and inter-striæ can generally only be seen to be striate under an immersion lens, while in Grunow's form both are relatively *coarsely* punctato-striate, the puncta being elongate. This last Diatom I think may doubtfully be considered as an extremely small variety, with interrupted rays of *Camp. clypeus*, Ehr. I have seen what seems to be a sporangial valve of W. Smith's form, measuring 0.865 in diameter, from Mr. Kitton's cabinet, labelled from Christianstadt, in which the inter-strials are more distinctly striate, while the inter-radials remain smooth.

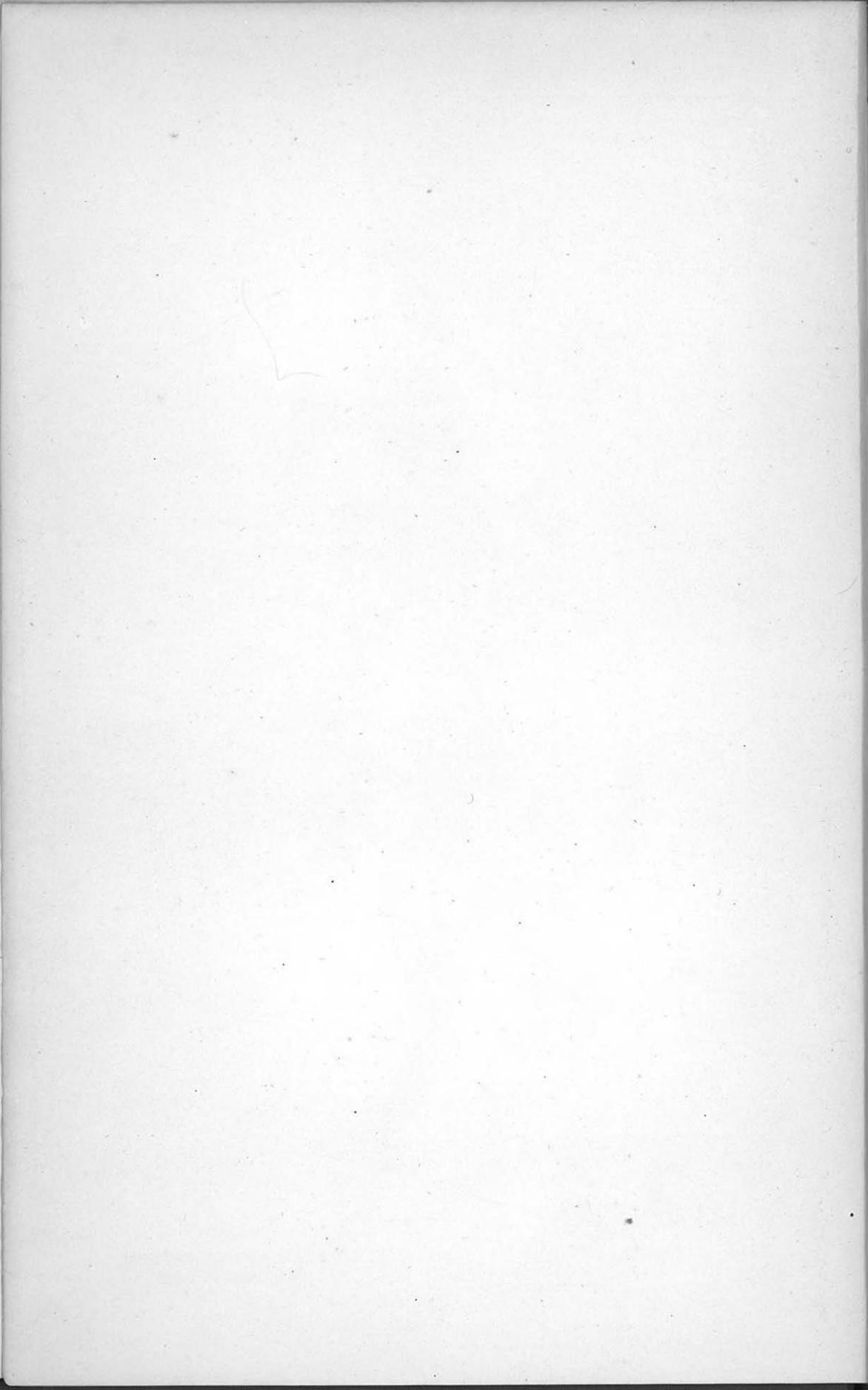
- 13.—Area with about 40 sub-parallel rows of puncta on each side of a more or less apparent blank Raphe.  
*C. imperialis*, Grev.
- 14.—Area without sub-parallel punctate striæ, and without appearance of a Raphe (15).
- 15.—Area with three or four squares one within the other, formed by conspicuous dots surrounded by scattered finer puncta.  
*C. mirabilis*, Leud.
- 16.—Area without quadrate rows of dots (17).
- 17.—Radials and inter-Radials rough with minute apiculi (19).
- 18.—No apiculi (21).
- 19.—Rays from 40 to 60 in number. *C. Hibernicus*, Ehr.
- 20.—Rays from 90 to 100 in number. *C. noricus*,\* Ehr.
- 21.—Inter-Radials with 2 or 3 rows of puncta; margin of valve double; circllet of large beads. *C. ornatus*, Grev.
- 22.—No inter-Radial rows of puncta, no double border (23).
- 23.—Area angular at top and bottom (25).
- 24.—Area rounded at extremities (27).
- 25.—Area coarsely granular. Rays smooth. Indication of a central smooth line. *C. eximius*, Greg.
- 26.—Area finely punctured, clepsydrate. Rays with a row of dots. No indication of a central line.  
*C. Pantocsekii*, Deby.
- 27.—A circllet, formed by a row of short lines or of dots (35).
- 28.—No distinct circllet formed by one row of lines or beads (29).

\* Through the great kindness of the Count Barbo, of Milan, I have had an opportunity of examining the *C. Larius* of Castracane, which I now possess, both from the Lake of Como and the Lake of Varese, and which I consider a fine-lined variety only of *C. noricus*, Ehr.

- 29.—Rays infundibuliform. *C. Challengerensis*, Deby.
- 30.—Rays not infundibuliform (31).
- 31.—Area oval, rows of dots radial on area. Rays contiguous.  
*C. limbatus*, Breb.
- 32.—Area circular. Dots not in radial rows. Rays distant.  
*C. albifrons*, Brun.
- 33.—Area with clepsydrate marking. *C. Kittonianus*, Grev.
- 34.—Area not clepsydrate. *C. latus*, Shadb.
- 35.—*Lines* in circllet twice as numerous as rays.  
*C. Kerguelensis*, Deby.
- 36.—*Dots* in circllet minute; one only to each inter-radial space.  
*C. punctulatus*, Grun.
-

V.

DESCRIPTION OF NEW SPECIES.





*Descriptions of some New Forms of the  
Campylodisci.*

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**Campylodiscus emarginatus.** Deby. (Pl. XIV., f. 73.)

Group of Raphidæ.

Diam. of valves, 0.100 m.m.

Valve distinctly emarginate, or notched at strongly incurved apices. Pseudo-Raphe linear, very narrow. Rays infundibuliform, few in number (12), with very narrow funnels formed by a row of dots. Stems about one-third as long as the funnels. Four inter-radial, marginal beads to each pair of rays.

This species inhabits the inland Sea of Japan. I have it from Mr. Rae's collection of Challenger gatherings. It appears to be very rare.

**Campylodiscus Macassarensis** (Grove). Deby.

(Pl. XIV., f. 71.)

Group of the Raphidæ, with striate area.

Diameter of valve, 0.101 m.m.

Diam. of area. Long diam., 0.077; short diam., the same.

Length of rays, 0.023 m.m.

Length of striæ, 0.031 m.m.

Striæ, 6 in. 0.01 m.m.

Puncta, 7 in. 0.01 m.m.

The striæ are in the same number as the rays, and radiate from a narrow pseudo-Raphe. Striæ long as compared with the

rays. Inter-striæ regularly punctate. This diatom differs from *C. crebrecostratus* by its more numerous striæ and punctate inter-striæ. Rays exceeding 100 in number.

This species is from the Straits of Macassar, in Mr. Grove's collection, in a slide No. 604, along with *C. biangulatus*, *C. horologium*, and var. *Pfitzeri*, *C. intermedius*, *C. undulatus*, etc.

**Campylodiscus trapezoidalis.** Deby. (Pl. XIV., f. 72.)

Group of the Raphidæ.

Diam. of valves, 0.110 m.m.

Area : length, 0.080 ; breadth, 0.083 m.m.

Length of rays, 0.013 ; length of striæ, 0.040 m.m.

Striæ, 6 to 0.01 m.m.

Puncta on striæ, 6 to 0.01 m.m.

Valves with a trapezoidal inscribed line, with rounded sides and sharp obtuse angles at the four corners. These angles terminate about half way up the rays. Raphe reduced to a simple line. Rays about 80 in number. Two striæ to each inter-radial, distinctly punctate.

From Sta. Monica, Cal., from Mr. Rae's collection.

**Campylodiscus de Tonianus.** Deby. (Pl. XV., f. 75.)

Group of the Hyalinæ.

Diam. of valves, 0.169 m.m.

Area : long axis, 0.119 m.m. ; short axis, the same.

Area quite circular. Rays short, tapering ; 0.030 long ; far apart (width of inter-radials, 0.006 m.m.) ; number of rays, 38. Rays containing a row of from 16 to 20 minute double beads or dots. Three marginal beads to each pair of rays.

This species has been found in coral washings from Mauritius (Doeg), and from Tamatave (Grove coll slide No. 582).

**Campylodiscus dentatus.** Deby. (Pl. XIV., f. 74.)

Group of the Hyalinæ.

Diam. of valves, 0.183.

Diam. of area, 0.099.

Valves perfectly circular. Rays short, rather indistinct, tooth-like, 0.033 long.

Two short marginal, bifid beads, with a granular surface to each inter-radial; length of these beads, 0.013. There exists, besides these large beads, a row of minute granules along the margin. Area smooth.

Philippine Islands. From Mr. Rae's collection.

**Campylodiscus margosinuatus.** Deby.

Group of the Hyalinæ, with rays reduced to teeth or spikes.

Diam. of valves, 0.146 m.m.

Area: length, 0.113 m.m., breadth the same.

Length of rays, 0.016 m.m.

The rays consist in short, straight teeth, rounded at their ends. They are separated by inter-radials of the same shape, but reversed, so that the internal margin of the valve appears regularly scalloped, or rather like a cog-wheel. The area is smooth. A circlet of minute dots at some distance from Rays. No inter-radial beads. No appearance of striæ on the area. Rays with a line of beads.

From Challenger trawl in lat. 140°, 33', long. 34°, 37', in 117 fathoms. From Mr. Rae's collection.

**Campylodiscus Balticus.** Cleve. In litt.

Group of the Hyalinæ.

Diam. of valve, which is circular, 0.077 m.m.

Diam. of area, 0.048 m.m.

Length of rays, 0.008 m.m.

Breadth of inter-radials, 0.009 m.m.

Rays 30 in number.

No circlet. No inter-radial beads. Striæ very fine, delicately and longitudinally punctate.

Striæ, 12 in 0.01 m.m.

This species was lately discovered in the Baltic Sea by M. Cleve, in 3 fathoms, off Killvilken.

**Campylodiscus Californicus** (Grove). Deby. Pl. XIV., f. 70).

Group of the Striatæ.

Diam. of valves, 0.182 m.m.

Area : long diam., 0.066 m.m. ; short diam., 0.046 m.m.

Length of longest rays, 0.033 m.m.

Area oval. Rays about 60, alternate ones reaching area, the others only half as long. A smooth circle exists between the area and termination of the rays, 0.003 wide. No circlet. No inter-radial beads. The central rays inclined to be horizontal and sub-parallel, those at the ends radiate.

This diatom seems to be abundant in the marine California deposits. I have seen it from Sta. Monica, San Pedro, San Redondo, and Sta. Barbara. I have a small variety, recent, with only 30 rays, from Apia, Samoa.

? vgl. die  
Abbildung,  
hier ist der Punkt  
nicht deutlich  
erkennbar!

**Campylodiscus coronilla**, Brun., = *C. Doegeanus*, Deby.

In litt. (Pl. XIV., f. 69, and pl. XIII., f. 66.)

Group of the Striatæ.

Diam. of valves, 0.132 m.m., but I have it as small as 0.062.

Area oval ; long axis, 0.056 m.m. ; short axis, 0.041 m.m.

Length of long rays, 0.043.

Alternate rays reach the area, the others stop mid-way. Breadth of inter-radials at margin, 0.006 m.m. Number of rays, including both long and short ones, 48. Radiating striæ same number as rays, and continuous with them. A circlet of small, rounded granules rather irregularly scattered. (I have seen a smaller variety, 0.115 in diam., with only 40 rays.)

Margin with two beads per inter-radial. Length of marginal beads, 0.007 m.m. The rays radiate from a central line. No central smooth space.

I have this fossil form from San Redondo and Sta. Monica, and seen it in Mr. Rae's collection, from the Philippine Islands (Challenger). It cannot be confounded with *C. Rabenhorstii*, but may be a form of *C. Californicus* (Grove), Deby, with a circlet.

**Campylodiscus Hardmanianus**. Grev. in litt. 1866.

(Pl. XV., f. 78.)

Group of the Punctatæ.

Diam. of valves, 0.183 m.m.

Area : length, 0.136 ; breadth, 0.113 m.m.

Total length of rays from margin, 0.0299 m.m.

Length of the punctate striæ on each side, 0.026 m.m.

Breadth of interruption of radial, 0.003 m.m.

Valves circular ; area quadrate. Number of double beads in R. about 8 to 10. Str. with 10 puncta in each of the longer ones. Centre occupied by a wide, blank space, on each side of which are the punctate striæ, followed by an external smooth space. No circlet. A continuous line of small marginal beads. Rays at interrupted portion, which occurs between the second and third double bead, indicated by a fine line. Granules in the Rays forming a double series.

This diatom is from Hong-Kong. A smaller var., with central portion of area clepsydrate, is from Derbend, in the collection of Mr. Grove (slide 236). I call this *C. Hardmanianus*, var. *Grovii*. This diatom is probably a form of the much commoner *C. dæmelianus*, Grun. The original specimen named by Greville is in my collection.

**Campylodiscus Kerguelensis.** Deby. (Pl. XV., f. 79.)

Group of the Punctatæ.

Diam. of valves, 0.080 m.m.

Area circular, diam. 0.053 m.m.

Length of rays, 0.008 m.m.

Breadth of inter-radials, 0.003 m.m.

A circlet formed by short, paired lines, one for each ray, and one for each inter-radial. The circlet lines are faintly prolonged as fine striæ towards the centre of the area, needing good definition to be well seen. Rays from 40 to 64 in specimens seen by me. Area irregularly and indistinctly punctate.

This diatom is from Kergueland's land, from Mr. Weissflog's collection. Very rare.

**Campylodiscus Challengerensis.** Deby.

Group of Hyalinæ.

Diameter of valves (average 0.153) are from 0.139 to 0.176 m.m.

Diam. of area : long., 0.099 to 0.116 m.m. ; lat., 0.099 to 0.116 m.m.

Length of rays, 0.026.

Valves circular. Rays infundibuliform. Shafts of equal length to funnels. No cirlet. Centre obsoletely punctate. Funnels showing granules distinctly. Inter-radials punctate.

This species has at first sight the appearance of *C. horologium*, but is without a cirlet and the area is oval. It is stated to have been collected at station 233 of the Challenger expedition, and was discovered and offered to me by Mr. T. E. Doeg.

**Campylodiscus vermiculatus.** Temp., "Le Diatomiste,"  
Vol. I., pl. 2, f. 9.

Through the kindness of M. Tempère I have had an opportunity of seeing the type of this species, which I find to differ so much from the figure published of it, that I think best to give a more elaborate description of it, which may help towards its recognition by others. It belongs to the group of "Striatæ."

Diam. of valves, 0.0865 m.m.

Diam. of area : long., 0.053 ; lat., 0.039.

Length of rays from margin to area, 0.019.

Valves nearly circular, much curved. Rays originating in conical marginal beads traversed by a fine longitudinal line. After these beads comes an interruption of 0.006 m.m., traversed by a fine line, followed by a moniliform portion of the rays, with a double row of small beads or puncta. Length of this double-beaded portion, 0.006. No cirlet. One minute inter-Radial marginal bead to each pair of Rays. Striæ radiating from centre of area; undulating, irregular, occasionally anastomosing.

The slide is labelled Sendai, Japan, but in "Le Diatomiste" New Caledonia is indicated as the habitat.

**Campylodiscus Raeanus.** Deby.

Group of the Raphidæ.

Diam. of valve, 0.133 m.m.

Diam. of area to termination of rays after their interruption,  
0.0665 m.m.

Diam. of central smooth space (Raphe), 0.0065 m.m.

Length of marginal beads (Rays), 0.006 m.m.

Breadth of the interruptions of the rays, 0.010 m.m.

Length of the portion of the beads after the interruption,  
0.005 m.m.

Breadth of the smooth space between apex of rays and striæ,  
0.016 m.m.

Length of short lines bordering Raphæ, 0.0065 m.m.

Valves circular. Rays short, linear, starting from a small, basal granule on the margin of the valves. Inter-radials forming a conspicuous row of regularly oval beads. This row of beads is followed by a blank space which runs all round the valve. After this blank space the continuation of the Rays form a second concentric row of smaller beads. After this row of smaller beads comes a crescentic, smooth space, limited internally by a series of parallel, linear granules, which limit the median clear space or Raphe. Marginal beads about 80 in number. Linear granules of centre about 30 on each side of Raphe. All the smooth regions of the valves appear to be without any trace of punctuation. At first sight this diatom resembles the *C. erosus*, Castr. var., but the shape of the inter-radials is quite different, being regularly oblong in *Racanus*, while they are pouch-shaped and constricted towards the margin in Castracane's form. The typical *erosus*, Castr., has a quite different margin to the valves, as shown in the figures, so that I do not hesitate in dedicating this species to my friend, Mr. Rae, to whom I am greatly indebted for the specimens described above, besides many other forms of diatoms.

### **Campylodiscus Pantocsekii.** Deby.

Group of Punctatæ.

Diam. of valves, 0.156 m.m.

Diam. of area, 0.113 m.m.

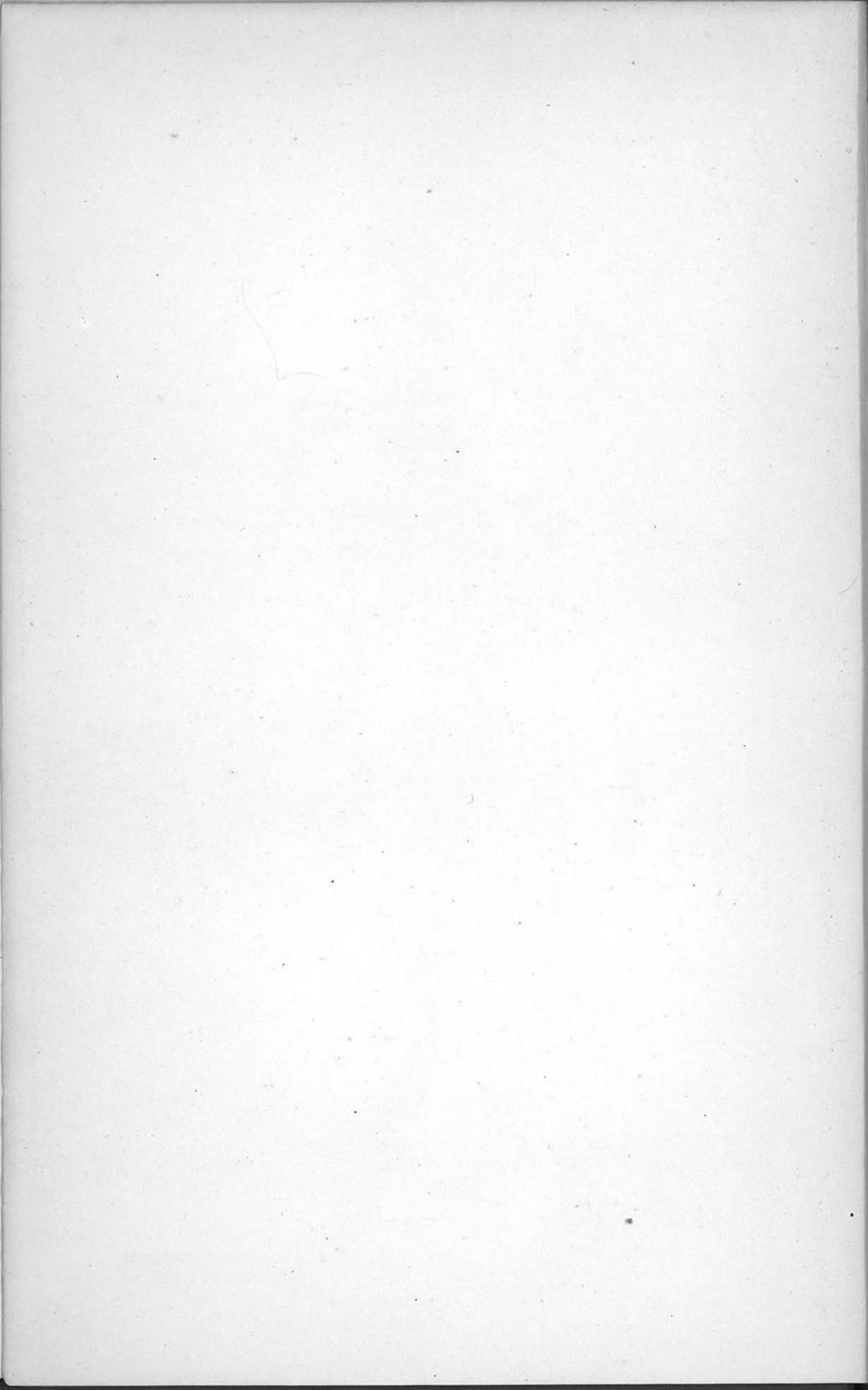
Length of rays, 0.016 m.m.

Valves nearly circular. Area nearly circular, but with indications of a thickened angle top and bottom. Rays narrow, subacute at tips, approximating, with a fine line of dots down their length and a faint linear prolongation into the area. Between each pair of Rays an acute marginal bead of 0.0066 in length. Area finely punctate over the central clepsydrate portion. No appearance of a central line or Raphe. This diatom I have from the fossil deposit of Karand in Hungary, where it was first noticed and pointed out to me by my friend, Fred. Kitton. I have named it after Dr. J. Pantocsek, the great explorer of the diatomaceous deposits of Hungary.

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VI.

ALPHABETICAL INDEX TO  
THE FIGURES.





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"	<i>Grevillii</i> , Leud.	...	II.	...	9
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„	<i>punctulatus</i> , Grun.	...	XIII.	...	65
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„	<i>rivalis</i> , A. S.	...	II.	...	17
„	<i>rivulosus</i> , Brun.	...	II.	...	16
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NOTE.

It will be remarked that a few of my accepted forms of *Campylodiscus* have not been figured in this preliminary monograph. These comprise:—

Five species reserved by Dr. Leuduger Fortmorel for his forthcoming List of Diatoms from the Malay Archipelago, viz.:—

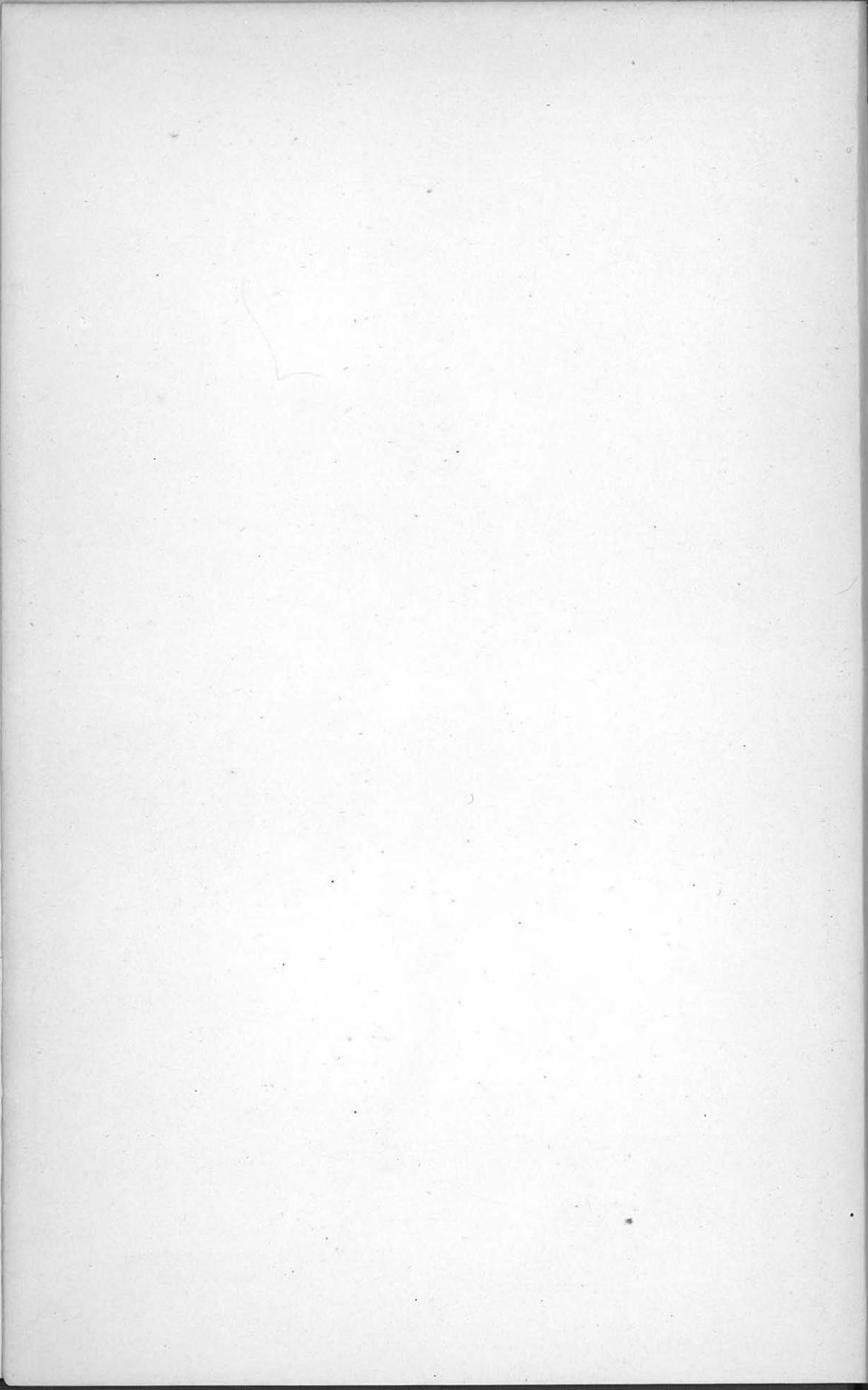
<i>C. Debyi</i> , Leud.	<i>C. pulchellus</i> , Leud.
<i>C. fortis</i> , Leud.	<i>C. Sumatrensis</i> , Leud.
<i>C. mirabilis</i> , Leud.	

One species reserved by Prof. Cleve—the *Campylodiscus Balticus*, Cl.

Ten species, the figures of which were either too bad for reproduction or have been accidentally omitted while preparing the plates. These comprise:—

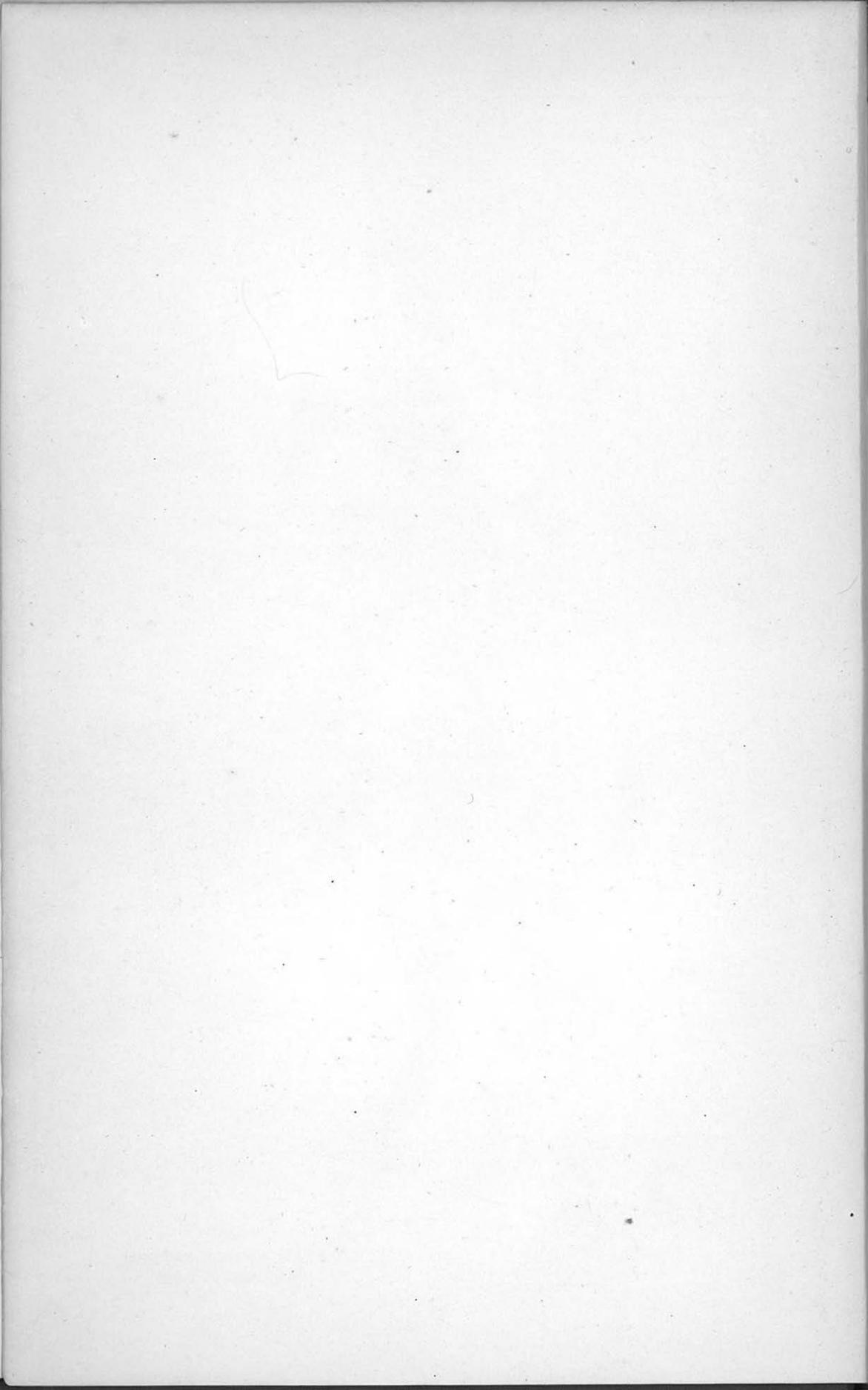
<i>C. Groenlandicus</i> . Cleve, Arctic Diat., pl. II., f. 9.
<i>C. bicinctus</i> . Castr., Challenger, pl. XI., f. 2.
<i>C. Castracaneis</i> . Janish, Gazelle, pl. XX., f. 1.

- C. *vermiculatus*. Temp. Diatomiste, pl. XI., t. 9.  
C. *Weissflogii*. Deby, A. S. Atlas, pl. XVI., f. 4.  
C. *Challengerensis*. Deby, N. sp.  
C. *Margosinuatus*. Deby, N. sp.  
C. *Raeanus*. Deby, N. sp.  
C. *Bruneanus*. Deby, N. sp.  
C. *Pantocsekii*. Deby, N. sp.
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VII.

LIST OF ABBREVIATIONS USED  
IN THIS WORK.





*List of Abbreviations employed in  
this Paper.*

---

- A. S., Atl.*—Adolf. Schmidt, Atlas der Diatomaceenkunde, 1874—1891.
- Bail., J. W., Mic. Obs.*—J. W. Bailey, Microscopical Observations made in South Carolina, Georgia, and Florida, 1850.
- Bail. L. W., Para.*—L. W. Bailey, Notes on New Species of Microscopical Organisms, chiefly from the Para River, South America, 1861.
- Bleisch, Hedw.*—Dr. Bleisch, Ueber zwei *Campylodiscus* (*C. costatus*, und *C. spiralis*) in Hedwigia, 1860.
- Breb., Cherbg.*—A. de Brébisson. “Sur quelques diatomées marines du littoral de Cherbourg,” 1854, and Ed. II., 1867.
- Brun, Diat. Esp. nouv.*—Jacq. Brun, Diatomées, Espèce nouvelles marines, Fossiles ou Pélagiques, 1891.
- Castr., Chall.*—Conte Castracane, Report on the Diatomaceæ collected by H.M.S. Challenger, 1886.
- Cl., Arctic D.*—P. T. Cleve, On Diatoms from the Arctic Sea, 1873

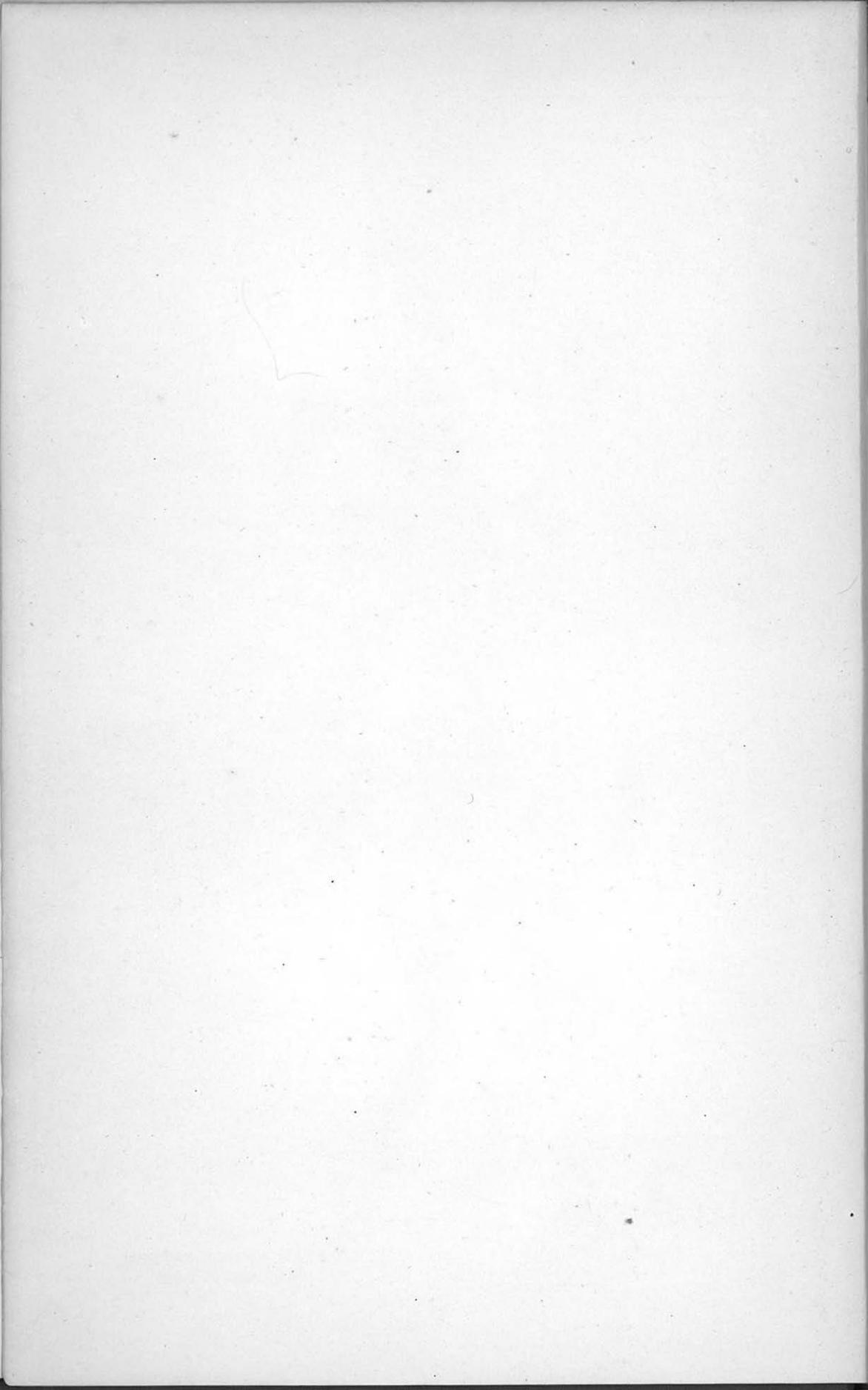
- Cl., New Diat.*—P. T. Cleve, *New Diatoms*, 1878— 879.
- Cl., Tegel.*—P. T. Cleve, On some fossil marine Diatoms found in the Moravian "Tegel" from Augarten, near Brünn, 1887.
- Cl., Vega.*—P. T. Cleve, Diatoms collected during the expedition of the "Vega," 1883.
- Ehr., Abh.*—C. G. Ehrenberg, in *Abhandlungen der Königl. Akademie zu Berlin*.
- Ehr., Ber.*—C. G. Ehrenberg, in *Berichte der Königl. Akademie zu Berlin*.
- Ehr., Mik.*—C. G. Ehrenberg, *Mikrogeologie*, 1854.
- Ehr., Nordpol.*—C. G. Ehrenberg, *Das unsichtbar wirkende Leben der Nordpolarzone*, 1875.
- Ehr., Wachs. Kennt. Calif.*—C. G. Ehrenberg, Ueber die Wachsende Kenntniss des unsichtbaren Lebens als felsbildende Bacillarien in Californien, 1870.
- Greg., Clyde.*—W. Gregory, On new forms of Marine Diatomaceæ found in the Firth of Clyde and in Loch Fyne, 1857.
- Grev., T.M.S.*—K. K. Greville, in *Transactions of the Royal Microscopical Society, and Transactions of the Botanical Society of Edinburgh*.
- Grun., A. S. Atl.*—A. Grunow, in *A. Schmidt's Atlas d. Diatomeenkunde*.
- Grun., O. Diat.*—A. Grunow, *Die Oesterreichischen Diatomeen*. 1862.
- Grundl., A. S. Atl.*—Grundler in *Adolf Schmidt's Atlas d. Diatomeenkunde*.

- Harting, Banda-See.*—P. Harting, Bijdrage tot de Kennis der Mikroskopische Fauna en Flora van de Banda-See, 1860.
- Harting, Boden onder Amsterdam.*—P. Harting, De Boden onder Amsterdam, onderzucht en beschreven, 1852.
- Harv. and Bail.*—Harvey and Prof. Bailey, Diatomaceæ in U. S. Exploring Expedition under Capt. Wilkes, 1862-74.
- Jan. and Rab., Honduras.*—C. Janish and L. Rabenhorst., Ueber Meeres-Diatomaceen von Honduras, 1862.
- Jan., Gazel.*—The Diatoms of the Gazelle Expedition, 17 beautiful photographic plates, unpublished, but liberally distributed to many Diatomists by C. Janish in 1889.
- Johnst., T. M. S.*—Christopher Johnston, in Transactions of the Microscopical Society, 1860.
- Kütz., Bac.*—F. T. Kützing, Die Kieselchaligen Bacillarien oder Diatomeen, 1844; and species Algarum, 1849.
- Leud., Ceylon.*—Leuduger Fortmorel, Catalogue des Diatomées de l'île de Ceylan, 1879.
- Norm., T. M. S.*—George Norman, in Transactions of the Microscopical Society, 1857—1865.
- O. Witt., Sudsee.*—Dr. N. Otto Witt, Ueber Sudsee Diatomaceen, 1873.
- Pantoc.*—Josef Pantocsek, Beiträge zur Kenntniss der fossilen Bacillarien Ungarns, 1886—1889.
- Peragal., Villef.*—H. Peragallo, Diatomées de la Baie de Villefranche, 1889.
- Rabn., Flor. Europ. Alg.*—L. Rabenhorst, Flora Europæa Algarum, 1864.

- Ralfs, Prit. Inf.*—John Ralfs, 'The Diatomaceæ in Pritchard's History of the Infusoria, 1861.
- Schum., Tatra.*—J. Schumann, Die Diatomeen der hohen Tatra, 1867.
- Shadb., T.M.S.*—G. Shadbolt, in Transactions of the Microscopical Society, 1854.
- Temp. Diatomiste.*—Tempère in le "Diatomiste," 1890-91.
- T. et B.*—Tempère et Brun., Diatomées fossiles du Japon, 1889.
- V. H., Synop.*—H. van Heurck, Synopsis des Diatomées de Belgique, 1880—1885.
- W. Sm., Synop.*—Rev. William Smith, Synopsis of the British Diatomaceæ, 1853—1856.
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VIII.

APPENDIX.





## Appendix.

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### A REVIEW OF THE FORMS OF *Campylodiscus*, DESCRIBED BY PROF. J. BRUN, OF GENEVA.

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SINCE the MS. of this "Analysis" was in the printer's hands, I have been kindly favoured by Prof. Brun with the loan of his authentic types. My examination of these beautiful selected slides has allowed me to carefully study them, and has led me to modify my views regarding the specific value of some of the forms. In order to complete this "prelude" to a final monograph, which will contain the figures and descriptions of all known *Campylodisci* and their varieties, I will now proceed to review Prof. Brun's species and describe them afresh, from the original specimens, in a more complete manner than was done by their able discoverer, who, as is well known, handles the artist's pencil better than he does the descriptive pen.

I now consider the following forms of Prof. J. Brun as being fairly distinct:—*Campylodiscus albifrons*, *C. altar*, *C. chrysanthemum*, *C. clivosus*, *C. coronilla*, *C. rivulosus* (Temp. et Brun), *C. vitricavus* (Temp. et Brun); while I am of opinion that *C. canalisatus* is only a variety of *C. vitricavus* (Brun), *C. simplex* a variety of *C. clivosus* (Brun), *C. scalaris* (Brun), a var. of *C. Ralfsii* (W. Sm.), and *C. hypodromus* (Brun), identical with *C. angularis* (Greg.).

DESCRIPTION OF J. BRUN'S *Campylodisci*.1.—*Campylodiscus albifrons*, Brun.Diat. *Especies Nouv.*, p. 14, pl. XXI., f. 2.

Brun., Collect. Slide 2173.

Group of the Punctatæ.

*Dimensions* :—

Diam. of valves, 0.139 m.m.

Diam. of area, 0.096 m.m.

Length of rays, 0.016 m.m.

Diam. of inter-radial spaces, 0.003 m.m.

Valves circular. Area circular. Rays short, narrow, teeth-like, straight, terminating inside in two minute apiculi, carrying 3 or 4 longitudinal rows of finely punctate striæ or lines. Extreme margin of valve coarsely striate. Area formed by, 1st, a smooth ring, 0.006 wide; 2nd, a circle, 0.009 wide, carrying numerous irregularly scattered puncta; and 3rd, a broad, smooth, central, circular space, 0.066 in diam. No appearance of a true circlet. No marginal, inter-radial beads. The affinity of this species with the *C. lepidus* of Castr. (*C. Pfizleri*, A. S.), which Prof. Brun indicates, is erroneous, as this last species has distinctly infundibuliform rays, with a notable stem to the funnels and also a genuine circlet, formed by short, fine, subparallel lines.

*C. albifrons* is indicated from Hong Kong and from Yokohama. This diatom has some affinity with my *C. margosinuatus*, but is readily distinguished by the characters of the Area and Rays.

2.—*Campylodiscus altar*, J. Brun.Diat. *Esp. Nouvelles*, p. 14, pl. XXI., f. 1.

Group of the Striatæ.

*Dimensions* :—

Diam. of valves, 0.116 m.m.

Diam. of area, 0.063 m.m.

Length of rays, 0.026 m.m.

Length of marginal beads, 0.006 m.m.

Length of striæ, 0.016 m.m.

Valves circular. Area quadrate. A circlet of small, distinct dots. Rays simple. Inter-radials moniliformly punctate. Marginal beads elliptical, coarsely punctate, one to each pair of rays. Alternate rays often shortened. Marginal beads and rays about 100. A narrow (0.003 m.m. wide), smooth space between the circlet and the origin of the striæ. Striæ distinct, radiating from a central point, obsoletely punctate, half as numerous as rays.

This form differs very materially from *C. ornatus*, Grev., of which M. Brun considers it a variety, both in the markings of the area and in the punctuation of the inter-radials. It is also very distinct from *C. Rabenhorstii*, A. S.

Fossil from Sendai, Japan.

### 3.—*Campylodiscus canalisatus*, Temp. et Brun.

Diat. Foss. du Japon., p. 28, pl. II., f. 5; Brun. Collect., Slide, No. 2864.

The characters which are supposed to distinguish this species are too slight to be of any specific value. It is barely a variety of *C. vitricavus*, from the same locality.

### 4.—*Campylodiscus chrysanthemum*, J. Brun.

Diat. Foss. du Japon., pl. II., f. 7. Brun. Coll., No. 2663.  
Group of the Punctatæ.

#### *Dimensions* :—

Diam. of valve, 0.083 m.m.

Long diam. of area, 0.033 m.m.

Small diam. of area, 0.019 m.m.

Length of rays, 0.022 m.m.

Length of funnel, 0.013 m.m.

Length of stem, 0.009 m.m.

Diam. of marginal beads, 0.006 m.m.

Valve circular. Area small, oval. Rays infundibuliform, with linear, non-punctate, non-striate funnels. Stems shorter than funnels. Area carrying a few sparse dots or apiculi. A very narrow, concentric, smooth zone follows the inner termination of

the rays. Inter-radials quite smooth. Rays 24 in number. Outer narrow rim of valves finely striate. One large marginal hyaline bead to each pair of rays.

*C. Mülleri*, which has some resemblance to this species, belongs to the group of *Hyalinæ*, and has a reniform area.

*C. chrysanthemum* is from the Yédo limestone, and according to M. Brun from Nossi-Bé.

### 5.—*Campylodiscus clivosus*, J. Brun.

Brun. et Temp., Diat. Foss. Japan., p. 28, pl. II., f. 11 *a, b*.

Brun. Coll., No. 2532.

Group of the *Punctatæ*.

*Dimensions of large specimen*:—

Diam. of valves, 0.103 m.m.

Diam. of area, 0.070 m.m.

Length of rays, 0.013 m.m.

Width of inter-radials varying, but average is 0.006 m.m. I have seen small specimens only 0.050 in diameter of frustule. Valves circular. Area circular, with a slight angle or notch top and bottom. Rays simple, originating at the margin in a small triangular notch. No marginal, inter-radial beads. Inter-radials finely, longitudinally striate. From 5 to 10 striæ to each inter-radial. Area very finely punctate, with a clepsydrate figure. At a certain focus of the microscope the whole surface of the valve shows an exquisitely fine and close very characteristic radial striation.

This diatom has no relation to *C. Grænländicus*, Cl., nor to *C. Hybernicus*, Ehr. It is more nearly intermediate between *C. Grænländicus*, Cl., and *C. simplex*, Brun.

Fossil from Yedo, Japan, and, according to Brun, from the mouth of the Oregon, U.S.A.

### 6.—*Campylodiscus coronilla*, J. Brun.

Diat. *Especies Nouv.*, p. 14, pl. XXI., f. 3.

Deby, *Analysis*, pl. XIV., f. 69; and pl. XIII., f. 66.

This was originally named *C. Doegeanus*, Deby, in my cabinet. It is described by me among the new species on a preceding page. This diatom is probably a variety of *C. Californicus* (Grove), Deby, which I have from San Redondo, Sta. Monica, etc. It differs principally from it by the presence of a distinct circlet. It is not a variety of *Rabenhorstii*, Jan., as supposed by M. Brun. On a slide, 3393, in Brun's collection, both *C. Californicus* and *C. coronilla* co-exist, while the label bears "*C. ecclesianus*, var. *coronilla*."

7.—**Campylodiscus simplex**, Brun. Coll., No. 2861.

Diat. Foss. du Japan, pl. II., f. 8, Brun. Collect., slides 2861 and 2864. From Sendai, Japan, Brun. Collect.

This I consider as a variety of *C. divosus*, with small buttons at the ends of the valves and the same fine striation. It is allied to *C. Grænländicus* of Cleve, which I have examined from the Stockholm museum.

8.—**Campylodiscus rivulosus**, Temp. et Brun.

Diat. Foss. du Japan, p. 29, pl. II., f. 9 *a, b*; Brun's Collect., slides 2863 and 2866.

Group of the Raphidæ.

*Dimensions* :—

Diameter of valve :—Large specimen, 0.093 m.m.; small species, 0.033 m.m.

Transverse diam. of raphe, 0.006 m.m.

Length of rays, 0.036 m.m.

Valve very slightly oval, nearly circular. Area linear, with blank space bordered at top and bottom by a row of from 8 to 12 distinct granules. The intermediate space without granules. The lines of granules occupy a length of about 0.016 at each end of area. Rays simple, from 60 to 100. Inter-radials distinctly and rather coarsely moniliform, which give the appearance of waviness figured by Temp. et Brun. The dots on the inter-radials from 6 to 7 in 0.01 m.m. A series of marginal oblong beads exist,

0.006 in length, obscurely bifid at the free tips and in equal number to the rays.

From Sendai and Yedo, Japan.

9.—**Campylodiscus vitricavus**, Temp. et Brun.

Diat. Foss. Japan., p. 30, pl. II., f. 8. Brun. Coll., No. 2863.  
Group of the Striatæ.

*Dimensions* :—

Diam. of valves, from 0.056 to 0.065 m.m.

Long diam. of area, 0.020 to 0.030 m.m.

Short diam. of area, 0.013 m.m.

Length of rays, 0.016 m.m.

Breadth of inter-radials, 0.005 m.m.

Valves very slightly oval, terminating in small hyaline, globular, buttons. Area small, elliptical. Rays, 20 to 24, simple, starting from a marginal bead. Inter-radials smooth. Striæ radiating from a median longitudinal line. Striæ equal to Rays in number. Striæ continuous with rays without any intervening blank space. Outer rim striate.

This diatom, which is not rare in the Sendai deposits, has no affinity to *C. Hodgsoni*, with which Messrs. Tempère and Brun would ally it.

10.—**Campylodiscus hypodromus**. Brun. Coll., 2138, =  
*C. Angularis*, Greg.

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## FINAL ADDENDA AND CORRIGENDA.

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IN looking through Prof. Brun's slides, I have discovered what I consider a distinctly new form, which I have much pleasure in dedicating to this obliging gentleman. I have called it

**Campylodiscus Bruneanus**, Deby, sp. n.

Brun. Collect., slide No. 2864.

Group of the Raphidæ.

*Dimensions* :—

Diat. of valves, 0.059 m.m.

Valves slightly oval. Raphe linear. Rays numerous (about 100) and close set (7 to 8 in 0.01 m.m.), distinctly crenato-punctate. Puncta at variable distances (from 5 to 6 in 0.01 m.m.). No marginal beads. Outer rim finely striate.

This species differs principally from *C. Kutzingii*, Bail (*C. striolatus*, Grun.), by its punctate rays. It is from Sendai, Japan.

---

Page 33, line 23, for *C. suberbus* read *superbus*.

Page 44, No. 57, *C. obsoletus*, Grev., instead of Mähre~~r~~ read Mähren.

Replace last paragraph on page 46 by the following :—

“I consider Nos. 16, 39, 63, 64, 78, to be doubtfully distinct forms; and Nos. 5 and 23 as probably not belonging to the genus *Campylodiscus*.”

Page 53, No. 48 read :—“Blank spaces lunate, not continuous all round the Area,” etc.

Page 62, No. 29, *C. Challengerensis*, Deby, should have been placed immediately after *C. clivosus*, Brun, on page 60.

## LAST WORD.

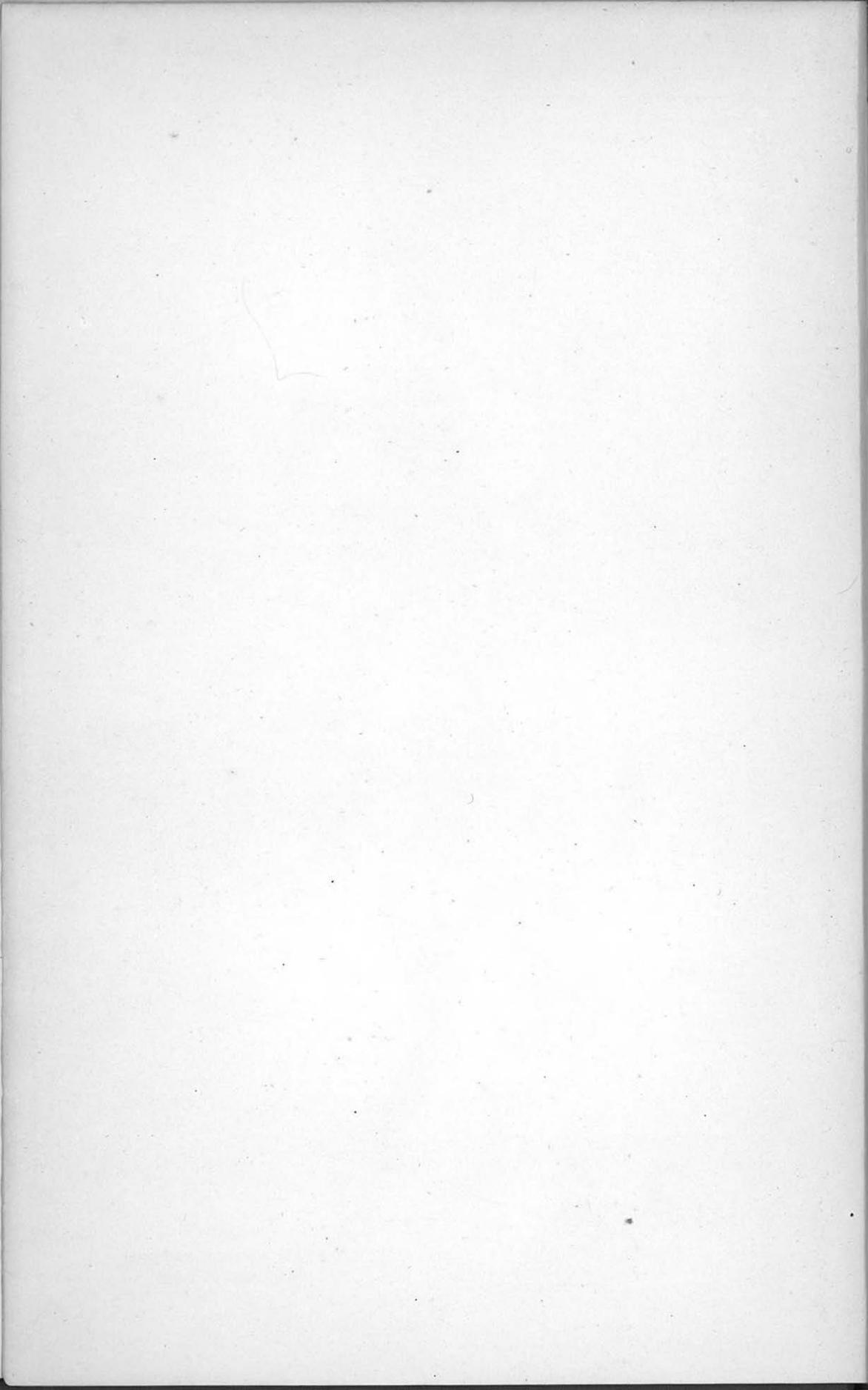
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I CANNOT allow this paper to be circulated without grateful acknowledgments to all who have helped me by the loan of specimens or kind advice during its preparation. To Mr. Grove, of Brighton; to Dr. Rae, of Stirling; to Herr Weissflog, of Dresden; to Mynheer Kinker, of Amsterdam; to Prof. Brun, of Geneva; to Prof. Cleve, of Upsal; to Mr. Doeg, of Evesham; to Fred. Kitton, of London; to Mr. Macrae, of London; to Mons. Tempère, of Paris; and to the Royal Botanical Museum of Stockholm, I am more specially under great obligations. Nor can I omit my thanks to my friend, Alfred Allen, of Bath, for his careful revision of MS. and text of this essay on *Campylodiscus*.

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<i>C. hypodromus</i> , Brun	-	-	-	-	-	p. 94
<i>C. Kerguelensis</i> , Deby	-	-	-	-	-	p. 69
<i>C. Macassarensis</i> (Grove), Deby	-	-	-	-	-	p. 65
<i>C. margosinuatus</i> , Deby	-	-	-	-	-	p. 67
<i>C. Pantocsekii</i> , Deby	-	-	-	-	-	p. 71
<i>C. Raeanus</i> , Deby	-	-	-	-	-	p. 71
<i>C. rivulosus</i> , Temp. et Brun	-	-	-	-	-	p. 70
<i>C. simplex</i> , Brun	-	-	-	-	-	p. 93
<i>C. trapezoidalis</i> , Deby	-	-	-	-	-	p. 66
<i>C. vermiculatus</i> , Temp.	-	-	-	-	-	p. 70
<i>C. vitricavus</i> , Temp. et Brun	-	-	-	-	-	p. 94

\* All others are classed alphabetically in this volume.

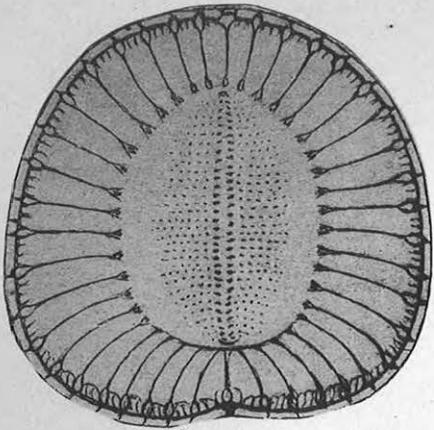
# Plates

Plate I.

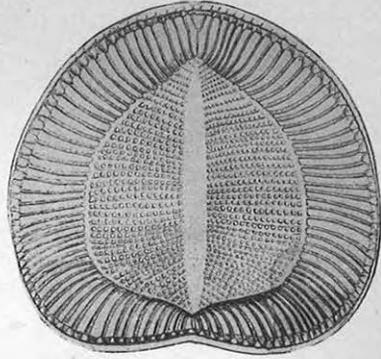
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- Fig. 1.—*Campylodiscus birostratus*, Deby  
2.—*C. biserialis* Deby.  
„ 4.—*C. panduriger*, A. S.  
„ 5.—*C. crebrecostratus*, Grev.  
„ 6.—*C. imperialis*, Grev.  
„ 7.—*C. Hodgsonii*, W. Sm.  
„ 10.—*C. Kutzingii*, Bailey.  
„ 11.—*C. Schmidtii*, Grun.  
„ 14.—*C. socialis*, Witt.
- 

- Figs. 1, <sup>2</sup>4, 6, 11, 14 are from A. S., Atlas, × 660.  
„ 5 from Greville, × 400.  
„ 7 from William Smith, × 400.  
„ 10 from A. S., × 660.



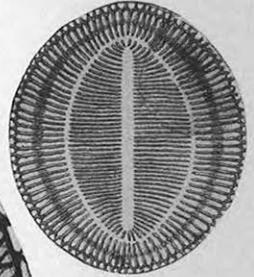
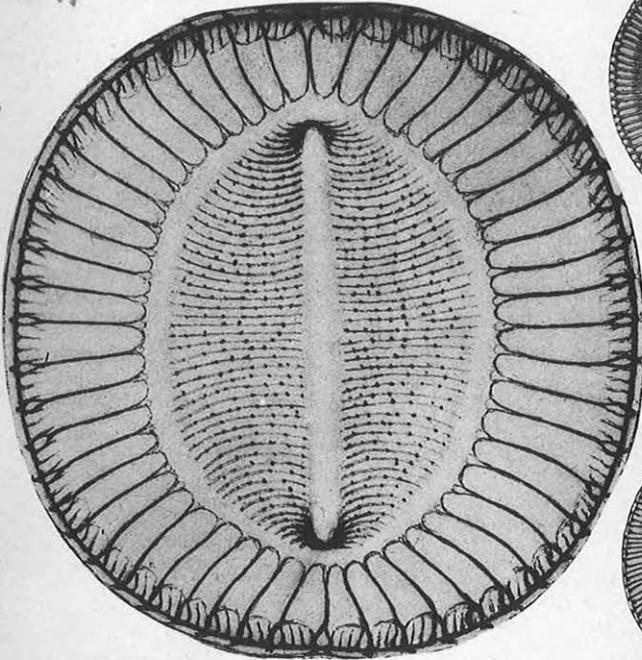
2. 11



7



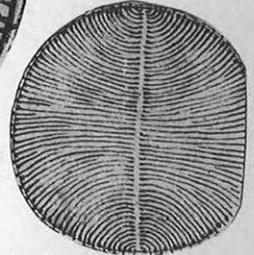
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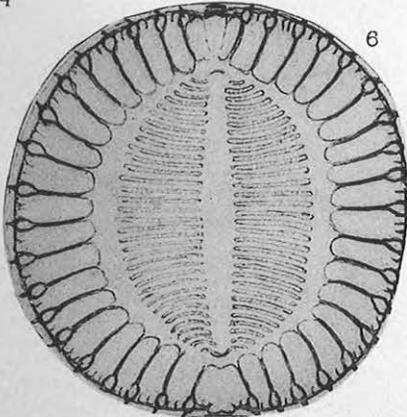
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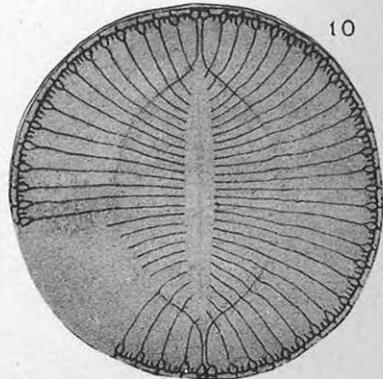
14



10



6



1

11

Plate II.

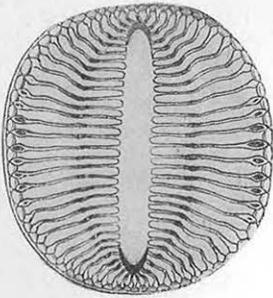
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- Fig. 2.—*Campylodiscus circumactus*, A. S.  
" 3.—*C. Samoensis*, Grun.  
" 8.—*C. undulatus*, Grev.  
" 9.—*C. Brightwellii*, Grun.  
" 12.—*C. biangulatus*, Grev.  
" 13.—*C. fluminensis*, Grun.  
" 15.—*C. decorus*, Breb.  
" 16.—*C. rivulosus*, Brun.  
" 17.—*C. rivalis*, A. S.  
" 18.—*C. Ralfsii*, W. Sm.
- 

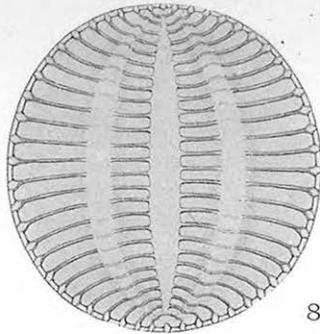
Figs. 2, 3, 9, 13, 15, 17, 18 are from A. S., Atlas,  
x 660.

, 8, 12 from Greville, x 400.

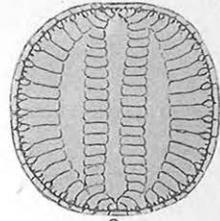
„ 16 from J. Brun, x 400.



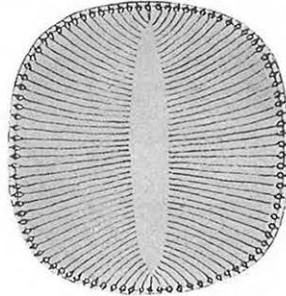
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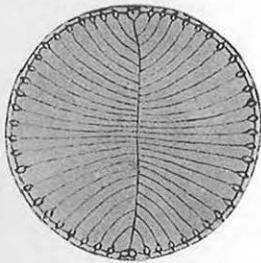
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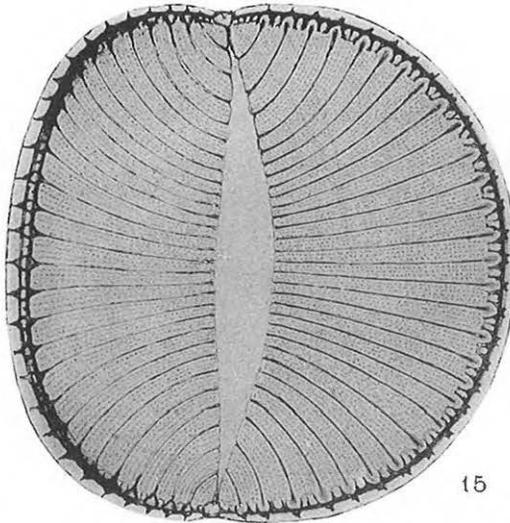
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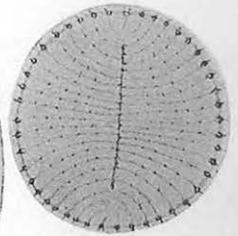
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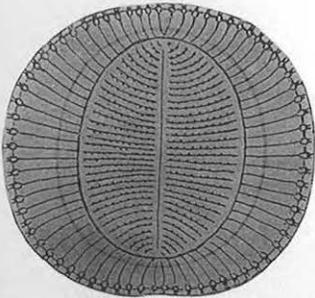
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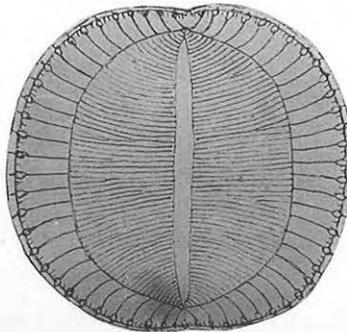
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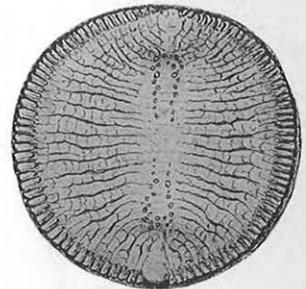
17



2



3



16

Plate III.

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Fig. 19.—*Campylodiscus Wallichianus*, Grev.

„ 21.—*C. adornatus*, A. S.

„ 22.—*C. angularis*, Greg.

„ 25.—*C. helianthus*, A. S.

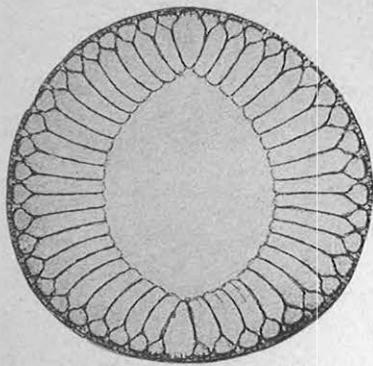
„ 30*b*.—*C. latus*, Shadb.

„ 32.—*C. Robertsianus*, Grev.

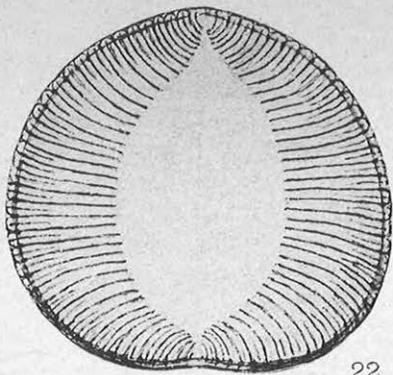
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Figs. 21, 22, 25, 30*b*, are from A. S., Atlas, × 660.

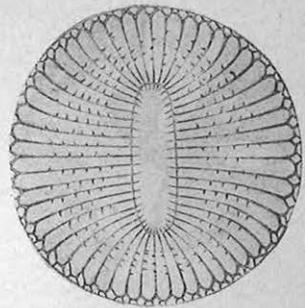
„ 19, 32, from Greville, × 400.



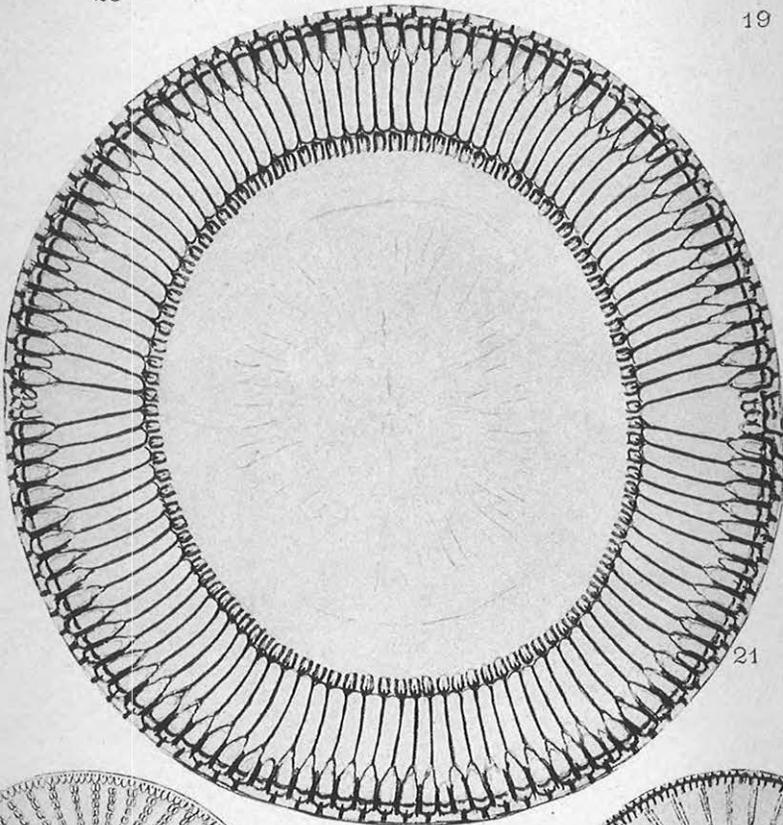
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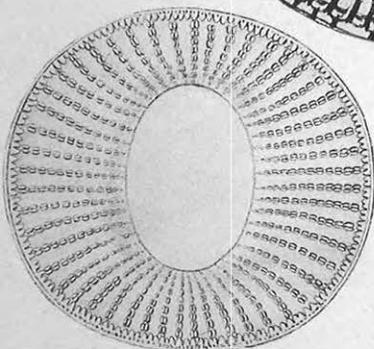
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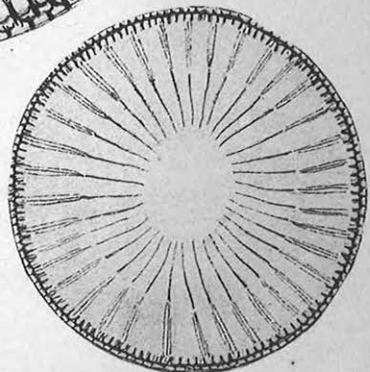
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21



32



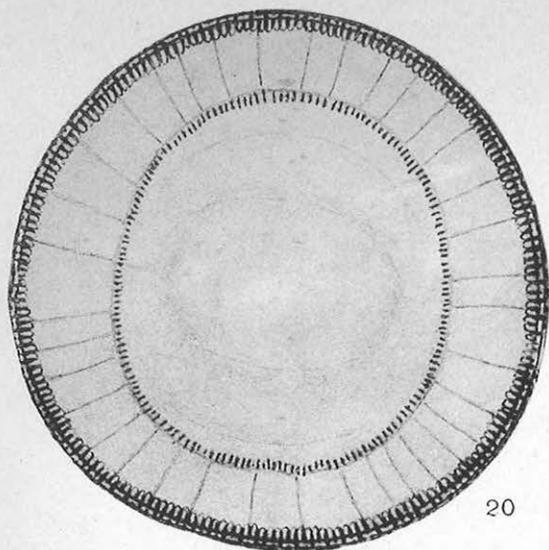
30. B.

Plate IV.

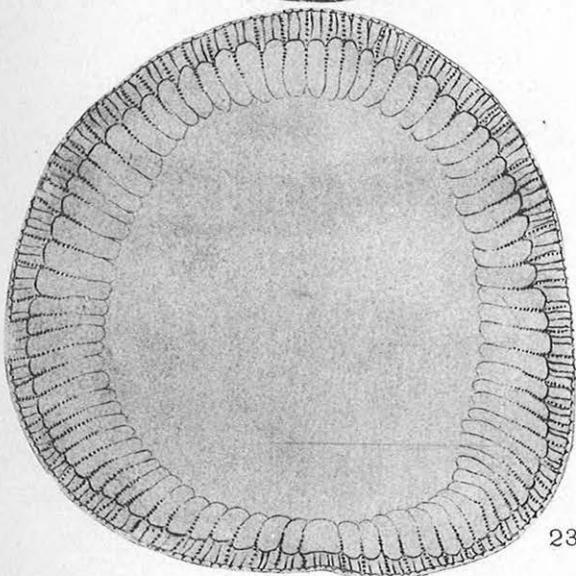
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- Fig. 20.—*Campylodiscus tabulatus*, A. S.  
„ 23.—*C. Japonicus*, Castrac.  
„ 26.—*C. radiosus*, Ehr.  
„ 30a.—*C. latus*, Shadb.  
„ 33.—*C. obsoletus*, Cleve.
- 

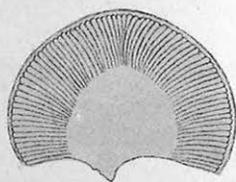
- Fig. 20 is from A. S., Atlas,  $\times 660$ .  
„ 23 is from Castracane,  $\times 440$ .  
„ 26 is from Ehrenberg,  $\times 300$ .  
„ 30a is from Shadbold,  $\times 400$ .  
„ 33 is from Cleve,  $\times 280$ .



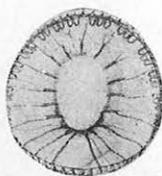
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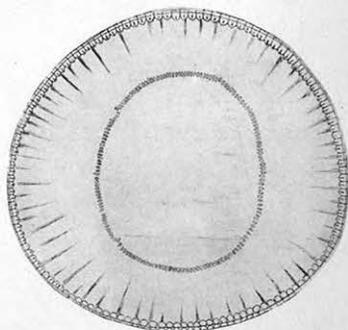
23



26



30. A.



33

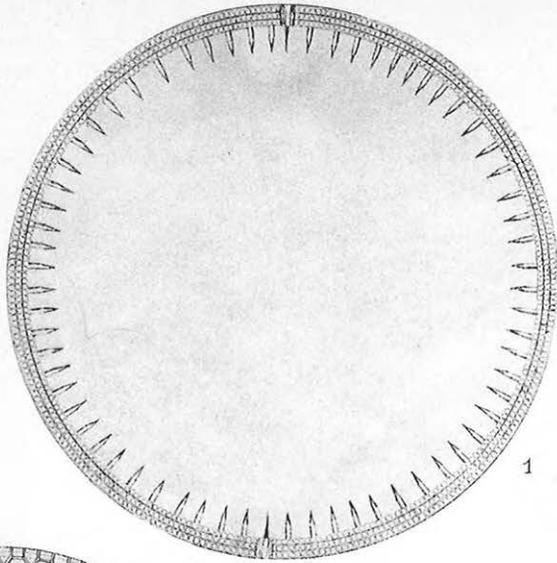


Plate V.

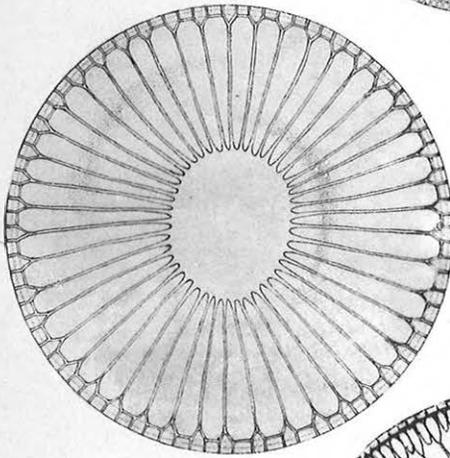
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- Fig. 1.—*Campylodiscus anceps*, Castr.  
„ 24a.—*C. Browneanus*, Grev.  
„ 24b.— „ var. *rotula*, Grun.  
„ 24c.— „ „ *C. phalangium*, A. S.  
„ 34.—*C. Adriaticus*, Grun.
- 

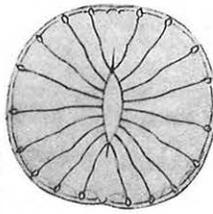
- Fig. 1 is from Castracane, × 440.  
„ 24a is from Greville, × 400.  
„ 24b and 24c and 34 from A. S., Atlas, × 660.



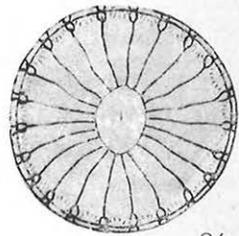
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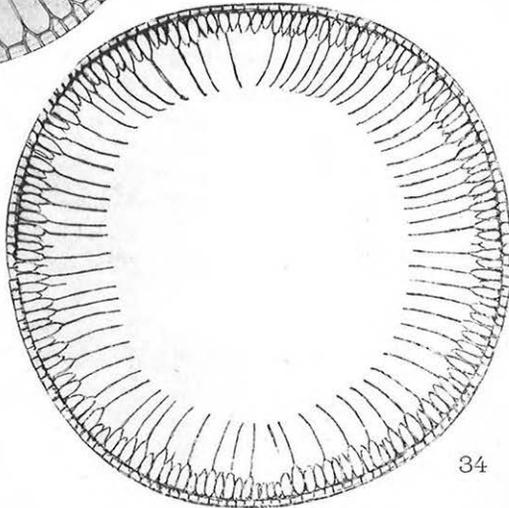
24. A



24. C.



24. B.



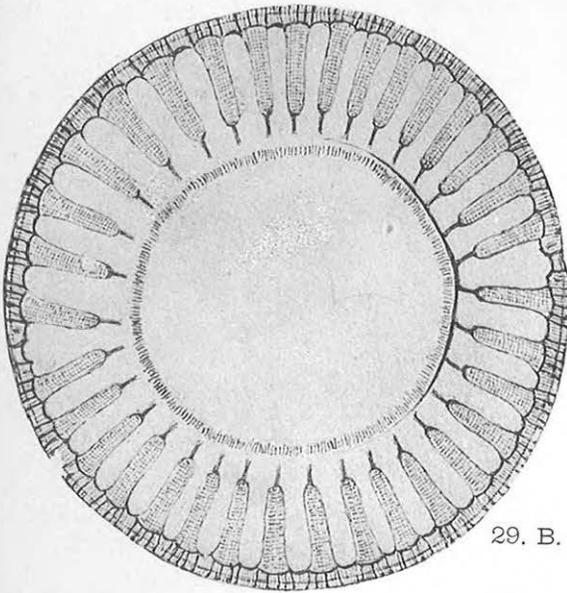
34

Plate VI.

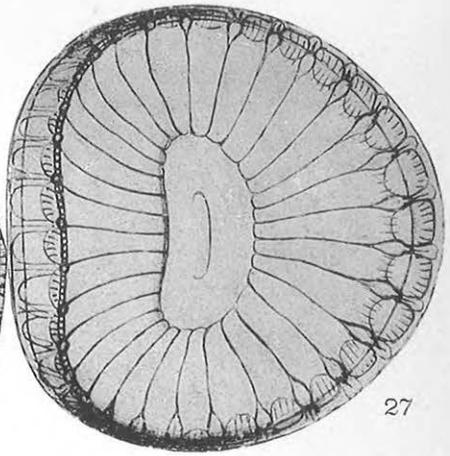
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- Fig. 27.—*Campylodiscus Müller*i, A. S.  
,, 29a.—*C. horologium*, Williamson.  
,, 29b.—*C. „* var. *Pfitzeri*, A. S.
- 

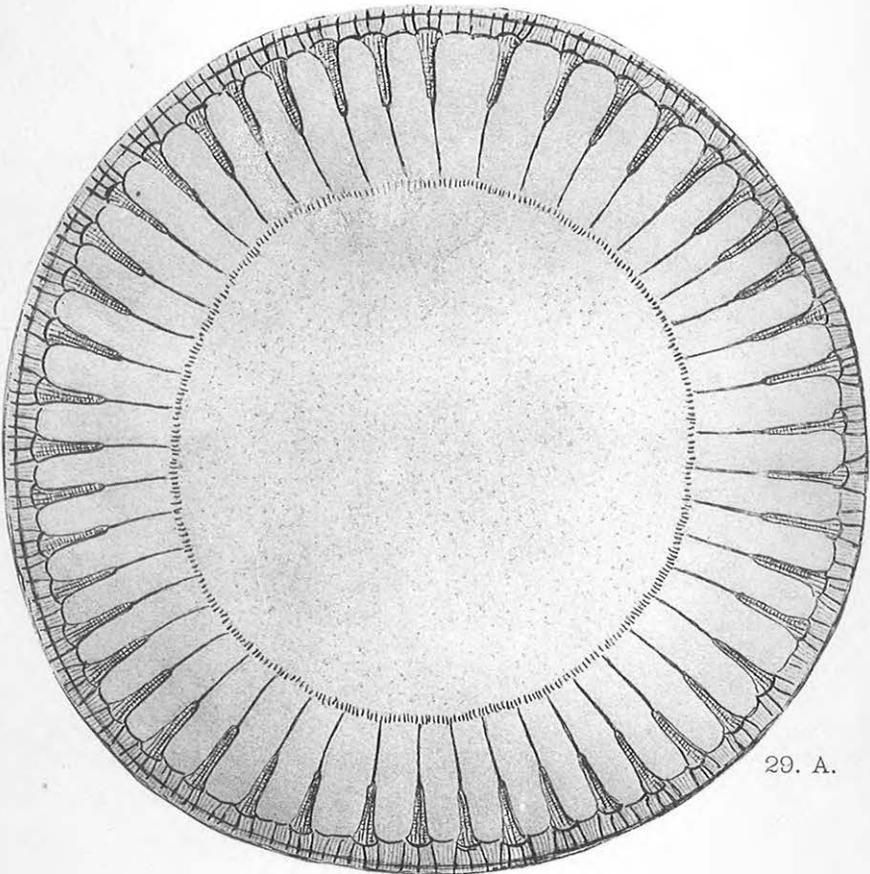
All the figures are from A. S., Atlas, × 660.



29. B.



27



29. A.

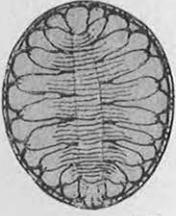
Plate VII.

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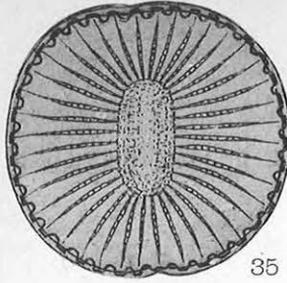
- Fig. 35.—*Campylodiscus coruscus*, A. S.  
„ 36.—*C. simulans*, Greg.  
„ 37.—*C. Thuretii*, Breb.  
„ 38*a*.—*C. bicostatus*, W. Sm.  
„ 38*b*.—*C. bicostatus*, Grun.  
„ 39.—*C. vitricavus*, J. Brun.  
„ 40.—*C. ecclesianus*, Grev.  
„ 41.—*C. taeniatus*, A. S.  
„ 42.—*C. stellatus*, Grev.  
„ 43.—*C. inconspicuus*, Deby.
- 

Figs. 35, 36, 37, 40, 43, are from A. S., Atlas, × 660.

- „ 38*a* is from Wm. Smith (Roper), × 400.  
„ 38*b* is from Van Heurck's Synopsis.  
„ 39 is from J. Brun, × 466.  
„ 42 is from Greville, × 400.



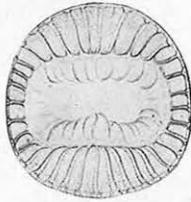
36



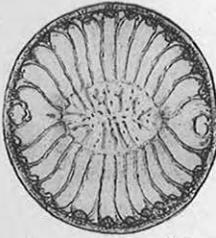
35



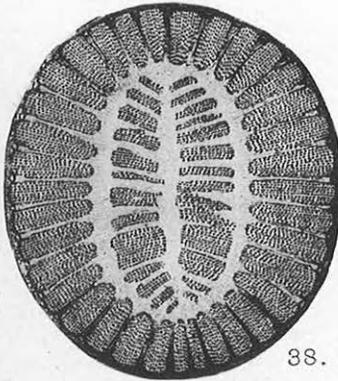
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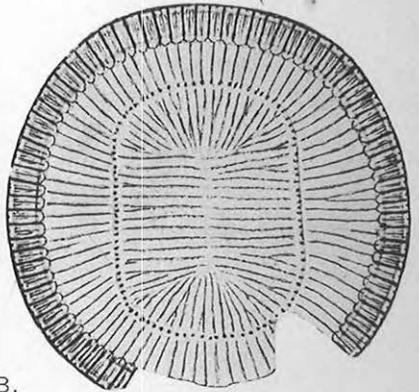
38. A.



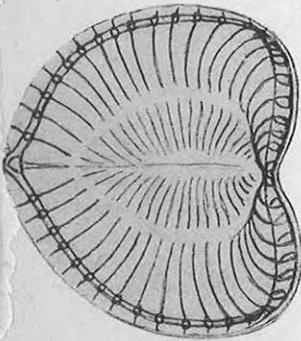
39



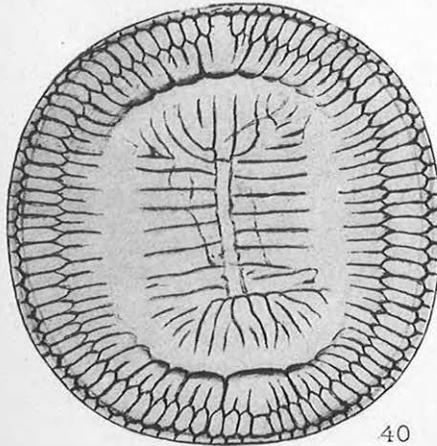
38. B.



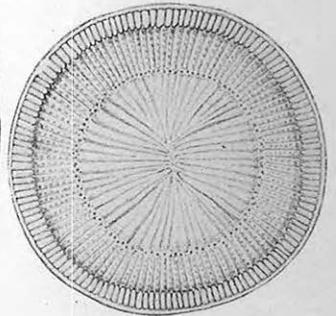
41



43



40



42

Plate VIII.

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Fig. 44.—*Campylodiscus bifurcatus*, A. S.

„ 47.—*C. binarginatus*, A. S.

„ 48.—*C. peramplus*, Cleve.

---

Figs. 44, 47, are from A. S., Atlas,  $\times 660$ .

„ 48 is from Cleve,  $\times 500$ .

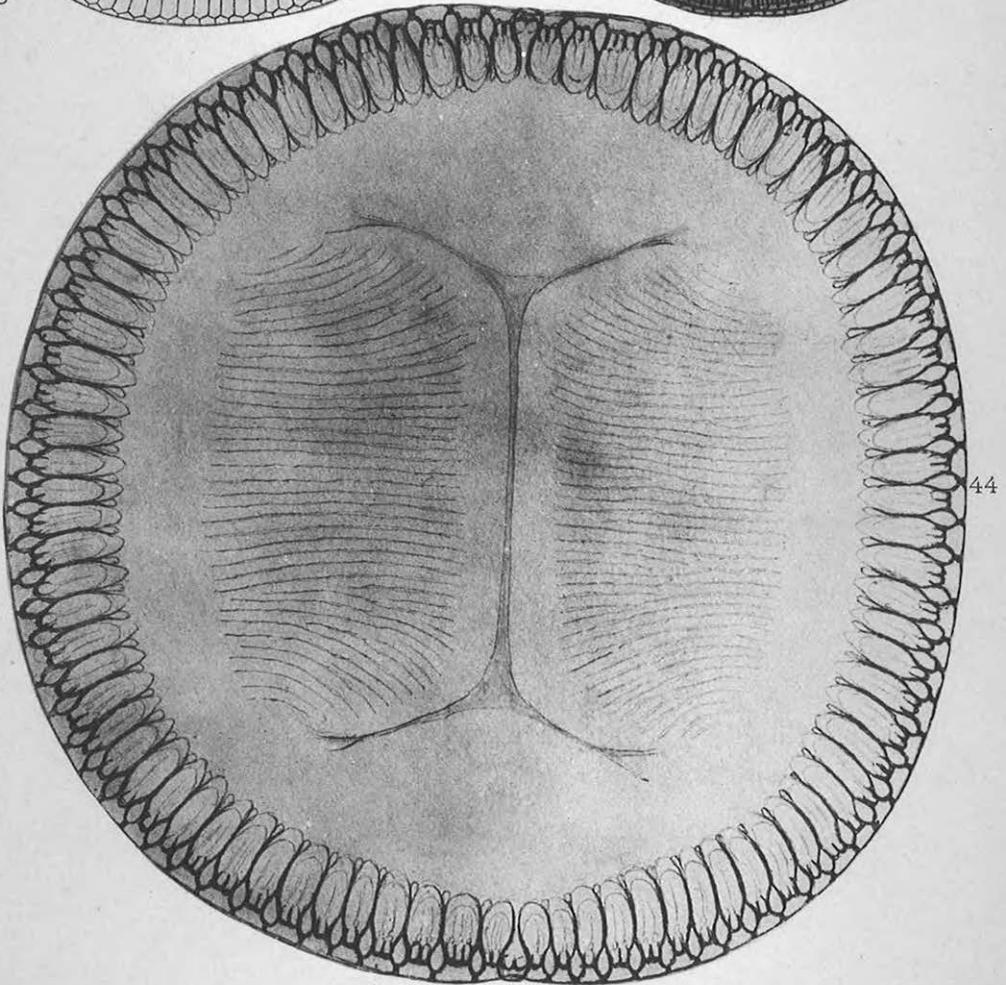
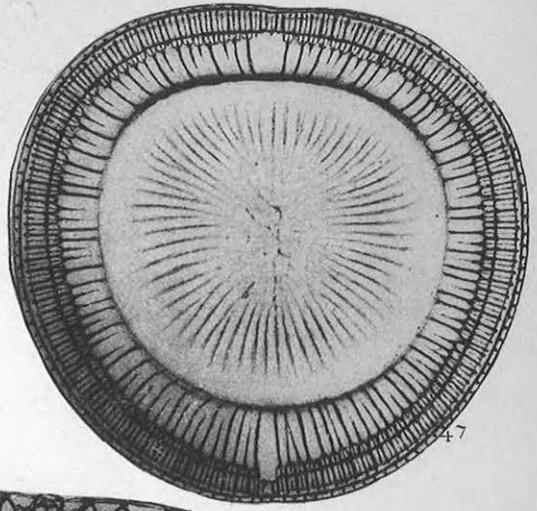
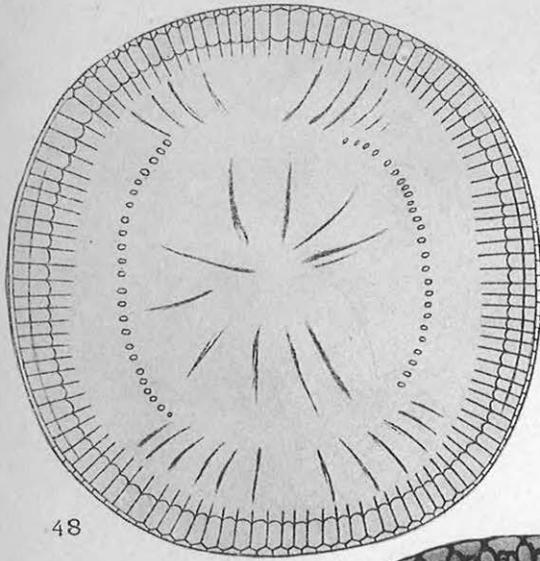
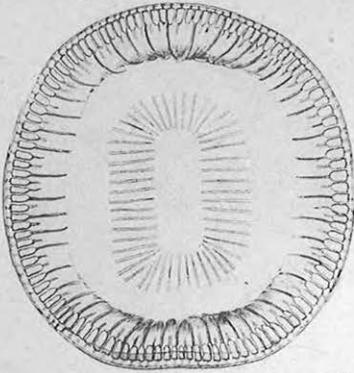


Plate IX.

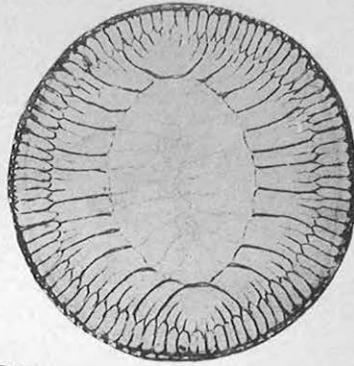
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- Fig. 45.—*Campylodiscus pacificus*, Grun.  
,, 46.—*C. Rabenhorstii*, Janish.  
,, 49.—*C. echeuis*, Ehr.  
,, 50. *C. clypeus*, Ehr.  
,, 51.—*C. cocconiformis*, Cleve.
- 

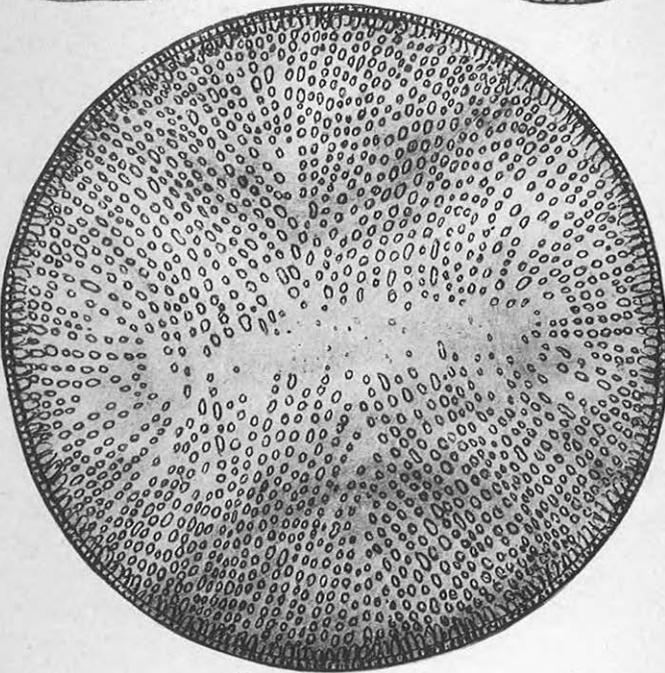
- Figs. 45, 49, 50, are from A. S., Atlas,  $\times$  660.  
,, 46 is from Janish,  $\times$  550.  
,, 51 is from Cleve,  $\times$  1000.



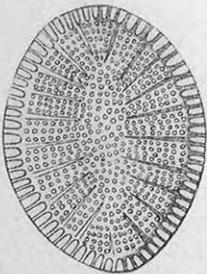
46



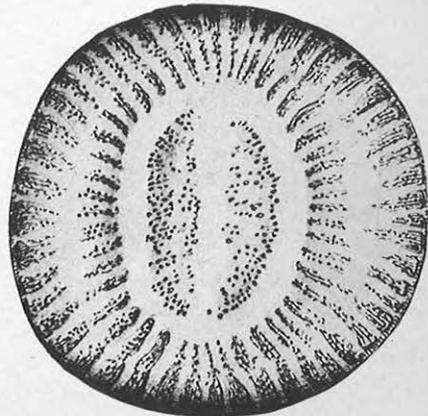
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49



51



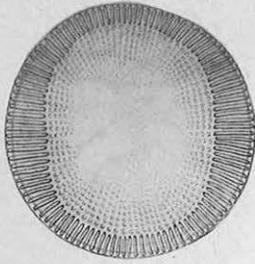
50

Plate X.

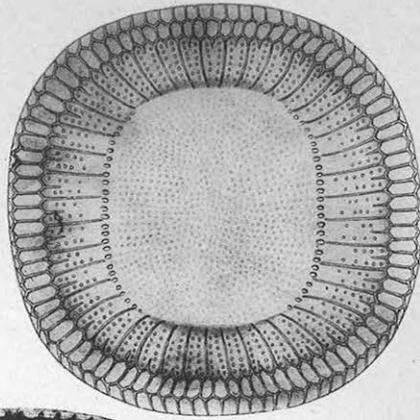
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- Fig. 62.—*Campylodiscus limbatus*, Bréb.  
„ 60.—*C. ornatus*, Grev.  
„ 61.—*C. eximius*, Greg.  
„ 52.—*C. Kittonianus*, Grev.
- 

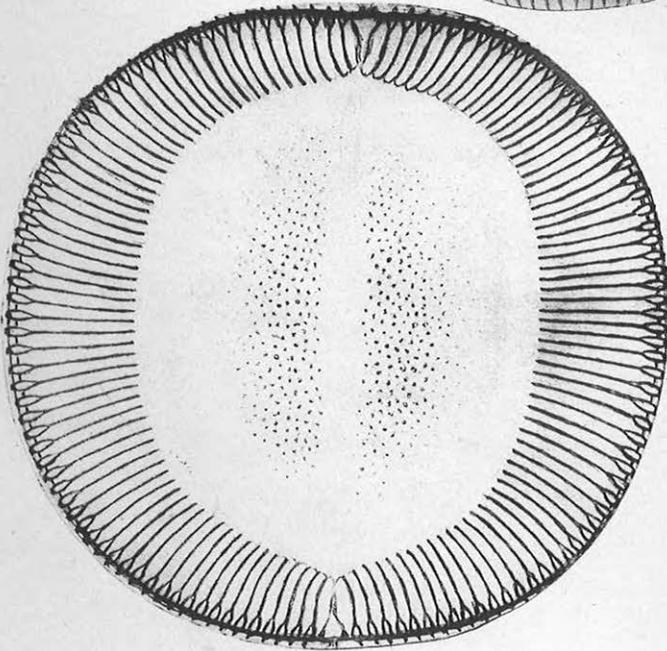
- Fig. 62 is from Brébisson,  $\times 350$ .  
„ 60 is from Greville,  $\times 400$ .  
„ 52, 61 are from A. S., Atlas,  $\times 660$ .



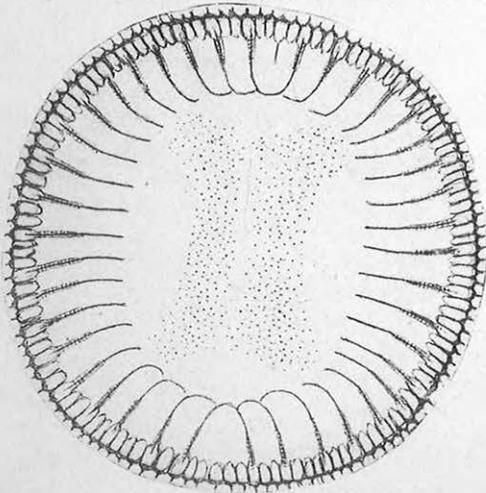
62



60



61



52

Plate XI.

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Fig. 57.—*Campylodiscus imperialis*, Grev.

„ 58.—*C. Hibernicus*, Ehr.

„ 59.—*C. noricus*, Ehr.

---

Fig. 57 is from Greville,  $\times$  400.

„ 58, 59 are from A. S., Atlas,  $\times$  660.

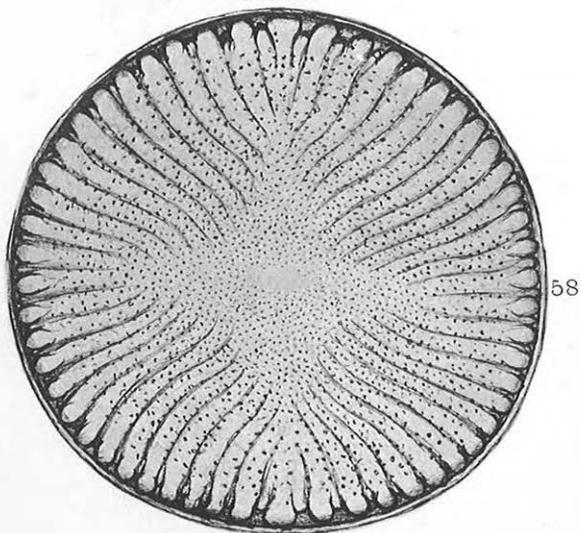
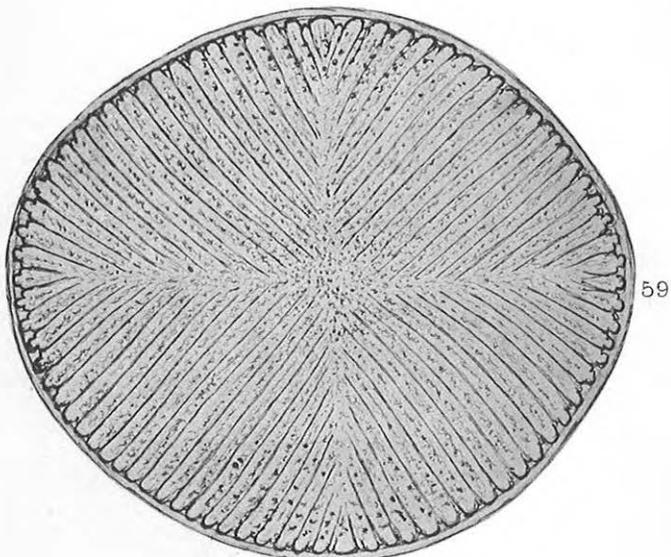
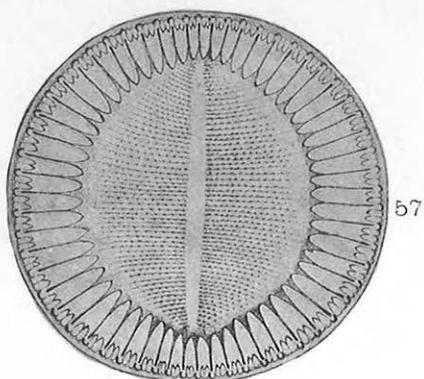
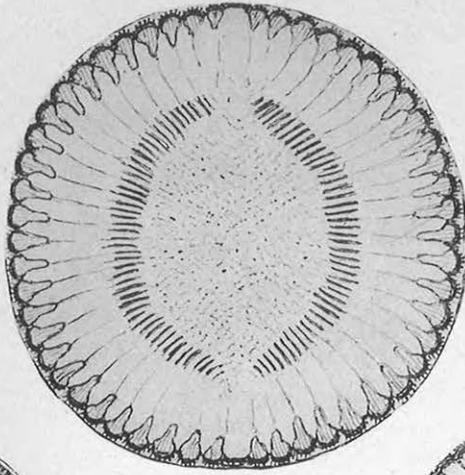


Plate XII.

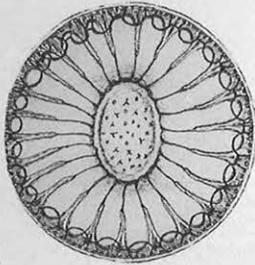
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- Fig. 53.—*Campylodiscus daemelianus*, A. S.  
„ 54.—*C. Schleinitzii*, Janish.  
„ 55.—*C. chrysanthemum*, Brun.  
„ 56.—*C. clivosus*, Brun.
- 

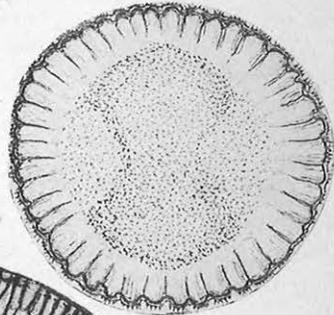
Figs. 53, 54 are from A. S., Atlas,  $\times 660$ .  
„ 55, 56 are from Brun,  $\times 400$  and 388.



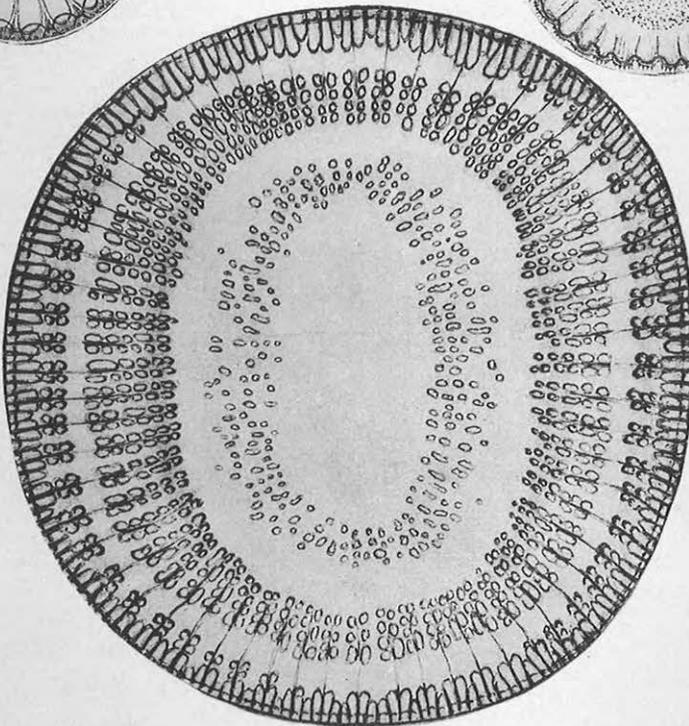
54



55



56



53

Plate XIII.

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Fig. 63.—*Campylodiscus undulatus*, var. *Leudugerii*, Deby.

„ 64.—*C. triumphans*, A. S.

„ 65.—*C. punctulatus*, Grün.

„ 66.—*C. coronilla*, Brun.

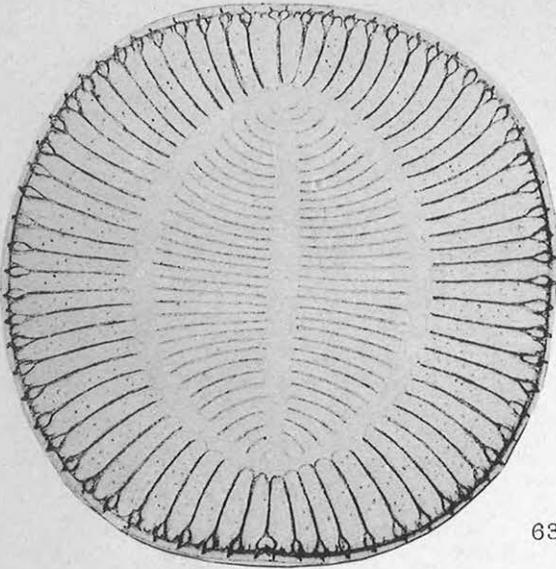
„ 67.—*C. albifrons*, Brun.

„ 68.—*C. altar*, Brun.

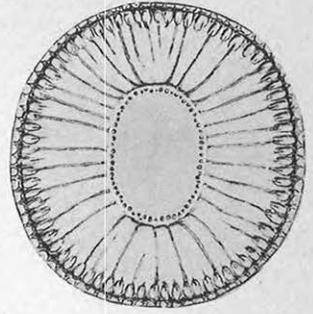
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Figs. 63, 64, 65, are from A. S., Atlas,  $\times 660$ .

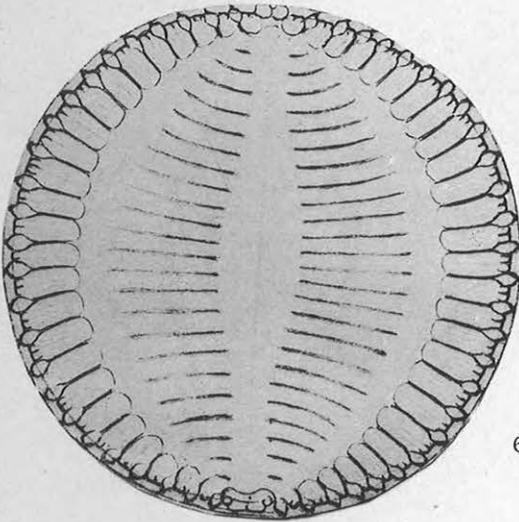
„ 66, 67, 68, are from J. Brun,  $\times 400$ .



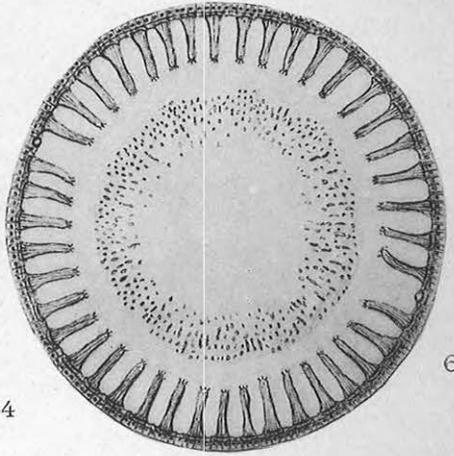
63



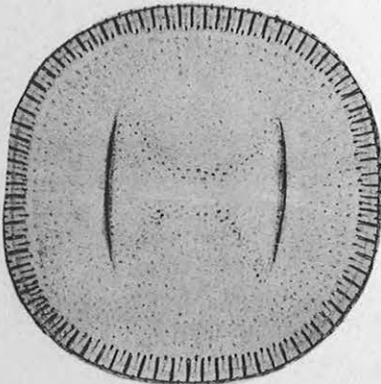
66



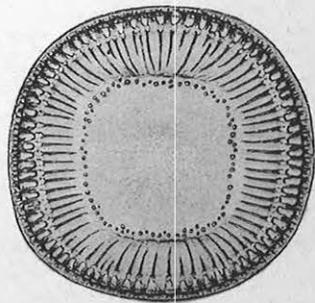
64



67



65



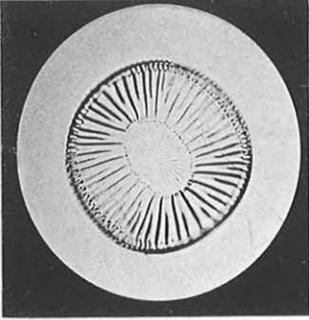
68

#### Plate XIV.

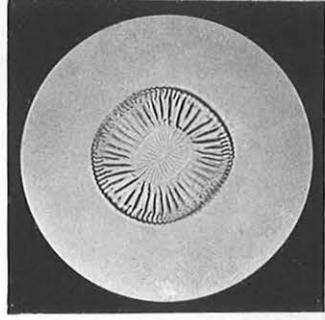
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- Fig. 69.—*Campylodiscus coronilla*, Brun.  
,, 70.—*C. Californicus* (Grove), Deby.  
,, 71.—*C. Macassarensis* (Grove), Deby.  
,, 72.—*C. trapezoidalis*, Deby.  
,, 73.—*C. emarginatus*, Deby.  
,, 74.—*C. dentatus*, Deby.
- 

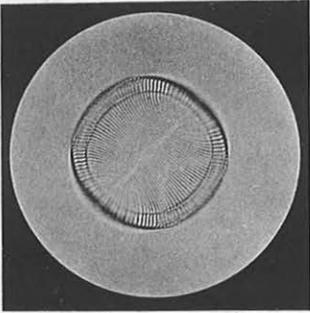
All the Figures on this Plate and in the next are from Photographs, most kindly taken for me from the original diatoms by Mr. Comber, Mr. Neilson, and Mr. Pringle. The very irregular shape of the frustules of the *Campylodisci* renders it quite impossible to focus the whole surface simultaneously, even under low powers of the microscope. This is the reason which explains the deficiencies of our figures, some portions of all of which were out of focus, while other portions were distinct. These latter alone should be examined by means of a pocket-lens. These figures are magnified about 200 diam.



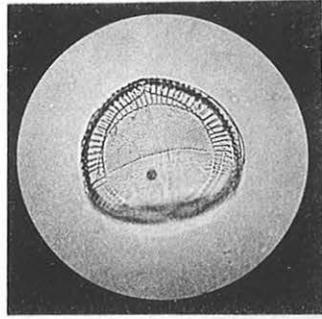
69



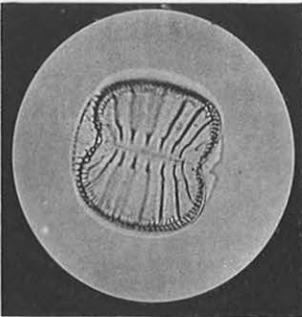
70



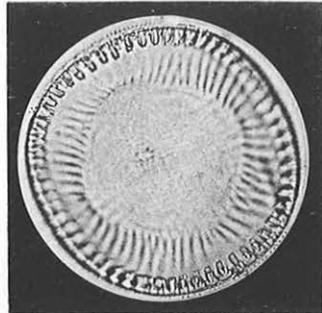
71



72



73



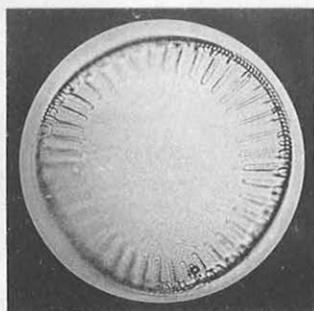
74

Plate XV.

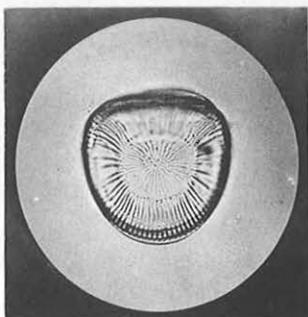
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- Fig. 75.—*Campylodiscus de Tonianus*, Deby.  
,, 76.—*C. stellatus*, Grev. var., Deby.  
,, 77.—*C. undulatus*, Grev., var. Deby.  
,, 78.—*C. Hardmanianus*, Grev.  
,, 79.—*C. Kerguelensis*, Deby.
- 
- 

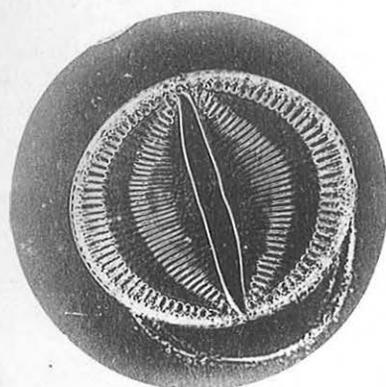
Messrs. Berthaud Freres, of Paris, deserve credit for the manner in which they have executed all of the phototypic plates for the present paper; and Mr. C. Seers, of Bath, for its careful typography.



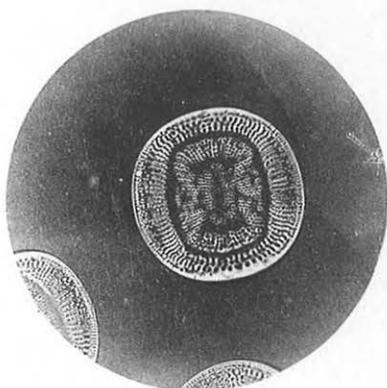
75



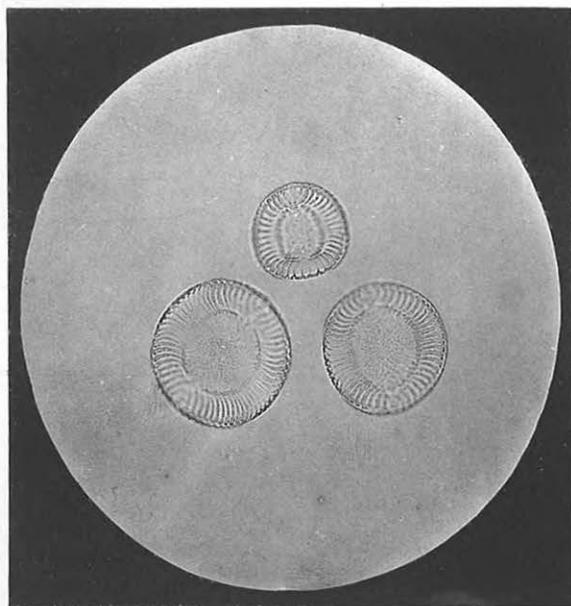
76



77



78



79