

*a a.* COSTÆ MARGINAL, OR VERY DELICATE AT THE MIDDLE OF THE VALVE

**S ovalis Bréb.** (Kütz. Bac., p. 61, pl. 30, f. 64; H.V.H. Atl., pl. 73, f. 2\*; Type No. 425), **plate 13, fig. 585.**

Valve oval elliptic or ovate, with costæ marginal, short, narrow, 5 in 1 c.d.m. Pseudo-raphæ narrow. Striæ rather delicate, 18 in 1 c.d.m. Girdle face slightly cuneate, with alæ indistinct. Length, 5 to 8 c.d.m.

Fresh and brackish water.—Brussels (Del.), Antwerp. Found everywhere.

**var. Crumena.** (*S. Crumena Bréb.*; H.V.H. Atl., pl. 73, f. 1\*; Type No. 424), **plate 13, fig. 586.**

Valve almost disciform. Pseudo-raphæ very narrow.

Fresh and brackish water.—Antwerp, common in the Scheldt. La Hulpe, Brabant (Del.). England (Comber, Norman, Stolt.), Scotland (Arnott. in Baxter Coll. 2686), Ireland (O'Meara)

**var. ovata.** (*S. ovata Kütz.*; H.V.H. Atl., pl. 73, f. 5-7\*; Type No. 426), **plate 13, fig. 587.**

Smaller than the type-form (4 to 5 c.d.m.), and quite ovate. In a form from the Scheldt (fig. 587, two right-hand figures), the costæ are prolonged up to the median line, while becoming gently thinner.

Same stations.—Rather common.

**var. minuta.** (*S. minuta Bréb.*; H.V.H. Atl., pl. 73, f. 9-14\*; Type No. 428), **plate 13, fig. 588.**

Still smaller than the preceding variety (2 to 3 c.d.m. in length), and more elongated, with costæ generally delicately prolonged as far as the median line.

Same stations.

**var. salina.** (*S. salina W. Sm.*; H.V.H. Atl., pl. 73, f. 15\*; Type No. 431), **plate 13, fig. 589.**

Valves oval elliptic; costæ 5 or 6 in 1 c.d.m.

Brackish water.—Antwerp, in the Scheldt. England (W. Sm.).

**var. angusta.** (*S. angusta Kütz.*; H.V.H. Atl., pl. 73, f. 12\*; in Type No. 430), **plate 13, fig. 590.**

Valve very narrowly oval, linear, or sometimes panduriform, with rounded apices. Length, 3 to 5 c.d.m.

Fresh water.—Koekelberg (Del.), Ard. Lieg. (De Wild.)

**var. pinnata.** (*S. Pinnata W. Sm.*; H.V.H. Atl., pl. 73, f. 13\*; Type No. 429), **plate 13, fig. 591.**

Valve linear, narrow, with apices cuneate. Mean length, 4 to 5 c.d.m.

Fresh water.—Laeken (Del.), England (W. Sm., Arnott in Baxter Coll., 2793).

All these forms, which are connected with one another, cannot be specifically separated.

II. Valves twisted, raphes of the two valves parallel.

**S. spiralis** Kütz. (Bac., pl. 3, f. 64; *Campylodiscus spiralis* IV. Sm.; S.B.D., i., p. 29, pl. 7, f. 54; *S. flexuosa* Ehr., Amer., 1843, p. 136, pl. J. 3, f. 1-20; *S. torta* Bréb.; H.V.H. Atl., pl. 74, f. 4-7\*; Type No. 434), plate 13, fig. 592.

Valve elliptic lanceolate, twisted round the longitudinal axis; costæ robust, 2 to 3 in 1 c.d.m., reaching close to the median line; striæ fine, but well marked, about 26 to 28 in 1 c.d.m.; here and there throughout the length of the costæ some coarse scattered puncta. Frustule twisted into a figure of 8, with connecting zone rather broad, showing the alæ distinctly, with raphes parallel and superposed on the two valves. Length, 10 to 13 c.d.m.

Fresh water.—Rather rare: Dieghem (Del.), Antwerp. England (W. Sm., Kitton in Baxter Coll., 3597), Ireland (O'Meara), France (Bréb.), etc.

By the side of *Surirella* are placed the two following genera, which have not been generally adopted.

**Stenopterobia** De Bréb. in litteris. Frustules very elongated and very narrow, sometimes sigmoid.

In this are comprised the *Surirella Baileyi* Lew., *S. intermedia* Lew., *S. delicatissima* Lew., and *S. anceps* Lew., which appears to be a *Synedra* furnished with coarse marginal sparse puncta.

These four forms are American, and are figured by Lewis in "*On some new and singular intermediate forms of Diatomaceæ.*"

The *S. anceps* Bréb. is found in Type No. 291, which is said to have come from Cornouailles.

**Plagiodiscus** Grun. and Eul., 1868. Valves reniform with radiant costæ, includes two forms, *Plagiodiscus nervatus* Grun., and *Pl. Martensianus* Grun. These are abnormal forms of a *Surirella*, closely allied to, if not identical with, *S. Gemma*.

## GENUS 79.—CAMPYLODISCUS EHR., 1841.

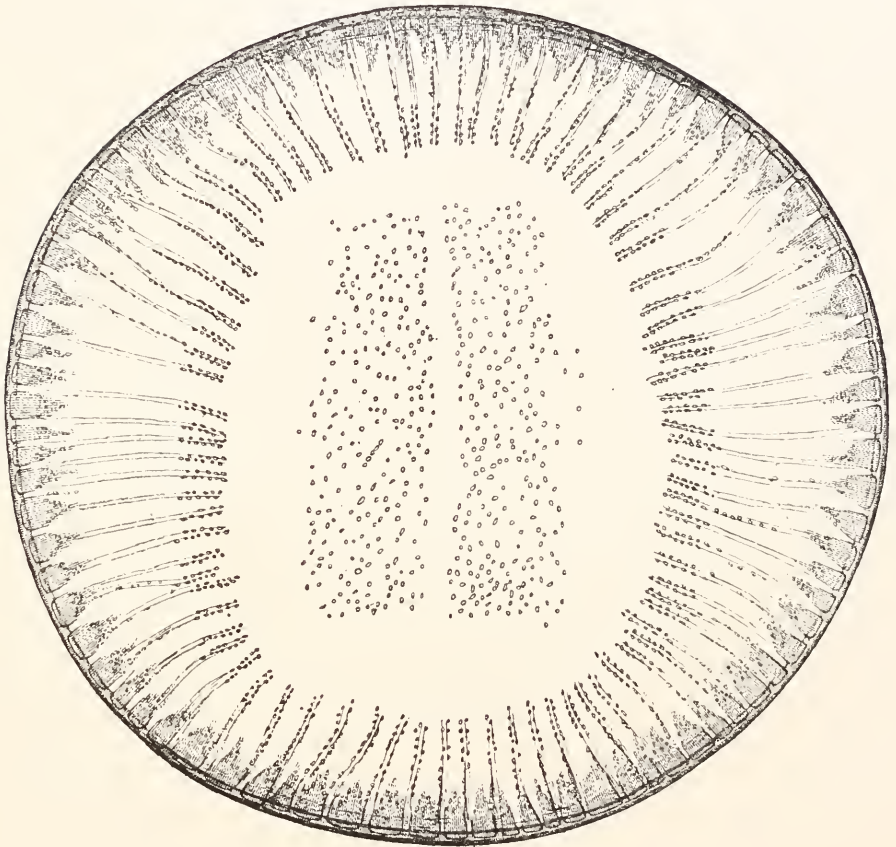
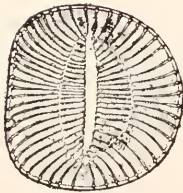
Fig. 121.—*Campylodiscus Clypeus*.

Fig. 122.

*Campylodiscus parvulus*.

Valves circular, furnished with costæ, usually short. Frustules saddle-shaped, with the median lines of the two valves thrown across one another at right angles.

The valve is perfectly circular, but it appears to be irregularly circular in consequence of its curvature. Endochrome as in the *Suirella*.

This genus was in great confusion, but Mr. J. Deby has set it in order by the publication of his Prelude to a Monograph, under the title of "An

Analysis of the Diatomaceous Genus *Campylodiscus*," London, 1891. Mr. Deby admits 92 species into the genus, and divides them into 5 sections, as follows:—(i.), The *Raphidæ*; (ii.), the *Vagæ*; (iii.), the *Hyalinæ*; (iv.), the *Striatæ*; and (v.), the *Punctatæ*. We shall adopt Mr. Deby's sections and analysis.

SECTION I. *Raphidæ*.—Valves furnished with a narrow hyaline space, or longitudinal line (*Raphe*).

{	Area limited internally by a distinct line, being the termination of the costæ ; discs without a trapezoidal inscribed line	. . . . .	. C. <b>Hodgsonii</b> .	
		{	Raphe reduced to a mathematical line . . . . .	. C. <b>Ralfsii</b> .
{	Area not limited by a distinct line	{	Raphe enlarged, distinct. . . . .	. C. <b>decorus</b> .

**C. Hodgsonii W. Sm.** (S.B.D., i., p. 29, pl. 6, f. 53\* ; Deby, pl. 1, f. 7) **plate 32, fig. 868.**

Valve appearing irregularly circular, furnished with a crown of radiant costæ, short, confluent on the interior side in a circular line ; costæ 3 or 3·5 in 1 c.d.m. Median hyaline space, narrow, lanceolate, bordered on each side by transverse rows of coarse beads. Diameter, about 18 c.d.m.

Marine.—England (Hodgson, Norman, W. Sm.), Ireland (O'Meara), France (Brebisson).

**C. Ralfsii W. Sm.** (S.B.D., i., p. 30, pl. 30, f. 257 ; Deby, pl. 2, f. 18\*) **plate 32, fig. 869.**

Valve small, almost regularly circular, showing narrow costæ extending up to the raphe, which appears in the form of a mathematical line. Costæ on the margin of the valve, 4 in 1 c.d.m. Diameter, 4 to 4·8 c.d.m.

Marine.—England (W. Sm., Kitton), Ireland (O'Meara), Coasts of France (Brebisson), Bahnsie (Lagerstedt).

**C. decorus Breb.** (Diat. Cherb., f. 2 ; H.V.H. Atl., pl. 75, f. 3\*), **plate 14, fig. 596.**

Differs from *C. Ralfsii* by the rather broad median area and by its size, which is larger.

Marine.—Escant (H.V.H.), England, (Norman),

**forma minima ?** (H.V.H. Atl., pl. 77, f. 2\*), **plate 14, fig. 597.**

Under the name of *C. parvulus*. Antwerp (Scheldt).

SECTION II. *Vagæ*.—Area vaguely limited in consequence of the absence of the rays.

- { Valves with very small puncta, forming short lines, interrupted by a hyaline circle . . . . . **E. Echeneis.**
- { Valves with very coarse puncta, forming continued radial lines . . . . . **E. Clypeus.**

**C. Echeneis Ehr.** (*Coronia Echeneis Ehr.*, Ber., 1841 ; *C. cribrus* W. Sm., Deby, pl. 9, f. 50 ; H.V.H. Atl., pl. 76, f. 1 and 2\* ; Type No. 437), **plate 14, fig. 600.**

Valve appearing irregularly circular, with costæ scarcely noticeable at margin, replaced over the remainder of their length by rows of elongated coarse beads, very variable in number. Pseudo-raphæ in the form of a blank space of greater or less breadth. Diameter, 8 to 14 c.d.m.

Fresh and brackish water.—Washings of mussels (Deby), Antwerp (Scheldt), Blankenberghe (H.V.H.). Very rare. France. Bahnsie. England (Brightwell, W. Sm., Comber, Stolt., Norm.), Ireland (O'Meara).

**C. Clypeus Ehr.** (Mikr. pl. 10, f. I. 1 ; Deby pl. 9, f. 49 ; H.V.H. Atl., pl. 75, f. 1\*, Type 435), **plate 14, fig. 598.**

Valve very large, regularly circular, with costæ (1.5 in 1 c.d.m.) occupying only about the moiety of the ray, interrupted on the two sides by a very broad sulcus (inflexion of the valve). Central portion of the valve occupied by coarse puncta arranged irregularly, interrupted by a rather broad pseudo raphæ and circumscribed by a second broad depression of the valve. Inter-costal striæ, 21 in 1 c.d.m., formed of elongated puncta, and accompanied by coarse puncta arranged throughout the entire length of the costæ. Diameter, about 20 c.d.m.

Brackish water.—Ostend (Grunow), Heyst (Deby), Antwerp (Scheldt), Blankenberghe (H.V.H.), England (Wigham, Okeden), frequent. Cuxhaven, Bremershaven.

SECTION III. *Hyalinæ*.—Valve with a large, smooth, hyaline central area, without any puncta.

- { Rays infundibuliform. { Hyaline area limited by a circle of puncta, narrow portion (stem) of rays often longer than the broader portion (funnel) . . . . . **C. Horologium.**
- { Rays not infundibuliform ; hyaline area elliptic, with acute apices ; rays not originating in a single very coarse bead . . . . . **C. angularis.**
- { Hyaline area not limited by a circle of puncta, intercostal spaces smooth . . . . . **C. latus.**

**C. Horologium Williams** (in Ann. and Mag. of Nat. Hist., 1848, Deby, plate 6, f. 29a\*), **plate 32, fig. 870.**

Valve large, orbicular, with external margin broad, traversed by numerous fine costæ, shortened: costæ infundibuliform, narrow portion (stem) of funnel often (not always) shorter than the broader portion, the latter showing rows of fine beads. Median area smooth, limited by a row of fine short lines, and by the confluent apices of the costæ. Diameter, 12 to 16 c.d.m.

Marine.—Coasts of England and Scotland; in Loch Fine (Greg.!).

**C. latus Shadb.** (in T.M.S., 1854, ii., p. 16, pl. 1, f. 13; Deby, pl. 3, f. 306\*), **plate 32, fig. 871.**

Differs from the preceding by its smaller size, by the broader portion of the funnel being much longer than the narrow portion, and by the absence of an internal circle of puncta and of confluent apices of the costæ. Diameter, 5 to 7 c.d.m.

Marine.—Coasts of Scotland (Greville).

**C. angularis Greg.** (Diat. of Clyde, p. 39, pl. 3, f. 53; Ad. Schm. Atl., pl. 18, f. 7\*; Deby Campyl., pl. 3, f. 22), **plate 35, fig. 909.**

Valve orbicular, of medium size; costæ not infundibuliform, very broad at the margin, gently diminishing, apparently genuflexed (and appearing to alternate with some shorter costæ), radiant, about 5 in 1 c.d.m., leaving in the middle of the valve an oval, broad, acuminate area. Diameter of valve, 5 to 9 c.d.m.

Marine.—Coasts of Scotland (Gregory). Bahusie (Lagerst.).

#### SECTION IV. *Striatæ*.—Median area bearing distinct striæ.

- |   |  |                       |
|---|--|-----------------------|
| { | Valve appearing more or less cordate, with median area smooth, limited by short lines; rays funnel-shaped, with the widened portion very broad | <b>C. Thuretii.</b>   |
|   | Valve appearing almost round, with median portion sub-quadrangular, showing a second row of costæ, separated from the first by a sulcus        | <b>C. bicostatus.</b> |

**C. Thuretii Bréb.** (Diat. Cherb., pl. 1, f. 3; H.V.H., pl. 77, f. 1\*; Types Nos. 438 and 439), **plate 14, fig. 595.**

Valve appearing irregularly circular or broadly ovoid, with coarse robust costæ, 2 to 3 in 1 c.d.m., becoming abruptly narrower near the central portion of the valve, which is covered with delicate transverse striæ, about 10 in 1 c.d.m., interrupted by the pseudo-raphe on each side, at a short distance from the latter, by a sulcus parallel to it. General appearance of the valve smaller to that of *Surirella fastuosa*. Diameter, about 5 c.d.m.

Marine.—Rare. Blankenberghe. Washings of mussels (Deby), Coasts of England (W. Sm., Gregory), France (Bréb. Thuret.), Bahusie (Lagerstedt).

**C. bicostatus** W. Sm. (S.B.D., ii., p. 88; Deby, pl. 7, f. 38a; H.V.H. Atl., pl. 75, f. 2\*), plate 14, fig. 599.

Valve appearing almost round, with narrow costæ, the intervals of which are punctate; median area subquadrangular with rounded angles, showing a second row of costæ separated from the first by a smooth space. Diameter 3.5 to 5.5 c.d.m.

Marine.—Blankenberghe, Antwerp (Scheldt, H.V.H.), England (Roper, Kitton, Norman, etc.), Ireland (O'Meara), France (Bréb.).

In spite of the opinion of our late friend Mr. Deby, we think that the figure in our Atlas represents faithfully the *C. bicostatus* of W. Sm. when viewed with an objective of superior quality. The figure was drawn from examples from our Type No. 436 (coming from Africa). Our gatherings from the Scheldt are intermediate in form between Professor Smith's figure and our own.

SECTION V. *Punctatæ*.—Median area punctate or punctato-striate.

{	Valves without intercostal apiculi.	{	Rays from 40 to 60 in number . . . . .	<b>C. Hibernicus.</b>
			Rays from 90 to 100 in number . . . . .	<b>C. Noricus.</b>
{	Valves with intercostal apiculi.	{	Median area angular at its two apices and strongly punctate; rays very numerous, commencing with a bead . . . . .	<b>C. eximius.</b>
			Median area elliptic, with rounded apices, provided with fine puncta near the costæ; rays contiguous	<b>C. limbatus.</b>

**C. Hibernicus** Ehr. (Mik., pl. 15A, f. 9; *C. costatus* W. Sm.; H.V.H. Atl., pl. 77, f. 3\*; Type No. 440), plate 14, fig. 593.

Valve appearing irregularly circular, furnished with costæ (1.5 to 2 in 1 c.d.m.), very robust at the margin but becoming gradually thinner near the central portion of the valve, where they leave a subquadrangular punctate space; striæ fine, intercostal, accompanied by coarse dots, scattered throughout the length of the costæ. Frustule very curved; connecting zone rather broad, bordered with coarse areolæ, produced by the commencement of the costæ. Diameter, about 10 c.d.m.

Fresh water.—Rather rare and not abundant; Louvain (P. Gaut.); Antwerp; England (W. Sm.); Ireland (O'Meara).

**var. Noricus.** (*C. Noricus* Ehr.; H.V.H. Atl., pl. 77, f. 4-6\*; Type No. 441), plate 14, fig. 594.

Costæ more approximate (2 to 3 in 1 c.d.m.) than the type-form.

Fresh water.—Rare. Rouge-Cloître (Delogne). England (W. Sm.).

**C. eximius** Greg. (Diat. of Clyde, p. 31, pl. 3, f. 54; Deby., pl. 10, f. 61\*), plate 32, fig. 872.

Valve suborbicular, with margin showing narrow costæ, approximate, commencing with a bead and about 160 in number in a valve (about 5 in 1 c.d.m); median area covered with a delicate network and showing a narrow pseudo-raphé. Diameter, 7 to 12 c.d.m.

Marine.—Scotland (Gregory); France!

**C. limbatus Bréb.** (Diat. Cherb., p. 12, f. 1; Deby., pl. 10, f. 62\*; plate 32, fig. 873.

Valve orbicular, with a circlet of costæ, very short, approximate, of almost equal thickness throughout their length, 3 in 1 c.d.m., and showing in each interval two rows of fine puncta; median area almost smooth at the central portion, with margin showing 3 or 4 rows of fine puncta, concentric.

Marine.—Coasts of Scotland and of France, and probably in other portions of the North Sea.

#### COHORT IV.—NITZSCHIINEÆ.

##### TRIBE XVII.—NITZSCHIEÆ.

{	Frustules free.	{	Keel diagonally opposite in the two valves	. Nitzschia.
		{	Keel of the two valves placed on the same side of the frustule	. Hantzschia.
{	Frustules enclosed in mucous sheaths			. Homœocladia.

#### GENUS 80.—HANTZSCHIA GRUNOW, 1877.

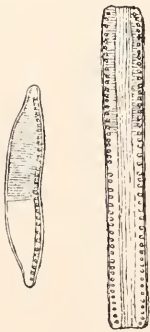


Fig. 123.

*Hantzschia amphioxys.*

Valves arcuate, with rostrate apices, furnished with a keel having short dots, prolonged into short costæ, or traversing the entire valve; between the two median dots is found the rudiments of a nodule. Girdle face showing keels placed on the same side of the frustule.



## ANALYSIS OF SPECIES.

{	Carinal dots prolonged into costæ, which traverse the entire valve		. <b>H. marina.</b>	
		{	Carinal dots slightly prolonged	. <b>H. virgata.</b>
			Carinal dots not prolonged	. <b>H. amphioxys.</b>

**H. amphioxys (Ehr.) Grun.** (Arct. Diat., p. 103; *Nitzschia amphioxys*, *W. Sm.*, S.B.D., i., p. 41, pl. 13, f. 105; H.V.H. Atl., pl. 56, f. 1 and 2\*; Type No. 367), plate 15, fig. 483*b*.

Valves feebly arcuate, with apices more or less prolonged. Keel with coarse short dots, about 7 in 1 c.d.m., the two median distant. Striæ about 16 in 1 c.d.m. Length (very variable), about 4·5 or 7·5 c.d.m.

Fresh and brackish water—Frequent. England (Kitton, *W. Sm.*, Norman). Ireland (O'Meara).

**var. major.** (H.V.H. Atl., pl. 56, f. 3 and 11\*), plate 15, fig. 484*b*.

Much larger, about 12 c.d.m., with 5 to 6 carinal dots, and about 11 striæ in 1 c.d.m.

**var. intermedia.** (H.V.H. Atl., pl. 56, f. 4\*), plate 15, fig. 485*b*.

Mean length, about 8 c.d.m., with 4 carinal dots, and about 11 striæ in 1 c.d.m.

**var. vivax.** (*Nitzschia vivax Hantzsch non W. Sm.*; H.V.H. Atl., pl. 56, f. 5 and 6\*; Type No. 368), plate 15, fig. 486*b*.

Valve slender, longly rostrate; about 5 carinal dots and 13 striæ in 1 c.d.m. Length, 10 c.d.m.

Brackish water.—England (Kitton).

**var. elongata.** (H.V.H. Atl., pl. 56, f. 7 and 8\*), plate 15, fig. 487*b*.

Length, up to 22 c.d.m.; strongly rostrate and genuflexed; 7 or 8 carinal dots, and 17 striæ in 1 c.d.m.

**H. virgata (Roper) Grun.!** (Arct. D., p. 104; H.V.H. Atl., pl. 56, f. 12 and 13\*; Type No. 370), plate 15, fig. 488*b*.

Valve robust, arcuate, with apices strongly rostrate, rostrum obtuse; Keel with 4 or 5 dots in 1 c.d.m., dots prolonged into short costæ on the valve. Striæ, 9 to 11 in 1 c.d.m. Length, about 13 c.d.m.

Marine.—Blankenberghe (H.V.H.), washings of mussels (Deby.), France (Breb.), England (Roper, Kitton, Comber, Stolt, Norman), Ireland (O'Meara).

**H. marina (Donkin) Grun!** (Arct. D., p. 105. *Epithemia marina* Donkin; H.V.H. Atl., pl. 56, f. 14 and 15\*; Type No. 369), plate 15, fig. 489b.

Valve arcuate, with rostrate apices. Keel with 6 dots in 1 c.d.m., prolonged into delicate costæ, which traverse the entire valve, and between each of which are found two rows of fine alternating puncta. Girdle face linear, showing two keels inflected towards the connecting zone. Length, about 6 to 10 c.d.m.

Marine.—Ostend, Blankenberghe (H.V.H), England (Donkin, Comber, Kitton), France (Bréb), Ireland (O'Meara).

**GENUS 81.—NITZSCHIA (HASSALL, 1845; W. SMITH)  
GRUNOW Ch. em., 1880.**

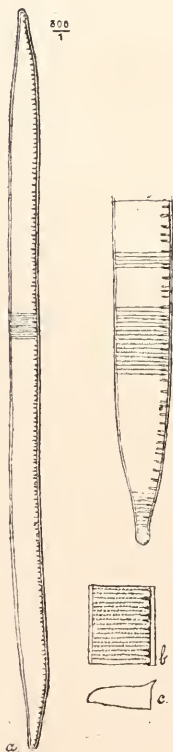


Fig. 124.

*Nitzschia spectabilis*.

Valves furnished with a keel, with carinal dots either short, or prolonged into short costæ, rarely traversing the entire valve. Keels of the two valves diagonally opposite. Frustules free, rarely enclosed in tubes or united into a stratum.

Endochrome consisting of a single lamina, interrupted partially or entirely at the median portion of the frustule.

In the classification of this genus I shall follow the excellent monograph published by Mr. Grunow in the *Arctische Diatomeen*, and I have also borrowed from him a few of his descriptions.

Table of Groups.

Valve not longly rostrate. Striæ not in quincunx. Valve not undulated. Frustules not sigmoid. Valves not arcuate. Keel without parallel lines. Girdle face not constricted in the median portion. Carinal dots not prolonged. No longitudinal sulcus. Keel not completely eccentric.	Striæ in quincunx; valve broad, constricted at the median portion . . . . .	Valve showing undulations or hollows.	Valve linear, longly lanceolate or longly elliptic; striæ very distinct . . . . .	Valve very broadly lanceolate; transverse striæ very fine and indistinct . . . . .	Valves showing costæ more or less dimidiate or carinal dots prolonged into delicate costæ.	Costæ dimidiate, robust . . . . .	Frustules straight . . . . .	Frustules spatulate or somewhat sigmoid . . . . .	Frustules more or less sigmoid.	Keel straight, not inflected at the median portion.	Keel almost central; girdle face with apices not attenuate . . . . .	Keel eccentric; girdle face with apices very slightly attenuate . . . . .	Keel eccentric, inflected at the median portion . . . . .	Valves arcuate . . . . .	Keel accompanied by two longitudinal parallel lines . . . . .	Girdle face constricted in the middle.	Keel eccentric; girdle face not broad . . . . .	Keel slightly eccentric; girdle face very broad . . . . .	Carinal dots somewhat prolonged . . . . .	Valves showing a longitudinal sulcus in which the striæ are absent or feebly marked . . . . .	Keel quite eccentric . . . . .	Keel almost central; striæ very distinct; frustules united into a stratum . . . . .	Keel somewhat eccentric; frustules not united into strata.	Valves linear, large; striæ distinct . . . . .	Valves lanceolate, very small; striæ indistinct . . . . .	2.* <b>Panduriformes.</b> 1. <b>Tryblionella.</b> 5. <b>Circumsutæ.</b> 9. <b>Grunowia.</b> 10. <b>Scalares.</b> 11. <b>Insignes.</b> 16. <b>Sigmoideæ.</b> 17. <b>Sigmata.</b> 18. <b>Obtusæ.</b> 19. <b>Spectabiles.</b> 14. <b>Spathulatæ.</b> 6. <b>Dubiæ.</b> 7. <b>Bilobatæ.</b> 13. <b>Vivaces.</b> 3. <b>Apiculatæ.</b> 21. <b>Lanceolatæ.</b> 12. <b>Bacillaria.</b> 20. <b>Lineares.</b> 15. <b>Dissipatæ.</b> 22. <b>Nitzschiella.</b>
	Valve very longly rostrate and with a very eccentric keel . . . . .																									

\* The figures correspond with those of the groups in H.V.H. Atlas; the missing numbers (4. Pseudo-Tryblionella and 8. Epithemioideæ) are those of groups which are not represented in Belgium or England.

## Group 1.—TRYBLIONELLA (W. SMITH PARTIM) GRUNOW.

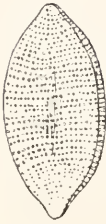


Fig. 125.

*Nitzschia punctata*  
(*Tryblionella*).

Keel very eccentric, with dots almost always indistinct, generally equal in number to those of the striae. Valves generally sulcate, undulate.

I unite with this group, group 4 (*Pseudo-Tryblionella*), which is only distinguished from it because the carinal dots are well marked.

## ANALYSIS OF SPECIES

{	Valves not with coarse puncta.	{	Striæ not as above.	{	Valve showing striæ formed of coarse puncta . . . . .	<b>N. punctata.</b>
					Valves with striæ very fine at the centre of the valve; striæ terminating at the margins in a double row of puncta .	<b>N. navicularis.</b>
					Striæ traversing the entire linear valve . . . . .	<b>N. angustata.</b>
					Valve showing a median sulcus. {	Valves with robust striæ; sulcus not hyaline . . . . .
					Valve very small; striæ very delicate; sulcus hyaline . . . . .	<b>N. debilis.</b>

**N. navicularis (Bréb.) Grun.!** (Arct. Diat., p. 67; H.V.H. Atl., pl. 57, f. 1<sup>\*</sup>; Type No. 371), plate 15, fig. 490.

Valves elliptic-lanceolate, with striæ (7 in 1 c.d.m.), fine at the central portion of the valve, terminating towards the margins on each side in a double row of puncta. Length, about 3.5 c.d.m.

Marine.—Ostend (Deby.); Scheldt at Antwerp (H.V.H.); England (Norm., W. Sm., Comber, Dickie); France (Bréb.).

**N. punctata (Sm.) Grun.!** (Arct. Diat., p. 68; H.V.H. Atl., pl. 57, f. 2<sup>\*</sup>; Type No. 372), plate 15, fig. 491.

Valve elliptic-lanceolate, with apices somewhat rostrate; striæ 7 to 9 in 1 c.d.m., formed of coarse puncta. Length of valve, 2.5 to 3.5 c.d.m. Breadth, 1 to 3 c.d.m.

Brackish water.—Ostend (Deby); Antwerp; England (W. Sm., Stolt., Comber); France; Holland; Denmark.

**var. elongata** Grun. (H.V.H. Atl., pl. 57, f. 3\*), **plate 15, fig. 492.**

Valves linear, with cuneate apices; striæ 5 or 6 in 1 c.d.m. Length of valves, 6 to 11 c.d.m. Breadth, 2 to 2.5 c.d.m.

Marine.—Mixed with the type-form.—Ostend (Deby.).

**N. Tryblionella Hantzsch** (*Tryblionella Hantzschiana* Grun.: H.V.H. Atl., pl. 57, f. 9, 10 and 15\*; Type No. 375), **plate 15, fig. 493.**

Valve elliptic-lanceolate, with subacute apices, showing a broad conspicuous sulcus; striæ robust, 5 to 7 in 1 c.d.m., between which appear striæ, fine, delicately punctate. Length, 8 to 11 c.d.m. Breadth, 2 to 3 c.d.m.

Fresh and brackish water.—Not yet found in Belgium. England (Stolt.). Ireland (O'Meara).

**var. Levidensis.** (*T. Levidensis* W. Sm.; H.V.H. Atl., pl. 57, f. 15; Type No. 375), **plate 15, fig. 494.**

Valves linear-lanceolate, with cuneate apices, median portion sometimes somewhat attenuate; transverse striæ robust, 7 to 11 in 1 c.d.m. Length, 2 to 5 c.d.m. Breadth, 1 to 1.5 c.d.m.

Brackish water.—Antwerp; sometimes fresh water.—Brussels Botanical Gardens (Delogne); England; Ireland (O'Meara).

**var. calida.** (*N. calida* Grun. Arct. Di., p. 75; H.V.H. Atl., pl. 59, f. 4 and 5\*) **plate 15, fig. 495.**

Valve linear, constricted at the median portion, with apices somewhat rostrate; sulcus scarcely visible; striæ 17 to 19 in 1 c.d.m. Keel with points rather distinct. Length, 3.5 to 4.5 c.d.m.

Fresh water (warm).—Brussels Botanical Gardens (Delogne).

**var. littoralis** Grun. (*N. littoralis* Grun.; H.V.H. Atl., pl. 59, f. 1-3\*; in Type No. 190), **plate 15, fig. 496.**

Distinguished from the type-form by the well marked carinal dots, and by the compact striation of the valve.

Fresh or brackish water.—Antwerp (Park lake).

**N. debilis (Arnott) Grun. !** (Arct. Diat., p. 68; H.V.H. Atl., pl. 57, f. 19-21\*; in Type No. 146), **plate 15, fig. 497.**

Valve lanceolate elliptic, with subrostrate apices; striæ very feeble, 12 to 14 in 1 c.d.m., interrupted in the middle of the valve. Length, 2 to 2.5 c.d.m. Breadth, about 1 c.d.m.

Fresh water.—Frahan, Groenendael (Del.), Maryhill Bridge, near Glasgow, Scotland (W. Arn., No. 847!).

**N. angustata (W. Sm.) Grun.** (Arct. Diat., p. 70; H.V.H. Atl., pl. 57, f. 22-24\*; in Type No. 475) **plate 15, fig. 498.**

Valve narrowly linear, with apices produced; striæ robust, not interrupted, 13 in 1 c.d.m. Length, about 8 to 9 c.d.m.; breadth, about 1 c.d.m.

Fresh and brackish water.—Antwerp. England (W. Sm.). Scotland (Baxter Coll., Nos. 2733, 2837). Ireland (O'Meara).

**var. curta.** (H.V.H. Atl., pl. 57, f. 25\*; Type No. 376), **plate 15, fig. 499.**

Valves much shorter, with apices somewhat rostrate.

Fresh water.—Brussels (D'elogne). England, France, Denmark, Sweden.

### *Group 2.*—PANDURIFORMES.

Valves broad, constricted at the median portion, showing a more or less pronounced sulcus. Keel approximate to one of the margins, with dots either very distinct or apparently absent. Striæ decussate.

#### ANALYSIS OF SPECIES.

{ Sulcus very deep, carinal dots very distinct . . . . .	<b>N. panduriformis.</b>
{ Sulcus indistinct, carinal dots not distinct . . . . .	<b>N. constricta.</b>

**N. panduriformis Grun. !** (Diat. Clyde, pl. 6, f. 102; H.V.H. Atl., pl. 58, f. 1-4\*; Type No. 377 forma), **plate 15, fig. 500.**

Valve broadly elliptic, with apices subrostrate, cuneate; sulcus strongly marked, and bordered with a hyaline line or irregularly punctate; striæ decussate, 14 to 19 in 1 c.d.m. Carinal dots well marked, about 6 in 1 c.d.m. Length, 8 to 12 c.d.m. Breadth, about 2 c.d.m. at the median constriction

Marine.—Not yet found in Belgium. England (Greg., Stolt.), Bahnsie (Lagers).

**N. constricta (Greg.) Grun. !** Arct. Diat., p. 71; H.V.H. Atl., pl. 58, f. 8\*), **plate 15, fig. 501.**

Differs from the preceding species by its coarser puncta, its more pronounced sulcus, and by the dots of the keel which are not distinct. Length, about 5 c.d.m.

Marine.—Scheldt. England.

**forma parva.** (H.V.H. Atl., pl. 58, f. 8\*), **plate 15, fig. 502.**

Very small, only attaining a length of about 1.5 c.d.m. Striæ, 16 or 17 in 1 c.d.m.

## Group. 3.—APICULATE.

Valves longly linear or somewhat attenuate at the median portion, showing a sulcus on which the striæ are absent, or are less marked than on the remainder of the valve. Keel very approximate to one of the margins.

## ANALYSIS OF SPECIES.

Keel with very distinct dots.	Valve very large; sulcus broad . . . . .	<b>N. plana.</b>
	Valve narrowly linear; sulcus narrow . . . . .	<b>N. Hungarica.</b>
Keel with indistinct or no dots	Sulcus very broad; valve of medium size, robust . . . . .	<b>N. acuminata.</b>
	Sulcus very narrow; valve small, very narrow . . . . .	<b>N. apiculata.</b>

**N. plana**, W. Sm. (S.B.D., i., p. 42, pl. 15, f. 114; H.V.H. Atl., pl. 58, f. 10, 11\*; Type No. 378), **plate 15, fig. 503.**

Valve longly linear, attenuate at the median portion, with cuneate apices, broad well-marked sulcus, generally attenuate at the median portion, somewhat more distant from the carinal margin than the other margin; striæ fine, about 18 in 1 c.d.m., constantly replaced in the sulcus by very irregular puncta. Carinal dots very distinct, square or elongated, 3.5 to 6 in 1 c.d.m. Length, attaining to 17 c.d.m.

Brackish water.—Not yet found in Belgium. England (W. Sm. ! Comber, Norman, Stolt.). Ireland (O'Meara).

**N. Hungarica** Grun. ! (Arct. Diat., p. 73; H.V.H. Atl., pl. 58, f. 19-22\*; Type No. 380), **plate 15, fig. 504.**

Valve narrowly linear; generally feebly constricted in the middle; apices cuneate, rostrate; sulcus narrow, very distinct; striæ fine, 16 to 18 in 1 c.d.m., very delicate in the sulcus; carinal dots very distinct, 9 or 10 in 1 c.d.m. Length, 5 to 11 c.d.m.

Brackish, sometimes fresh water.—Antwerp, Schaerbeeck (Delogne). Ireland (O'Meara). England (H.V.H. Types, Nos. 7, 174, 186, 234, 389, 431, 471).

**N. apiculata** (Greg.), Grun. ! (Arct. Diat., p. 73; H.V.H. Atl., pl. 58, f. 26 and 27\*; in Types Nos. 7, 12, 44, etc.), **plate 15, fig. 505.**

Differs from the preceding species by its valves being generally smaller and narrower, and by the carinal dots being absent or indistinct. Striæ about 16 or 17 in 1 c.d.m. Length, 2.5 to 5 c.d.m. Breadth of valves, less than 1 c.d.m.

Brackish water.—Antwerp. England. Scotland. Finmark. Ireland (O'Meara).

**N. acuminata** (W. Sm.) Grun. ! (Arct. Diat., p. 73; H.V.H. Atl., pl. 58, f. 16 and 17\* ; Type No. 379), **plate 15, fig. 506.**

Valve broadly linear, sometimes constricted in the median portion, with a very broad and conspicuous sulcus. Striæ very strong, about 12·5 to 13 in 1 c.d.m., very feeble or absent in the sulcus. Keel without dots. Length, 7 to 8·5 c.d.m.

Brackish water,—Not yet found in Belgium. England (W. Sm.). Ireland (O'Meara, W.Sm.).

*Group 5.—CIRCUMSUTÆ.*

Valves with sulcus more or less narrow, sometimes invisible, keel very eccentric, with conspicuous dots. Valves finely striate and showing in addition some irregular puncta. These two kinds of puncta belong to different layers of the valve.

ANALYSIS OF SPECIES.

Valve elliptic, very large; striæ fine, undulated; carinal dots very coarse, quadrangular . . . . . **N. circumсутa.**

**N. circumсутa** (Bailey) Grun. ! (*Surirella circumсутa* Bailey; H.V.H. Atl., pl. 59, f. 8\* ; Type No. 381), **plate 15, fig. 507.**

Valve elliptic, very large, with sub-acute apices; striæ very fine, undulated, about 26 in 1 c.d.m. Carinal dots very coarse, quadrangular, 3 to 5 in 1 c.d.m.; the median somewhat distant and showing between them a vestige of a nodule. Length, up to 21 c.d.m.; breadth, up to 6·5 c.d.m.

Brackish water.—Very rare: Antwerp (P. Gaut.) Maritime Scheldt. (H.V.H.). Flessingue (Holland) (H.V.H., Deby.). England (W. Sm.).

*Group 6.—DUBLE.*

Valves analogous to those of *Tryblionella* but without a sulcus. Keel eccentric. Girdle face attenuate at the median portion.

ANALYSIS OF SPECIES.

{	Carinal dots elongated on the valve; valve rather broad . . . . .	<b>N. dubia.</b>
	Carinal dots round; valve narrow. {	Striæ fine, valves small, distinctly rostrate . . . . . <b>N. commutata.</b>
	Striæ very fine, valve of medium size, sub-rostrate . . . . .	<b>N. thermalis.</b>



**N. dubia W. Sm.!** (S.B.D., i., p. 41, pl. 13, f. 112; H.V.H. Atl., pl. 59, f. 9-12\*; Type No. 382), **plate 15, fig. 508.**

Valves linear, somewhat constricted at the median portion, with subrostrate apices; striæ fine, 21 to 24 in 1 c.d.m.; keel with 9 or 10 dots in 1 c.d.m., slightly prolonged on the valve. Length, about 9 to 16 c.d.m.

Fresh water.—Antwerp. Schaerbeeck (Delogne). England (W. Sm.!).

**N. thermalis (Kütz.) Grun.!** (Arct. Diat., p. 78; H.V.H. Atl., pl. 59, f. 20; in Type No. 74 *var. littoralis*), **plate 15, fig. 509.**

Differs from the preceding species by its narrower valves and round carinal dots, the two median of which are somewhat distant. Striæ fine, about 28 in 1 c.d.m.; carinal dots about 7 or 8 in 1 c.d.m. Length, about 8 to 10 c.d.m.; breadth, about 1 c.d.m.

Fresh water.—Ard. Lieg. (De Wild.). Ireland (O'Meara).

**var. intermedia Grun.** (H.V.H. Atl., pl. 59, f. 15-19\*), **plate 15, fig. 510.**

Valves small (5 to 6 c.d.m.) and narrow (somewhat more than 1/5 c.d.m., with small carinal dots (9 in 1 c.d.m.)), the two median of which are slightly distant; striæ very fine, about 32 in 1 c.d.m.

Fresh water.—Ard. Lieg. (De Wild.).

**var. littoralis Grun.** (H.V.H. Atl., pl. 59, f. 21). England.

**N. commutata Grun.** (Arct. Diat., p. 79; H.V.H. Atl., pl. 59, f. 13 and 14\*), **plate 15, fig. 511.**

Valve longly linear, constricted at the median portion, with apices distinctly rostrate, rostrum obtuse. Carinal dots round, the two median distant. Striæ fine, 21 to 24 in 1 c.d.m. Carinal dots 9 or 10 in 1 c.d.m. Length, 5 to 7 c.d.m. Breadth, 1.25 to 1.75 c.d.m.

Brackish water.—Not yet found in Belgium. England (W. Sm.)

#### *Group 7.—BILOBATÆ.*

Differs from the preceding group by the more central position of the keel.

**N. bilobata W. Sm.** (S.B.D., i., p. 42, pl. 15, f. 113; H.V.H. Atl., pl. 60, f. 1\*), **plate 15, fig. 512.**

Valve linear, lanceolate, constricted at the median portion, with apices abruptly attenuate, rostrate, acute. Keel almost central, with carinal dots

transversely elongated. Striæ fine, about 17·5 to 19 in 1 c.d.m. Carinal dots about 6·5 to 7 in 1 c.d.m. Girdle face very broad, constricted at the median portion, with connecting zone finely plicate. Length, 8 to 15 c.d.m.

Marine.—Not yet found in Belgium, but found in England (W. Sm., Comber, Norman, Stolt.), Ireland (O'Meara), and throughout most of Europe.

**var. minor Grun.** (H.V.H. Atl., pl. 60, f. 2 and 3\*), **plate 15, fig. 513.**

Small (5 to 7 c.d.m. in length) with very fine striæ (23 to 27 in 1 c.d.m.

Marine.

### Group 9.—GRUNOWIA.

Keel very eccentric, with dots elongated into costæ, which generally occupy a moiety of the valve.

#### ANALYSIS OF SPECIES.

- |   |   |                      |
|---|---|----------------------|
| { | Valves narrowly lanceolate, with margins not sinuous; costæ diminishing very gently in breadth                            | <b>N. Denticula.</b> |
|   | Valve with margins sinuous or strongly inflated at the median portion; costæ stopping abruptly in the middle of the valve | <b>N. sinuata.</b>   |

**N. Denticula Grun.!** (Arct. Diat., p. 82; H.V.H. Atl., pl. 60, f. 10\*; Type No. 384), **plate 15, fig. 514.**

Valves narrowly lanceolate, with apices acute or subacute, not rostrate, furnished with costæ which most frequently traverse the entire valve, while diminishing very gently in breadth; striæ fine, 15 to 18 in 1 c.d.m., distinctly punctate; costæ 6 to 8 in 1 c.d.m. Length, 1·5 to 4·5 c.d.m.

Fresh water.—Throughout Europe.

**var. Delognei Grun.!** (H.V.H. Atl., pl. 60, f. 9\*), **plate 15, fig. 515.**

Costæ not reaching, at most, farther than to a moiety of the valve; striæ very delicate, 24 or 25 in 1 c.d.m. Length, 1 to 2 c.d.m.

Fresh water.—Brussels Botanical Gardens (Delogne).

**N. sinuata (W. Sm.) Grun.!** (Arct. Diat., p. 82; H.V.H. Atl., pl. 60, f. 11\*; Type No. 385), **plate 15, fig. 516.**

Valve lanceolate, with margins triundulate, median portion inflated, apices rostrate-capitate; costæ 5 or 6 in 1 c.d.m., only occupying a moiety of the

valve, and equally robust throughout their length; striæ about 18 in 1 c.d.m., distinctly punctate. Length, about 4 c.d.m.

Fresh water.—Frahan (Delogne); England, France, Germany, etc; Scotland (Greville, Henedy).

**var. Tabellaria Grun.!** (Arct. Diat., p. 82; H.V.H. Atl., pl. 60, f. 12 and 13\*; Type No. 386), **plate 15, fig. 517.**

Valve very inflated in the median portion, with apices longly diminuate rostrate; costæ 6.5 to 7.5 in 1 c.d.m.; striæ 21 or 22 in 1 c.d.m., delicately punctate.

Fresh water.—Brussels (Delogne).

#### *Group 10.*—SCALARES.

Distinguished from the preceding groups by the keel being more acute and less eccentric.

**N. scalaris W. Sm.** (S.B.D., i, p. 39, pl. 14, f. 115; H.V.H. Atl., pl. 60, f. 14-15\*; Type No. 387), **plate 32, fig. 874.**

Valve broadly linear, with conical apices, costæ of unequal length, 3 to 5 in 1 c.d.m.; transverse striæ narrowly punctate, 9 to 11 in 1 c.d.m. Frustule in transverse section quadrate or in form of an oblong square. Length, up to 48 c.d.m. Breadth of valves, 2 to 2.5 c.d.m.

Brackish water.—England (W. Sm., Norman, Stolt.), France (De Bréb.), Denmark (Heiberg).

#### *Group 11.*—INSIGNES.

Similar to the forms of the preceding group, but with a keel still more eccentric and frustules sometimes somewhat sigmoid.

**N. insignis Greg.** (T.M.S., 1857, v., p. 80, pl. 1, f. 46; H.V.H. Atl., pl. 61, figs. various\*), **plate 32, fig. 875.**

Valves linear, lanceolate, with apices subconical, produced, keel almost central, broad, straight or gently curved. Costæ rather long, 4 or 5 in 1 c.d.m. Striæ, 10 or 11 in 1 c.d.m., strongly punctate. Frustules straight, linear. Length, up to 40 c.d.m.

Marine.—Coasts of England (Norman), and Scotland (Gregory).

**var. Smithii.** (*N. spectabilis* W. Sm.; H.V.H. Atl., pl. 61, f. 4\*), **plate 32, fig. 876.**

Distinguished from the type-form by being slightly sigmoid; costæ short, 2 or 3 in 1 c.d.m. Striæ 13 or 14 in 1 c.d.m.

Brackish water.—England (Norman), France (De Bréb.).

## Group 12.—BACILLARIA.

Keel central or almost central, with dots not elongated. Frustules straight. Striation conspicuous.

## ANALYSIS OF SPECIES.

Keel almost central, frustules united in a stratum. . . . . **N. paradoxa.**

**N. paradoxa (Gmel.) Grun.!** (*Bacillaria paradoxa* Gmel.; H.V.H. Atl., pl. 61, f. 6\* ; Type No. 388), plate 15, fig. 518.

Valves narrowly lanceolate, with apices feebly rostrate. Keel almost central, with 6 to 8 coarse round dots in 1 c.d.m. Striæ 20·5 to 22·5 in 1 c.d.m. Frustules united in a stratum, displaced by a sliding movement of one frustule over another. Length, about 6 c.d.m.

Brackish water.—Blankenberghe, Ostend, Antwerp. England, Ireland, and almost everywhere. Sometimes found in water containing only a trace of salt. Canal at Louvain (P. Gaut.).

**var. major.** (H.V.H. Atl., pl. 61, f. 7\*), plate 16, fig. 519.

## Group 13.—VIVACLS.

Valves semi-lanceolate, with margins showing elongated carinal dots. Valves similar to those of *Hantzschia*, but not showing (like those of the species of that genus) a vestige of a central nodule.

## ANALYSIS OF SPECIES.

{	Valve semi-lanceolate, strongly arcuate, very small, with rostrate apices ; striæ very delicate . . . . .	<b>N. Petitiana.</b>
	Valve semi-lanceolate elliptic, large, with rostrate apices ; striæ rather robust . . . . .	<b>N. vivax.</b>

**N. vivax W. Sm.!** (S.B.D., i., p. 41, pl. 31, f. 267 ; H.V.H. Atl., pl. 62, f. 1-2\* ; in Type No. 389), plate 33, fig. 877.

Valve semi-lanceolate, elliptic, with ventral margin straight, dorsal margin arcuate, apices produced rostrate. Carinal dots somewhat elongated, 6 in 1 c.d.m. ; striæ 12 in 1 c.d.m., finely punctate. Frustules linear. Length, 10 to 16 c.d.m. Breadth of valves, 1·3 c.d.m.

Marine.—England (W. Sm., Comber, Norman), Ireland (O'Meara).

**N. Petitioniana** Grun. (H.V.H. Atl., pl. 62, f. 6\*), plate 16, fig. 520

Valve small, with ventral margin straight, dorsal margin very gently and regularly attenuate up to the apices, which are rostrate. Carinal dots 8 or 9 in 1 c.d.m., scarcely prolonged. Striæ delicate, about 27 to 30 in 1 c.d.m.

Brackish water.—Not yet found in Belgium.

Group 14.—SPATHULATÆ.

Analogous to *Bacillaria* from which it is differentiated by the very delicate striation of the valves and by two auxiliary lines parallel to the keel.

ANALYSIS OF SPECIES.

{	Keel not elevated	{	Girdle face showing the apices of the keel enlarged and elevated	. <b>N. spathulata.</b>		
			{	Valve with apices longly rostrate	. <b>N. cursoria.</b>	
				{	Valves with apices not rostrate. { Carinal dots, 1·5 to 3 in 1 c.d.m. ; apices somewhat produced	. <b>N. distans.</b>
					Carinal dots, 3·5 to 5 in 1 c.d.m. ; apices not produced	. <b>N. angularis.</b>

**N. angularis** W. Sm. ! (S.B.D., i., p. 40, pl. 13, f. 117 ; H.V.H. Atl., pl. 62, f. 11-14\*), plate 16, fig. 521.

Valve narrowly lanceolate, very gently attenuate up to the subobtuse apices. Valve with keel central, 3·5 to 5 marginal dots in 1 c.d.m. ; auxiliary lines clearly visible ; transverse striæ delicate, 31 or more in 1 c.d.m., formed of puncta which equally produce longitudinal and oblique striæ. Girdle face broadly linear, somewhat inflated at the median portion, with connecting zone plicate. Length, 6 to 20 c.d.m. ; breadth of valves, about 1 to 1·5 c.d.m.

Marine.—Washings of Mussels (Deby). England (W. Sm. ! Comber, Norman), Ireland (O'Meara), Scotland (Baxter Coll., No. 2765).

**var. affinis** Grun. (H.V.H. Atl., pl. 62, f. 16\*), plate 16, fig. 522.

Differs from the type-form by its smaller size (3 to 9 c.d.m. in length) and its more approximate carinal dots (6 to 9 in c.d.m.), and its still finer striæ.

**N. spathulata** Bréb. (in W. Sm., S.B.D., i., p. 40, pl. 31, f. 268 ; H.V.H. Atl., pl. 62, f. 7 and 8\* ; Type No. 390), plate 16, fig. 523.

Differs from the preceding species by the apices of the keel, which are much enlarged and elevated. Carinal dots 4 or 5 in 1 c.d.m. Striæ excessively delicate. Length, about 10 c.d.m.

Marine.—Blankenberghe, Antwerp (Seheldt H.V.H.), France (Bréb.), Denmark (Heib.!), England (Harrison, Norman), Ireland (O'Meara).

**var. hyalina** (H.V.H. Atl., pl. 62, f. 9\*), **plate 16, fig. 524.**

Very small (about 4 c.d.m.), about 7 or 8 carinal dots in 1 c.d.m.  
Same habitat.

**N. distans** Greg. (Diat. of Clyde, p. 58, pl. 6, f. 103; H.V.H. Atl., pl. 62, f. 10\*), **plate 33, fig. 878.**

Valve narrowly lanceolate, with apices somewhat produced, sub-rostrate; keel central with dots unequally distant, 1.5 to 3 in 1 c.d.m. Striæ excessively delicate and approximate. Girdle face linear, with sub-truncate apices, showing the keel somewhat alate. Length, up to 15 c.d.m.

Marine.—England (Stolt.), Glenshira sand, Scotland (Gregory), Bahnsie (Lagerstedt).

**N. cursoria** (Donk.) Grun. (Arct. Diat., p. 89; H.V.H. Atl., pl. 62, f. 19\*; *Bacillaria cursoria* Donk.,) **plate 33, fig. 879.**

Valve very narrowly lanceolate, with apices longly rostrate, keel central, narrow, with about 10 dots in 1 c.d.m., accompanied by two accessory lines, distant about .4 c.d.m. Striation very fine. Frustule linear, with truncate apices. Length, 7 to 8 c.d.m. Breadth of valve, .7 c.d.m.

Marine.—England (Donkin, Norman), France (Bréb.).

#### *Group 15.*—DISSIPATÆ.

Differs from the two preceding groups by the keel being less central and the absence of auxiliary lines. Valves very small and very delicately striated.

#### ANALYSIS OF SPECIES.

Keel not quite central. Valves very small and delicately striated

. **N. dissipata.**

**N. dissipata** (Kütz.) Grun. ! (Arct. Diat., p. 90; *N. minutissima* W. Sm. ?; H.V.H. Atl., pl. 63, f. 1\*; Type No. 391), **plate 16, fig. 525.**

Valve lanceolate, with apices very slightly rostrate. Keel slightly eccentric, with 6 to 8 dots in 1 c.d.m. Striæ excessively faint (about 14 in 1 c.d.m. according to Mr. Kitton). Length, 2 to 3.5 c.d.m.

Fresh and brackish water.—Antwerp (H.V.H.) Schaerbeeck (Delogne). Ard. Lieg. (De Wild.). Here and there in Europe.

**var. media.** (H.V.H. Atl., pl. 63, f. 2 and 3\*; Type No. 190), **plate 16, fig. 526.**

Valves larger, with apices sometimes subrostrate, capitate, keel somewhat more eccentric, with 6 or 7 dots in 1 c.d.m. Length, 4.5 to 7 c.d.m.

**var. acuta.** (H.V.H. Atl., pl. 63, f. 4\*), **plate 16, fig. 527.**

Valves longer, attaining to 10.5 c.d.m., with keel quite central, 6 or 7 dots in 1 c.d.m.

#### Group 16.—SIGMOIDÆÆ.

Valves without sulci, keel quite central, without auxiliary lines, carinal dots not elongated. Girdle face sigmoid, with apices not produced.

#### ANALYSIS OF SPECIES.

{ Striæ very robust; carinal dots round. Brackish water species	{ Striæ fine; carinal dots somewhat elongated. Fresh water species.	{ Striæ very robust; carinal dots round. Brackish water species	. <b>N. Brebissonii.</b>
		{ Striæ fine; size very considerable; carinal dots 4 to 7 in 1 c.d.m.	. <b>N. sigmoidea.</b>
		{ Striæ very fine; size medium; 7 to 9 dots in 1 c.d.m.	. <b>N. vermicularis.</b>

**N. sigmoidea (Ehr.) W. Sm.** (S.B.D., i., p. 38, pl. 13, f. 104; H.V.H. Atl., pl. 63, f. 5-7\*; Type No. 392), **plate 16, fig. 528.**

Valves linear, with cuneate apices. Keel central, with 5 to 7 dots in 1 c.d.m. Striæ fine, 23.5 to 26 in 1 c.d.m. Girdle face narrow, sigmoid, with truncate apices, connecting zone finely striated. Length, attaining 48 c.d.m.

Fresh water.—Rather common everywhere.

**N. vermicularis (Kutz.) Grun.!** (Arct. Diat., p. 91; H.V.H. Atl., pl. 64, f. 1 and 2\*; in Type No. 96), **plate 16, fig. 529.**

Differs from the preceding species by its smaller and narrower size, its closer carinal dots, 6 to 9 in 1 c.d.m., and shorter at the margin of the valve, as well as by its finer striæ, 32 to 34 in 1 c.d.m. Length, 9 to 22 c.d.m.; breadth of valve, about .5 c.d.m.; breadth of girdle face, .5 to 1.0 c.d.m.

Fresh water.—Belgium? England (H.V.H. Type No. 96). Scotland (W. Arn.). (var. lamprocompa., Ard. Lieg. (De Wild.)).

**N. Brébissonii W. Sm. !** (S.B.D., i., p. 38, pl. 31, f. 226 ; H.V.H. Atl., pl. 64, f. 4 and 5\* ; Type No. 393), **plate 16, fig. 530.**

Valves straight, or curved, or arcuate, or sigmoid ; about 5 carinal dots in 1 c.d.m., apices rather abruptly attenuate, acute ; striæ very robust, 9 to 11 in 1 c.d.m. Length, 22 to 24 c.d.m. Breadth of valve, 1.3 to 1.5 c.d.m.

Brackish water.—Heyst (Deby). Antwerp. England (W. Sm., Comber, Norman), Ireland (O'Meara). France, etc.

*Group 17.*—SIGMATA.

Valves still less sigmoid, keel somewhat more eccentric than in the preceding group. Girdle face sigmoid, with apices produced.

ANALYSIS OF SPECIES.

{	Keel with coarse, very projecting dots . . . . .	. <b>N. fasciculata.</b>
	Keel with rather delicate dots . . . . .	. <b>N. Sigma.</b>

**N. Sigma, W. Sm. !** (S.B.D., i., p. 39, pl. 108 ; H.V.H. Atl., pl. 65, f. 7 and 8\* ; Type No. 394), **plate 16, fig. 531.**

Valves linear, somewhat sigmoid, with apices very slightly produced. Keel eccentric, with 7 to 9 dots in 1 c.d.m. Striæ fine, 22 to 24 in 1 c.d.m. Girdle face sigmoid, with tapering apices. Length, attaining 25 c.d.m. Breadth, a little more than 1.0 c.d.m.

Brackish water.—Antwerp, Blankenberghe. England, (W. Sm. ! Comber, Norman, Stolt) Ireland (O'Meara). France, Bahnsie. Finmark.

**var. intercedens Grun.** (H.V.H. Atl., pl. 66, f. 1\*), **plate 16, fig. 532.**

Large and generally very much curved, with 6 to 7 carinal dots, and 27 or 28 striæ in 1 c.d.m., the valve being about 1 c.d.m. broad, and up to 30 c.d.m. long.

Brackish water.—Antwerp (Scheldt, Belleroche).

**var. rigida (Kütz.) Grun.** (*Amphipleura rigida Kütz.* ; *A. sigmoidea, W. Sm.* ; H.V.H. Atl., pl. 66, f. 2\* ; in Type No. 395), **plate 16, fig. 533.**

Valve narrowly lanceolate, sigmoid, with 7 to 9 carinal dots, and 30 or 31 striæ in 1 c.d.m. Valves attaining a length of 20 c.d.m., and a breadth of 8 $\mu$

Fresh water.—Brussels, Antwerp. England (W. Sm., Comber, Norman). Scotland. Ireland (O'Meara).

**var. rigidula Grun.** (H.V.H. Atl., pl. 66, f. 8\* ; Type No. 396), **plate 16, fig. 534.**



Differs from the preceding variety by its smaller size and breadth, 8 to 10 carinal dots, and 30 or 31 striæ in 1 c.d.m. Length, about 6 to 7 c.d.m. Breadth, less than 0.5 c.d.m.

Fresh water.—Rouge-Cloître (Delogne).

**var. Sigmatella Grun.** (H.V.H. Atl., pl. 66, f. 6 and 7\* ; Type No. 397), **plate 16, fig. 535.**

Valves very narrowly lanceolate, sigmoid, with 8 to 11 carinal dots in 1 c.d.m., and 25 or 26 striæ in 1 c.d.m. Valves attaining 32 c.d.m., (sometimes, but rarely, even 45 c.d.m.), and about 5 c.d.m. in breadth.

Brackish water.—Ostend.

**N. fasciculata Grun.** (*Homæocladia sigmoidea*, W. Sm. ; H.V.H. Atl., pl. 66, f. 11-13\*), **plate 16, fig. 536.**

Valve more or less sigmoid, sometimes almost straight. Keel with coarse dots, somewhat elongated, 5 or 6 in 1 c.d.m. Striæ fine, 28 or 29 in 1 c.d.m. Frustules often united in small fascicles. Length, 5 to 10 c.d.m.

Marine or brackish.—Ostend (Grunow), Antwerp. England (W. Sm.).

#### Group 18.—OBTUSÆ.

Analogous to the preceding groups, from which it is distinguished by the keel, which in the middle of its length shows an inflexion at the internal portion, and at the same part two somewhat distant dots between which the rudiment of a nodule appears.

#### ANALYSIS OF SPECIES.

Keel showing in the middle of its length an inflexion, at which the two median dots are somewhat distant, and between them the rudiment of a nodule is shewn

**N. obtusa**

**N. obtusa W. Sm.!** (S.B.D., i., p. 39, pl. 13, f. 109 ; H.V.H. Atl., pl. 67, f. 1\* ; Type No. 398), **plate 16, fig. 537.**

Valve linear, with apices rounded or abruptly attenuate unilaterally. Keel with 5 or 6 coarse dots. Median inflexion very visible. Striæ fine, 26 or 27 in 1 c.d.m. Length, 12 to 25 c.d.m. Breadth of valves somewhat less than .8 to .9 c.d.m.

Brackish water.—Blankenberghe (H.V.H.), Ard. Liege (De Wild.), England (W. Sm. ! Stolt.), Denmark, Holland, &c.

**var. scalpelliformis.** (Arct. Diat., p. 92 ; H.V.H. Atl., pl. 67, f. 2\*), **plate 16, fig. 538.**

Shorter, narrower, and with apices more sigmoid and more abruptly attenuate unilaterally; 7 or 8 carinal dots and 26 or 27 striæ in 1 c.d.m. Length, 6 to 8 c.d.m. Breadth of valves, about .75 c.d.m.

Brackish water.—Ard. Lieg. (De Wild.).

**var. nana** Grun. (H.V.H. Atl., pl. 67, f. 3\*; Type No. 399), plate 16, fig. 539.

Quite small, sigmoid, with 10 or 11 carinal dots and about 35 striæ in 1 c.d.m. Length, about 4 c.d.m.

Distinguished from analagous forms of *N. Sigma* by the conspicuous central pseudo-nodule (Grunow).

Brackish water.—Not yet found in Belgium.

**var. brevissima** Grun. (H.V.H. Atl., pl. 67, f. 4\*; Type No. 400), plate 16, fig. 540.

Valves linear, rather broad, somewhat constricted at the median portion, with rostrate, gently sigmoid apices. Carinal dots coarse, about 8 in 1 c.d.m.; striæ, 30 to 36 in 1 c.d.m.

Brackish water.—Piles in the Scheldt at Antwerp (H.V.H.), Ard. Lieg. (De Wild.).

#### Group 19.—SPECTABILES.

Valves large, slightly arcuate, with eccentric keel. Carinal dots somewhat prolonged on the valve.

#### ANALYSIS OF SPECIES.

Valves large, slightly arcuate, with eccentric keel, carinal dots somewhat prolonged on the valve . . . . . **N. spectabilis.**

**N. spectabilis** (Ehr.) Ralfs. (*Syneira spectabilis* Ehr. Amer. and Mikr., numerous figures; H.V.H. Atl., pl. 67, f. 8 and 9\*; Type No. 401), plate 16, fig. 541.

Valves linear, more or less arcuate, with apices attenuate, often rostrate-capitate; keel very eccentric, with 4 to 6 dots in 1 c.d.m., often prolonged on the valve into a very short costa; striæ, 10 to 12 in 1 c.d.m., distinctly punctate; length, attaining 45 c.d.m.

Brackish water.—Scheldt at Antwerp. Probably England.

#### Group 20.—LINEARES.

Valves without sulci. Keel somewhat eccentric, with round or somewhat angular carinal dots, just a little elongated transversely. Girdle face straight, sometimes slightly attenuate at the median portion.

## ANALYSIS OF SPECIES.

- |   |  |                     |
|---|--|---------------------|
| } | 8 to 12 faint carinal dots in 1 c.d.m.; valve showing a slight inflexion at the median portion . . . . . | <b>N. linearis.</b> |
|   | 5 to 7.5 very robust carinal dots in 1 c.d.m.; valve without median inflexion . . . . .                  | <b>N. vitrea.</b>   |

**N. linearis (Ag.) W. Sm.!** (S.B.D., i., p. 39, pl. 13, f. 110, and Supp., pl. 31, f. 110; H.V.H. Atl., pl. 67, f. 13\*-15; Type No. 404), **plate 16, fig. 542.**

Valves longly linear, almost in the form of a boat, with apices rounded at the external, and attenuate at the internal portion. Keel, 8 to 10 dots in 1 c.d.m., the two median more distant than the others, the space between generally corresponding with a small inflexion of the valve. Striæ, 29 or 30 in 1 c.d.m.; finely punctate. Length, 7 to 18 c.d.m. Breadth of valve, about .5 c.d.m.

Fresh water.—Rather common throughout Europe.

**var. tenuis Grun.** (H.V.H. Atl., pl. 67, f. 16; Type No. 4c6), **plate 16, fig. 543.**

Valve narrow (.4 to .7 c.d.m.). Keel, 11 or 12 dots in 1 c.d.m. Striæ more than 30 in 1 c.d.m., generally interrupted at the median portion of the valve. Girdle face .4 to .9 c.d.m. Length, 7 to 15 c.d.m.

Fresh water.—Common.

**N. vitrea, Norman!** (T.M.S., 1861, 1, n.s., p. 7, pl. 2, f. 4; H.V.H. Atl., pl. 67, f. 10\*), **plate 16, fig. 544.**

Differs from the preceding species by the carinal dots (5 or 6 in 1 c.d.m.) being often coarser and quadrangular, rounded, and by the girdle face being very broad, sometimes constricted and by the connective zone having numerous plicæ. Striæ, 20 to 22 in 1 c.d.m. Length, 6 to 13 c.d.m. Breadth of valves, .5 c.d.m.; breadth of girdle face, up to 2.5 c.d.m.

Brackish water.—Scheldt at Antwerp. Arct. Lieg. (Dr. Wild.). Hull, England (Norman), Scotland (H.V.H. Type No. 382).

**forma major.** (H.V.H. Atl., pl. 67, f. 11\*; Type No. 402), **plate 16, fig. 545.**

Valves up to 12.5 c.d.m. in length and 1.25 c.d.m. in breadth, with 17 striæ in 1 c.d.m.

**var. salinarum Grun.** (Arct. Diat., p. 94; H.V.H. Atl., pl. 67, f. 12\*; in Type No. 431), **plate 16, fig. 546.**

Smaller than the type-form (3.5 to 8.5 c.d.m. in length), valves broad (.5 to .9 c.d.m.), and striæ narrower (28 to 30 in 1 c.d.m.).

Brackish water.—Ostend (Grunow).

**var. recta** (*N. recta* *Hantzsch*; H.V.H. Atl., pl. 67, f. 17 and 18\*), plate 16, fig. 547.

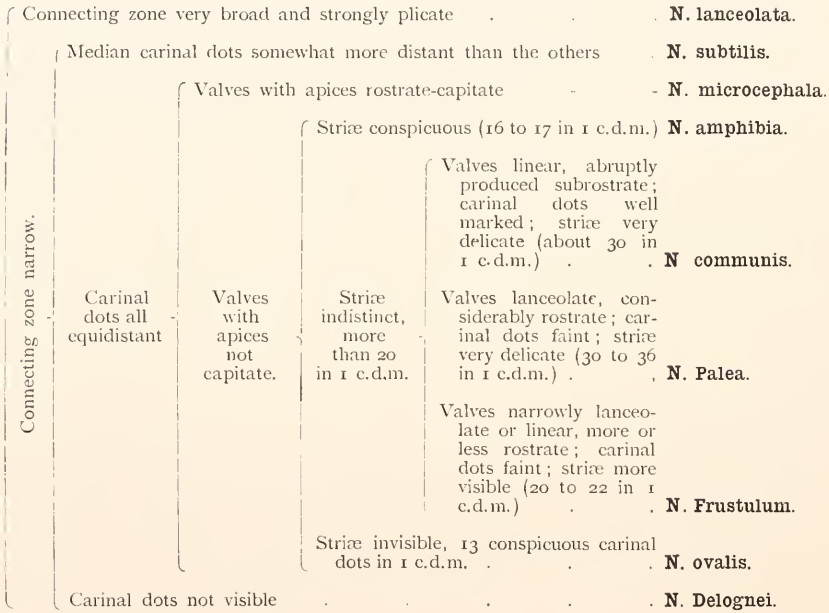
Keel somewhat eccentric, with 6.5 to 7.5 dots in 1 c.d.m., the median more approximate than the others. More than 30 striæ in 1 c.d.m. Frustules narrower than the preceding variety, about .6 to 1.2 c.d.m. in breadth).

Fresh (?) and brackish water.—Ard. Lieg. (De Wild.); England (H.V.H. Type No. 96).

*Group 21.—LANCEOLATÆ.*

Valves lanceolate, linear lanceolate, or more rarely oval. Keel very eccentric, with dots not elongated.

ANALYSIS OF SPECIES.



**N. lanceolata, W. Sm.** (S.B.D., i., pl. 14, f. 118; H.V.H., pl. 68, f. 1 and 2\*; Type No. 407), plate 17, fig. 548.

Valve narrowly lanceolate, with acute apices. Keel very eccentric, about 5 to 7 dots in 1 c.d.m., all equidistant. Striæ fine, about 30 in 1 c.d.m. Girdle face linear, strongly inflated at the median portion, with obtuse apices and strongly plicate connecting zone. Length, up to 20 c.d.m. Breadth of valve, 1.75 c.d.m.

Brackish water.—England (W. Sm., Norman, Stolt.), Ireland (O'Meara).

**forma minor.** (H.V.H. Atl., pl. 68, f. 3\* ; in Type No. 397), **plate 17, fig. 549.**

Only attaining 5·5 to 6 c.d.m.

**forma minima.** (H.V.H. Atl., pl. 68, f. 4\*), **plate 17, fig. 550.**  
Still smaller, and scarcely 2 c.d.m. in length.

**var. incrustans.** (H.V.H. Atl., pl. 68, f. 5 and 6\*), **plate 17, fig. 551.**

Valves more narrowly lanceolate, with 5 to 7 carinal dots in 1 c.d.m. Striæ very fine, more than 30 in 1 c.d.m. Girdle face scarcely or not inflated at the median portion. Length, about 2 to 5 c.d.m. Breadth of valves, 4 to 6 c.d.m. ; breadth of girdle face, up to nearly 2 c.d.m.

On piles in harbours. Ostend (Grun. †). Ilfracombe, England (Baxter Coll. No. 2627.)

**N. subtilis Grun. !** (Arct. Diat., p. 95 ; H.V.H. Atl., pl. 68, f. 7 and 8\* ; in Types Nos. 165 and 190), **plate 17, fig. 552.**

Valves narrowly lanceolate, very gently attenuate as far as the apices. Keel with 7 to 10 dots in 1 c.d.m., the two median generally somewhat more distant. Striæ fine, 30 to 32 in 1 c.d.m. Girdle face narrow, with apices very slightly attenuate. Length, up to 9·5 c.d.m. Breadth of valve, about 5 c.d.m. ; and of girdle face, about 6 c.d.m.

Fresh water.—Rather common (?).

**var. paleacea Grun.** (Arct. Diat., p. 95 ; H.V.H. Atl., pl. 68, f. 9 and 10\* ; in Type No. 10), **plate 17, fig. 553.**

Smaller and narrower, valves attaining to 2·5 to 3·5 c.d.m. in length, and 3 to 4 c.d.m. in breadth. Keel with 12 to 14 dots in 1 c.d.m. Striæ very fine.

Fresh and brackish water.—Common (?)

**N. Palea (Kütz.) W. Sm.** (S.B.D., ii., p. 89 ; H.V.H. Atl., pl. 69, f. 22*b* and 22*c*\* ; in Types Nos. 165, 196, 343 and 479 ; different varieties in Types Nos. 411 and 413), **plate 17, fig. 554.**

Differs from the preceding by the valves being more linear-lanceolate, with apices shortly rostrate ; 10 to 12 carinal dots, the median not distant, and 33 to 36 striæ in 1 c.d.m. Girdle face linear-lanceolate, with apices rounded or truncate. Length, 2·5 to 6·5 c.d.m. Breadth of valves, about 5 c.d.m.

Fresh water.—Very common.

**var. debitis.** (H.V.H. Atl., pl. 69, f. 28 and 29\* ; Type No. 412), **plate 17, fig. 555.**

Valves somewhat narrower.

Ard. Lieg. (De Wild.). England (H.V.H., Type No. 428).

**var. tenui rostris.** (H.V.H. Atl., pl. 69, f. 31\*), **plate 17, fig. 556.**

Apices with narrow, rather long rostrum.

St. Josse ten Noode (Delogne). Ard. Lieg. (De Wild.).

**var. fonticola Grun.** (H.V.H. Atl., pl. 69, f. 15 and 20\* ; in Type No. 143), **plate 17, fig. 557.**

Valves lanceolate, with rostrum well marked, 14 or 15 carinal dots and 28 to 30 striae in 1 c.d.m. Length, 1 to 3 c.d.m. Breadth of valves, 3·5 to 4 $\mu$ .

Fresh water.—Brussels (Delogne).

**N. microcephala Grun.!** (Arct. Diat., p. 96 ; H.V.H. Atl., pl. 69, f. 21\* ; in Type No. 12), **plate 17, fig. 558.**

Very small ; valves lanceolate, linear, with apices rostrate-capitate ; 12 to 13 carinal dots and 33 striae in 1 c.d.m. Length, 1 to 1·5 c.d.m. Breadth of valves, about 3 c.d.m.

Brackish water.—Blankenberghe.

**var. elegantula.** (H.V.H. Atl., pl. 69, f. 22a\*), **plate 17, fig. 559.**

Valves more regularly linear ; 12 carinal dots and 26 striae in 1 c.d.m.

Brackish water.—Blankenberghe.

**N. communis Rabenh.** (Alg., 949 ; Grun. Arct. Diat., p. 97 ; H.V.H. Atl., pl. 69, f. 32\* ; Type No. 219), **plate 17, fig. 560.**

Valves somewhat elongated, with apices abruptly tapering, not rostrate. Carinal dots well marked, about 10 to 11 in 1 c.d.m. Length, 2·5 to 3·5 c.d.m. Breadth of valves, 5 c.d.m. ; breadth of girdle face, 8 c.d.m.

Fresh water.—Common.

**var. abbreviata Grun.** (H.V.H. Atl., pl. 69, f. 35\* ; in Type No. 144), **plate 17, fig. 561.**

Very small and rather broad, 12 to 14 carinal dots and 30 striae in 1 c.d.m. Length, 6 to 1·3 c.d.m. Breadth, 2·5 to 3 c.d.m.

Brackish water.—On the piles of the Scheldt at Antwerp.

**var. obtusa Grun.** (H.V.H. Atl., pl. 69, f. 33 and 34\*), **plate 17, fig. 562.**

Valves lanceolate, with apices attenuate, subrostrate, truncate.

Fresh water.

**N. amphibia Grun.!** (Arct. Diat., p. 68; H.V.H. Atl., pl. 68, f. 15-17\*; Type No. 408), **plate 17, fig. 563.**

Valves longly linear, or lanceolate and short, with apices produced subrostrate, 7 to 8 carinal dots, and 16 to 17 very distinct striæ in 1 c.d.m. Length, 2 to 4.5 c.d.m. Breadth of valves, about .5 c.d.m.

Fresh water.—Common.

**N. Frustulum (Kütz.) Grun.!** (Arct. Diat., p. 98; H.V.H. Atl., pl. 68, f. 28 and 29\*; Type No. 410 *var. tenella.*), **plate 17, fig. 564**

Valves narrowly lanceolate or linear, with 9 to 11 carinal dots and 20 to 22 striæ in 1 c.d.m. Length, 2 to 4 c.d.m. Breadth, about 1 c.d.m.

Brackish water.—Ard. Lieg. (De Wild.).

**var. minutula.** (H.V.H. Atl., pl. 69, f. 5\*), **plate 17, fig. 565.**

Small, very narrowly linear, with 12 or 12.5 carinal dots and 30 or 31 striæ in 1 c.d.m.

Groenendael (Delogne).

**var. perpusilla Rabenh.** (H.V.H. Atl., pl. 69, f. 8\*), **plate 17, fig. 566.**

10 to 12 carinal dots and 23 or 24 striæ in 1 c.d.m. Frustules often united in short filaments. Length, 1.5 to 4.3 c.d.m. Breadth of valves, about .4 c.d.m.

Common.

**N. ovalis Arnott!** (Manuscript H.V.H. Atl., pl. 69, f. 36\*; Type No. 414), **plate 33, fig. 880.**

Valves very broad, longly oval, with rounded apices, and striæ excessively delicate, scarcely visible with the best objectives; about 13 well marked carinal dots in 1 c.d.m. Girdle face narrow. Length, 1.5 to 2 c.d.m. Breadth of valves, about .5 c.d.m.

Fresh water.—Durham, England (Coll. W. Arnott! No. 1892 and 190).

**N. Delognei Grun.!** (H.V.H. Atl. Supp., f. 38\*; Type No. 106), **plate 17, fig. 567.**

Valves lanceolate, linear, somewhat rostrate-apiculate. Carinal dots indistinct; transverse striæ about 19 in 1 c.d.m., strongly punctate. Breadth of valve about 1.5 $\mu$ . Length, about 1.5 c.d.m.

Fresh water.—Brussels (Delogne).

This species may easily be mistaken at first sight for a *Synedra*, which should have no trace of a pseudo-raphé.

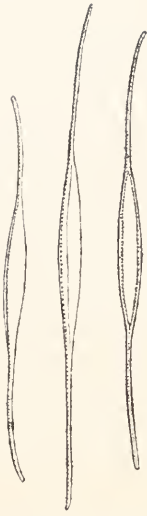


Fig. 126.—*Nitzschia longissima* (*Nitzschiella*.)  
var. *Closterium*.

Group 22.—NITZSCHIELLA RABENHORST.

Valves with very eccentric keel and longly  
rostrate apices.

ANALYSIS OF SPECIES.

{	Valves terminating abruptly in a rostrum; striæ scarcely or not visible.	{	Rostrum longer than the valve. Salt water	<b>N. longissima.</b>	
			Rostrum shorter than the valve. Fresh water	<b>N. acicularis.</b>	
				Valves terminating gradually in a rostrum; transverse striæ very visible	<b>N. Lorenziana.</b>

**N. longissima** (Bréb.) Ralfs. (in Pritch., p. 783; H.V.H. Atl., pl. 70, f. 1 and 2\*), plate 17, fig. 568.

Valves lanceolate, with rostrum excessively long and equal to or exceeding the length of the valve. Keel very eccentric, with 6 to 12 dots in 1 c.d.m. Striæ, about 16 in 1 c.d.m., excessively faint and difficult to be seen. Length, attaining to 50 c.d.m. Breadth of valve, .4 to .8 c.d.m.

Marine.—Not yet found in Belgium. England (W. Sm., etc.), France (Bréb.), Denmark, (Heib).

**forma parva.** (H.V.H. Atl., pl. 70, f. 3\*), plate 17, fig. 569.

Small, and scarcely attaining a length of 12 to 13 c.d.m.



**var. Closterium.** (*N. Closterium*, *W. Sm.*; H.V.H. Atl., pl. 70, f. 5, 7 and 8\*; Type No. 416), **plate 17, fig. 570.**

Distinguished from the type-form by its rostra being curved on the same side crosswise. Mean length, 26 to 32 c.d.m.

Brackish water.—Blankenberghe. England (W. Sm., Comber, Norman, Stolt.). Ireland (O'Meara). France.

**var. reversa.** (*N. reversa*, *W. Sm.!*)

Differs from the preceding by its rostra curved in opposite directions, 10 to 14 carinal dots in 1 c.d.m. Length, 7 to 20 c.d.m.

Marine.—England (Lewes, W. Sm. ! Norman, Stolt.). France (Bréb.). Holland (T. Spreck). Denmark (Heiberg).

In the gatherings from the herbarium of Professor W. Smith we have found perfect valves, which has enabled us clearly to prove that Wm. Smith's form is a *Nitzschia* and not a *Synedra*, as Mr. Grunow thought (*Arct. Diat.*, p. 100). The carinal dots are only visible with difficulty. It requires an excellent immersion objective to distinguish them clearly. There are 10 of them at the apices of the valve, and 14 to 16 in the median portion. It was probably the carinal dots that Prof. Smith described as indistinct marginal striæ.

**N. acicularis, W. Sm.** (*S.B.D.*, i., p. 43, pl. 15, f. 122; H.V.H. Atl., pl. 70, f. 6\*; Type No. 415), **plate 17, fig. 571.**

Valve lanceolate, with rostrum shorter than the valve. Carinal dots 18 in 1 c.d.m. Striæ not visible, or at least only traces visible at the margins of the valve. Length, 6 to 7 c.d.m.

Fresh water.—Brussels (Delogne), Antwerp, etc. England (W. Sm., Norman, etc.)

**N. Lorenziana Grun.!** (*Arct. Diat.*, p. 101; H.V.H. Atl., pl. 70, f. 12\*), **plate 17, fig. 572.**

Valve very narrowly lanceolate, very slightly attenuated into curved rostra, with apices turned in opposite directions. Carinal dots 6 or 7 in 1 c.d.m., conspicuous up to the apex of the rostra; striæ 13.5 to 14 in 1 c.d.m. at the middle of the valve, and conspicuous, becoming less visible and more compact (20 in 1 c.d.m.) towards the apices of the valve. Length, 13 to 19 c.d.m. Breadth of valves, .6 to .7 c.d.m.

Brackish water.—Not yet found in Belgium.

var. *incurva* Grun. (H.V.H. Atl., pl. 70, f. 13 and 14\*), plate 17, fig. 573.

Small, often taking up such a position (fig. 573 left-hand figure) that it appears quite straight, 6 or 7 carinal dots in 1 c.d.m. Central striæ, 14.5; terminal, 18 to 20 in 1 c.d.m. Length, 5 to 6 c.d.m. Breadth of valves, about .5 c.d.m.

Marine.—Between *Oscillatorie* on posts in the harbour of Ostend (Grunow).

Obs.—*Synedra hamata* W. Sm. ! is not a *Nitzschiella* as stated by Rabenhorst and De Toni (Syllog., p. 550); it is a true *Synedra*, or rather a monstrosity of *Synedra*, with hamular apices. The striæ are marginal, about 10 in 1 c.d.m., and the hyaline area is lanceolate. I think therefore this form may be regarded as belonging to *S. affinis*.



Fig. 127.

*H. subcoarctata* Grun.  
var. *Scotica*.

The genus *Homæocladia* Ag. (1827) is analogous to the genus *Schizonema*, that is to say, it is established for certain *Nitzschia*, which live in mucous tubes. I cannot admit this genus any more than *Schizonema*.

Three forms on our shores are included in the group or sub-genus *Homæocladia*.

**N. (H.) Martiana** Ag. (Consp., p. 25; W. Sm., S.B.D., ii., p. 80, pl. 55, f. 347\*), plate 33, fig. 881.

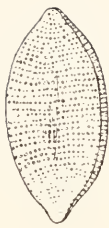
Valves linear, lanceolate, with obtuse apices. Keel central, with 5 or 6 dots in 1 c.d.m. Transverse striæ very fine, with difficulty visible, more than 30 in 1 c.d.m. Girdle face linear, lanceolate, with obtuse apices. Length, 16 to 28 c.d.m. Frustules generally collected together in dense fascicles enclosed in rugose fronds, simple or divided dichotomously.

Marine.—On all the maritime coasts of Europe.

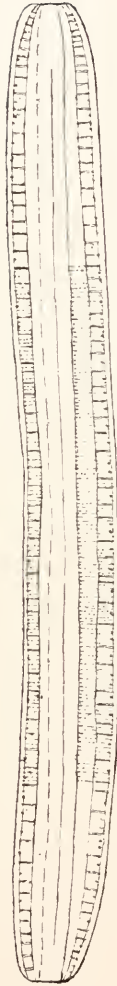
**N. (H.) filiformis**, W. Sm. ! (S.B.D., ii., p. 80, pl. 55, f. 348\*), plate 33, fig. 882.

Valves linear, lanceolate, with subacute apices. Keel central, with 5 or 6 dots in 1 c.d.m. Striæ fine. Girdle face linear, lanceolate, obtuse. Length, about 10 c.d.m. Frustules collected in groups of 3 or 4 in filiform, simple, undivided fronds.

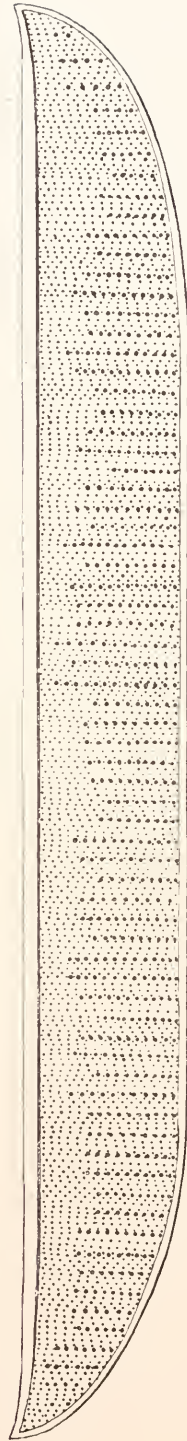
Fresh and brackish water.—Bexhill, Lewes, England (W. Sm.!), Liverpool (Comber), near Hull (Norman), Ireland (O'Meara).



128.



129.



130

Fig. 128.—*Tryblionella punctata*.

Fig. 129.—*Pritchardia insignis* var. *Mediterranea*.

Fig. 130—*Perrya pulcherrima*.

**N. (H.) subcohærens Grun.** (Diat. Kasp, p. 23; H.V.H. Atl., pl. 66, f. 14\*), plate 35, fig. 915.

Valves 3 c.d.m. in length, .4 in breadth; 9 or 10 carinal dots, and 33 or 34 transverse striæ in 1 c.d.m. Frustules living solitary or united in dense fascicles (Grunow).

Marine.—Leith, Scotland (Frauenfeld).

**N. (H.) sigmoidea, W. Sm.**, is nothing else but *N. fasciculata* Grun., which we have previously described.

**Tryblionella, W. Sm.** (figure 128) and **Pritchardia Rab.** (figure 129), are both true *Nitzschia*, as well as **Perrya Kitton, 1877**, (figure 130), which is distinguished by its carinal dots being prolonged into long interrupted lines, so as to appear to form long rows of coarse dots.

All the *Perrya* are exotic. The most remarkable species of this group is the *Perrya pulcherrima* (Grun. and Kitton), which will be found reproduced on the preceding page.

#### GENUS 82. —GOMPHONITZSCHIA GRUN., 1868.

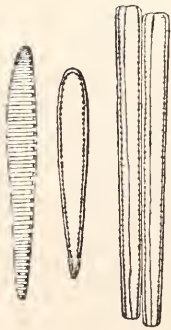


Fig. 131.

*Gomphonitzschia Ungerii*.

Frustules similar to those of *Nitzschia*, but with cuneate valves and girdle face. The frustules are sessile or stipitate, and in that case they grow flabilliform.

The *Gomphonitzschia* are, therefore, gomphonemoid *Nitzschia*.

The genus only includes two species, one *G. Ungerii* Grun. (fig. 131), inhabits Egypt, and the other, *G. Clevei* Grun., has been found in Batavia.

TRIBE XVIII.—*Cylindrothecæ*.GENUS 83.—CYLINDROTHECA RABH.,  
1859.

Frustules fusiform, furnished with 2 or 3 lines (carinæ?), arranged spirally, and showing juxtaposed (carinal?) dots.

One species.

**C. gracilis (Breb.) Grun.!** (*Ceratoneis Breb.*; *Nitzschia Tenia*, *W. Sm.*; *Cylindrotheca Gerstenbergeri Rab.*; H.V.H. Ati., pl. 80, f. 2\*; Type No. 417), plate 17, fig. 574.

Frustule becoming abruptly fusiform; spiral line with 20 to 22 elongated dots in 1 c.d.m. Length, about 7 to 8 c.d.m.

Fresh water.—Brussels (Delogne). Antwerp (H.V.H.), England (Ralfs, *W. Sm.*, Comber, Stolt., Norman).



Fig. 132.  
*Cylindrotheca gracilis*.

## SUB-FAMILY III.—CRYPTO-RAPHIDIEÆ.

Frustules with valve face generally circular, subcircular, or angular, more rarely elliptic, oval, or bacillar.	}	<i>frequently</i>	}	much developed in girdle view and filamentous; <i>or</i>
				with processes, teeth, spines, or awns; <i>or</i>
				more or less hyaline; <i>or</i>
				irregular; <i>or</i>
				furnished with transverse costæ in girdle view.
		<i>never</i>	}	with a central <i>linear</i> blank (hyaline) space or a true raphe on the valves.

All the crypto-raphidieæ have a granular endochrome; in cylindrical forms the granules are scattered on the internal surface of the valves; in discoid or analogous forms the granules radiate round a central point.

## TABLE OF TRIBES.

Valves not as above.	{	Frustules cylindrical or flattened. Valves alike, terminated by a calyptra (hood), pointed with a bristle; or frustules with valves unlike or mostly smooth; furnished with awns, horns (elongated processes), spines or setæ, which in fossil forms are sometimes imperfect or absent; frustules often imperfectly silicious. Valves without radial or cellulose costæ; or again, frustules imperfectly silicious, united in distant series; connecting zone more or less turgid. Valves angular, with a long central spine . . . . .		<b>Chætocereæ.</b>	
		Frustules cohering; girdle face generally much developed and cylindrical; firmly silicious. Valves rarely hyaline; unlike or elliptic and without median line, sometimes apiculate or conical or with a peculiar central nodule (spine); or umbilicus, smooth, punctate or cellulate, and frequently with marginal or submarginal spines. Frustules cohering either by teeth or marginal spines, or by a central spine or a short central cushion . . . . .		<b>Melosireæ.</b>	
		Girdle face much developed, valves of very different forms, sometimes furnished with horns or simple spines or prominences at the apices; always without ocelli or radiating septa . . . . .		<b>Biddulphiææ.</b>	
		{	Valves round or elliptic, divided into radiating compartments.	Compartment alternately elevated and depressed	<b>Heliopelteæ.</b>
				Compartment arranged on the same plane	<b>Asterolampreæ</b>
{	Valves not divided into radiating compartments.	Valves always round or very broadly elliptic, furnished with one or more ocelli or with very short obtuse horns, simulating ocelli	<b>Eupodisceæ.</b>		
		Valves generally round or elliptic, rarely elongated, semi-lunar or cuneate; with cellulate or punctate structure; sometimes furnished with small, short and slender spines, always without ocelli . . . . .	<b>Coscinodiscus.</b>		

## TRIBE XIX.—CHAETOCEREE.

Frustules consisting of numerous imbricate or juxtaposed hoops.	Valves symmetrical.	{ Without awns, sometimes a circle of marginal dots . . . . .	<b>Dactyliosolen.</b>
		{ Furnished with numerous more or less developed awns . . . . .	<b>Lauderia.</b>
		{ Valves elliptic, furnished with two awns . . . . .	<b>Attheya.</b>
		{ Valves round, with two long spine-like horns . . . . .	<b>Peragalloa.</b>
	Valves asymmetrical.	{ Valve showing an undulation terminating in a rudimentary mucro, placed laterally . . . . .	<b>Guinardia.</b>
		{ Valve calyptiform, showing a more or less developed mucro, generally ending in a seta . . . . .	<b>Rhizosolenia.</b>
Frustules not consisting of numerous hoops.	Valves bordered with extremely long spines.	{ Spines not arranged in a circle on the margin of the valve . . . . .	<b>Chaetoceros.</b>
		{ Spines arranged in a circle. { Spines forming a flat corona (rays) round the valve . . . . .	<b>Bacteriastrum.</b>
		{ Spines erect . . . . .	<b>Corethron.</b>
	A long central spine.	{ Valve angular, very slightly silicious; spine setiform . . . . .	<b>Ditylum.</b>
{ Valve rounded, with two biddulphiform marginal elevations and with a central spine terminating in a forked claw . . . . .		<b>Syndetoneis.</b>	
Frustules not consisting of numerous hoops.	No very long marginal spines.	{ Valve with a cylindrical central elevation, bordered with very robust spines . . . . .	<b>Pyrgodiscus.</b>
		Spines robust, in form of horns.	{ Frustules compressed, with sutural portion narrow; horns often branching or bifurcate, sometimes mucronate. Valves sometimes short and obtuse, at other times furnished with short scattered spines . . . . .
	Valves not as above.		{ Frustules elongated, with mucronate horns. Generally one of the valves with only one horn or process and the other with two . . . . .
		{ Valves dissimilar, furnished with rather short setiform spines . . . . .	<b>Hercotheca.</b>
	{ Valves similar, smooth or hyaline, fossil, without spines, often united by a constricted central part . . . . .	<b>Goniothecium.</b>	
{ Valves furnished with small scattered spines . . . . .	<b>Chaetoceros.</b>		

## I.—RHIZOSOLENIEÆ.—Frustules consisting of numerous imbricate or juxtaposed hoops (annuli).

The Rhizosoleniæ are the subject of an excellent monograph by Mr. H. Peragallo inserted in *Le Diatomiste* for 1892, to which we refer the reader for a complete examination of this sub-tribe.



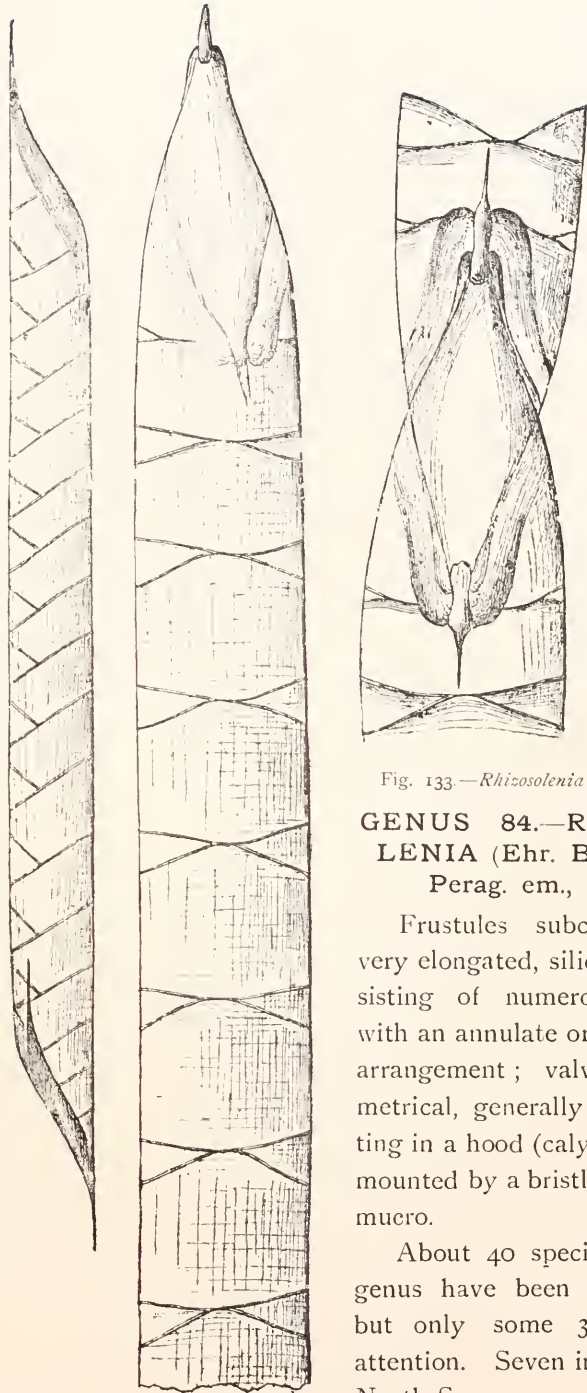


Fig. 133.—*Rhizosolenia styliformis*.

**GENUS 84.—RHIZOSOLENIA** (Ehr. Brightw.)  
Perag. em., 1892.

Frustules subcylindrical, very elongated, silicious, consisting of numerous joints with an annulate or imbricate arrangement; valves asymmetrical, generally terminating in a hood (calyptra) surmounted by a bristle (seta) or mucro.

About 40 species in this genus have been described, but only some 30 deserve attention. Seven inhabit the North Sea.

Mr. Peragallo divides the *Rhizosolenia* into three groups, which we adopt here, viz. :—

GROUP I. *Annulata*.—Frustules annulate.

**R. robusta** Norm. (in Pritch. Inf., p. 866, pl. 8, f. 42; Perag., pl. 2, f. 1, and pl. 3, f. 1-2\*), **plate 33, fig. 883.**

Frustule cylindrical, depressed; section elliptic, axis curved, hood consisting of annuli with antero-posterior imbrication confused, mucrones very small; annuli of frustules flat, finely striate, lines of an antero-posterior imbrication straight and opposite; silica rather delicate, size variable but always considerable (H. Pér.)

Marine.—North Sea (Norman). Teignmouth, Devonshire (stomach of Phallusia W. Arn. !)

GROUP II. *Squammosæ*.—Frustules formed of scales, more or less rhombical, very numerous and giving a squamous appearance to the frustule.

We have no form belonging to this group within the limit of the North Sea.

GROUP III. *Genuina*.—Frustules formed of rhombical scales arranged usually in two but never exceeding four rows.

ANALYSIS OF SPECIES.

{	Valve furnished with a mucro.	{	Mucro long and very robust, curved like a spur . . . . .	<b>R. setigera.</b>	
			Mucro short, straight, broad.	{ Scales showing coarse inclined striæ, finely divided transversely . . . . .	<b>R. Calcar-avis.</b>
				{ Scales fine; puncta in quincunx, visible with difficulty . . . . .	<b>R. imbricata.</b>
{	Valve with a rather long calyptra, attenuate, flattened, without seta or mucro . . . . .				
					<b>R. styliformis.</b>
				<b>R. alata.</b>	

**R. setigera** Brightw. (Q.J.M.S., 1858, vi., p. 95, pl. 5, f. 6; H.V.H. Atl., pl. 78, f. 5 and 8\*), **plate 17, fig. 602.**

Frustule sub-cylindrical, about 5 to 15 times longer than broad, joints only visible in oblique illumination. Striæ excessively delicate; calyptriform

process terminating in a very long delicate bristle, generally curved. Breadth of frustule, 1.5 to 2 c.d.m. Usually only fragments of this form are found.

Marine.—Rare. Blankenberghe and basin. Coasts of England (Brightwell, Stolt., Kitton, Norman, Baddeley, Wallick). Scotland (Baxter Coll., No. 2591). Ireland (O'Meara). Kattegat (Cleve).

**R. Calcar-avis Schultze** (Mull. Arch., 1858, p. 339, pl. 13, f. 5-10; Pér., p. 113, pl. 4, f. 9-10\*), **plate 33, fig. 884.**

Frustules usually solitary, rarely united in threes, cylindrical, of rather large size, with calyptra terminating in a robust mucro, curved like a spur. Frustules very delicately silicious, with annulation scarcely visible.

Marine.—Heligoland (Max Schultze). England (Norman). Ireland (O'Meara). Mr. Peragallo says that this species is wide spread, but that it is overlooked in preparations and is easily destroyed by acids. It is only distinctly visible when its endochrome is present.

**R. styliformis Brightw.** (Q.J.M.S., 1858, vi., p. 94, pl. 5, f. 5; H.V.H. Atl., pl. 78, f. 1-5; pl. 79, f. 1, 2 and 4\*; Type No. 442), **plate 17, fig. 601.**

Frustules sub-cylindrical, about 6 to 20 times longer than broad, formed of distinct joints, surface covered with decussating striæ, about 20 in 1 c.d.m., terminating in a calytriform spathulate process, bifid at the base, the upper part finishing in a straight, stiff process. Breadth of frustule, 2 to 4 c.d.m. Length, very variable. Silica robust.

Marine.—Rather rare in Belgium; Blankenberghe and basin. England (Brightwell, Kitton, Baddeley, Norman, Stolt.). Scotland (Baxter Coll., No. 2691). Ireland (O'Meara).

**R. imbricata Brightw.** (Q.J.M.S., 1858, vi., p. 95, pl. 5, f. 6; H.V.H. Atl., pl. 79, f. 5-6\*; Perag., p. 113, pl. 5, f. 2-3), **plate 33, fig. 885.**

Frustules cylindrical with section elliptical; calyptra furnished with a small and robust mucro; annuli covered with coarse striæ, finely divided transversely (analogous to those of the Radiosæ) inflected on each side of the median line or pseudo-raphe of the scale; lines of imbrication lateral, straight, very distant in each pair, silica robust.

Marine.—Coasts of England (Brightwell? Kitton, Norman, Baddeley). Scotland (Baxter Coll., No. 2691), Surface of River Dee (Stolt.).

**var. Shrubsolii** (*R. Shrubsolii Cleve*; H.V.H. Atl., pl. 79, f. 11-13\*), **plate 33, fig. 886.**

Only differs from the type-form by its narrower diameter.

Marine.—England (Norman, Kitton), Mouth of the Thames (Shrubsole). Excessively common and abundant in the Scheldt.

**R. alata Brightw.** (Q.J.M.S., 1858, vi., p. 95, pl. 5, f. 8; H.V.H. Atl., pl. 79, f. 8\*), plate 33, fig. 887.

Frustule cylindrical, narrow; calyptra rather long, much flattened, obtuse, without a mucro, with the line of articulation twisted spirally, showing a small spine at its base. Scales rhombical, finely striate.

Marine.—North Sea (Schütt), Kattegat (Cleve), Yarmouth (Kitton), East Coast of England (Norman).

**R. Stolterfothii** (H. P. Monog., p. 13, pl. 1, fig. 17-18; *Eucampia striata Stoll.*), a cylindrical arcuate form, is met with rather frequently in pelagic gatherings and has been recorded by Stolterfoth from the surface of the Dee, and has been raised by M. Schült to the rank of a genus under the name of *Henseniella*, which the author defines in the following manner:—

**Henseniella Schütt, 1893.**—Frustule elongated, cylindrical, twisted, recurved, forming spiral chains; membrane slightly silicious, showing numerous annuliform septa; valves elliptic, plane, or concave.

This genus includes two forms: *Henseniella (Pyxilla) Baltica* (Hens.) Schütt and *Henseniella Stephanos* (Hens.) Schütt.



Fig. 134.

*Dactyliosolen antarcticus.*

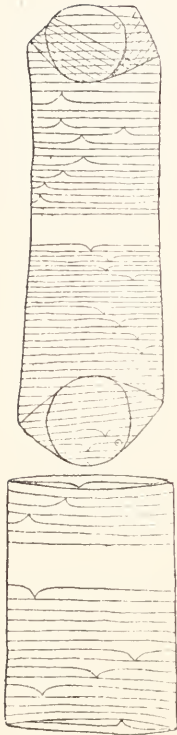
#### GENUS 85.—DACTYLIOSOLEN CASTR., 1886. Pér. em., 1892.

Frustules cylindrical, annulate; valves plane, circular, symmetrical, without spines or processes, sometimes showing a crown of marginal dots.

This genus was established by Count Castracane for a single form, *D. antarcticus* represented in the margin (fig. 134). Mr. Peragallo has extended it somewhat so as to admit into it different badly-classed forms, which link the true *Rhizosolenia* to *Melosira*.

No *Dactyliosolen* belongs to our regions.

## GENUS 86.—GUINARDIA, H. Pér., 1892.



Frustules cylindrical, annulate ; valves circular, showing an undulation ending in an elementary mucro.

Fig. 135.

*Guinardia flaccida*.

**G. flaccida (Castr.) H. Perag.** (Monogr. Rhizos., p. 107, pl. 1, f. 3-5).

Frustules cylindrical, valves hyaline, furnished with a small projecting spur, lateral, placed on the summit of an undulation of the valve ; rings flat, hyaline, imbricated in twos ; lines of imbrication oblique, simple and opposite. Diameter, 25 to 80 c.d.m. Silica very slight, frustule completely put out of shape by dessiccation (H.P.).

Marine.—Maritime Scheldt (H.V.H.), Kattegat (Cleve). Peragallo says it is very wide-spread.

## GENUS 87.—LAUDERIA CLEVE, 1873.

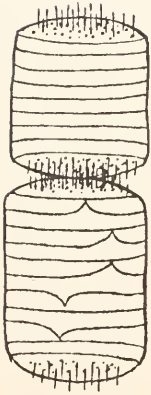


Fig. 136.  
*Lauderia annulata*.

Frustules cylindrical, annulate ; valves orbicular, covered, at least near the margins, with numerous filiform processes or spines.

The type-form of this genus is *Lauderia annulata* Cleve, which is figured in the margin (fig. 136), and which inhabits the Java Sea: *Lauderia delicatula* was found by Stolterfoth, in 1879, on the surface of the Dee, England.

About a dozen other species have been described, but all those hitherto discovered belong to warmer regions than ours.

**Detonula Schütt (1893)**, is a genus created at the expense of *Lauderia*, for forms with plane valves, without small spines, on the disc surface.

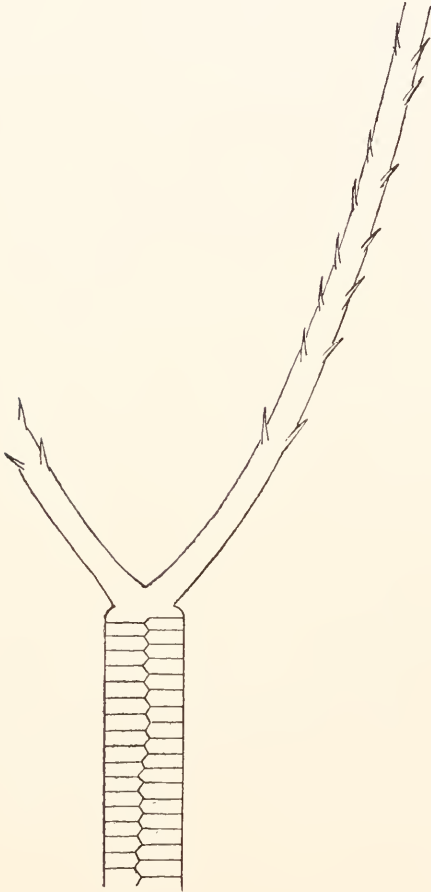
GENUS 87<sup>bis</sup>.—PERAGALLOA SCHÜTT, 1895.

Fig. 137.

*Peragalloa Meridiana.*

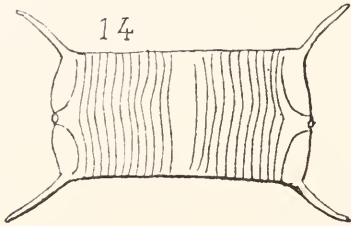
Frustules formed of numerous annulate joints, interrupted, with orbicular valves furnished with two long horns, more or less spinous or hirsute.

This curious genus, which approaches *Attheya*, has the body of a *Dactyliosolen*, and the valves of a *Chatoceros*. It only comprises a single species.

**Peragalloa meridiana Schütt** (Ber. Deutsch. Bot. Gesell. 1895, xiii., p. 36, pl. 5, f. 28\*).

Found pelagic in the Baltic Sea (Schütt).

## GENUS 88.—ATTHEYA WEST, 1860

Fig. 138.—*Attheya decora*,

Frustules cylindrical, annulate, slightly elongated, flattened; valves elliptic, having a central nodule, and furnished with two bristles at the apices.

A single species.

***Attheya decora*, West.** (T.M.S., 1860, viii, p. 152, pl. 7, f. 15\*

Characteristics of the genus.

Marine.—Normandy (Bréb.!) England (West), Creswell R. Taylor!), Tynemouth (R. Taylor!), Surface of Dee (Stolt.).

Mr. Peragallo, at page 11 of his monograph, says:—

On the margins of the valve may be seen two lines or sutures, which, parting from the central umbilicus, pass under the bristles, so that the valve in reality consists of two calyptræ coupled together. The sutural lines of the frustule follow this direction, and are inflected at their middle.

In my opinion, and until otherwise determined, the *Attheya* ought to be considered as the longitudinal juxtaposition of two *Rhizosolenia*. It is a transition between a true *Rhizosolenia* and a *Chaetoceros*.

II.—EUCHÆTOCEREÆ.—Frustules not consisting of numerous annuli.

## GENUS 89.—CHÆTOCEROS EHR. (1844). Char. emend.

Valves convex, elliptic or circular, furnished with very elongated arms. Frustules generally united into long cylindrical filaments.



*Sub-genus* I.—CHÆTOCEROS. Valves elliptic, with awns not arranged in a circle on the margin of the valve.

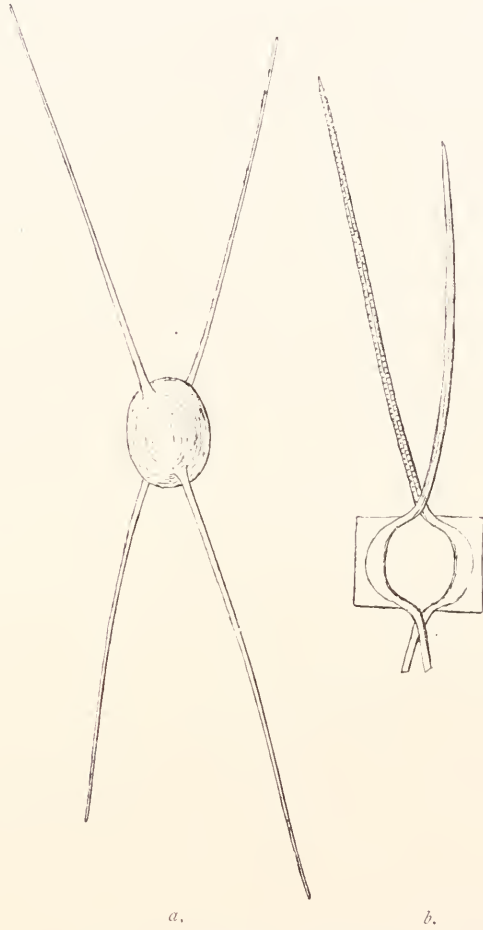


Fig. 139.—*a.* *Chatoceros Wighamii*. *b.* *Chatoceros Lorenzianus*.

ANALYSIS OF SPECIES,

{	Frustules leaving apertures between one another.	{	Apertures very large, suborbicular; valves with horns straight or very slightly curved	. <i>Ch. Wighamii</i> .
			Apertures longly elliptic, lanceolate; horns curved in the direction of minor axis	. <i>Ch. paradoxum</i> var. <i>Eibenii</i> .
			Frustules closely united	. <i>Ch. armatum</i> .

**Ch. armatum, West.** (T.M.S., 1860, viii., p. 151, pl. 7, f. 12; H.V.H. Atl., pl. 81, f. 1-4\* ; Type No. 446), plate 18, fig. 603.

Valve elliptic, having at each apex a long awn, with an obtuse enlarged apex, surrounded at the base with several acute and much shorter awns. Girdle face of frustule elongated, quadrangular. Frustule slightly silicious, of variable size, 3 to 6 c.d.m. in breadth.

Marine.—Found in abundance on the sands at Blankenberghe, where the waves sometimes leave it in the form of long brownish streaks. England (West., Stolt., Kitton). Scotland (Baxter Coll., No. 2838), Holland (Suringar).

**Ch. Wighamii Brightw.** (Q.J.M.S., 1856, iv., p. 108, pl. 7, f. 19-36; H.V.H. Atl., pl. 82, f. 1\*), **plate 18, fig. 604.**

Valve convex, oval, covered with small spines, having at each end two very long acute awns. Frustules united into a long filament. Valve (in the specimen observed), 2.5 c.d.m. in length, by 2 c.d.m. in breadth.

Marine.—Very rare at Blankenberghe (2nd Basin). Floating in the Scheldt (H.V.H.). England (Kitton, Stolt., Norman).

**Ch. paradoxum Cl.** (Diat. Java, p. 10, pl. 3, f. 16).

Valves flat, with raised centre, oval, horns flexed in the direction of the minor axis, very flat, furnished with alternating elevations. Frustules united in a chain, leaving between them two large elliptic oval apertures.

Pelagic.—Found floating at Java. Surface of Dee, England (Stolt.).

**var. Eibenii Grun.** (H.V.H. Atl., pl. 82, f. 9, 10\*) **plate 35, fig. 916.**

Centre not raised, interfrustular apertures longly elliptic, with lanceolate apices. Length of valve, about 4 c.d.m.

Pelagic.—North Sea (Eiben). Maritime Scheldt. (H.V.H.).

*Sub-genus II.*—**BACTERIASTRUM.**—Valve circular, bearing on its margins a circlet of long awns.

**Ch. (Bacteriastrum) varians Lauder** (T.M.S., 1864, iv., n.s., p. 8, pl. 3, f. 1-6; *Actiniscus Ehr.*; H.V.H. Atl., pl. 80, f. 3-5\*; Type No. 445), **plate 18, fig. 605.**

Valve circular, covered with more or less sparse granules, showing a conspicuous median dot, and bearing on its margins a corona of long awns, variable in number, with their ends often undulate, sometimes straight, bifurcated in the individuals forming the median portion of the filament,

simple and more or less curved in the terminal individuals. Frustules united by about 20 in a filament.

Marine.—Rare. Blankenberghe, 2nd Basin; ; floating in the Scheldt. (H.V.H.). Stomachs of *Noctiluca*, Yarmouth (Kitton). Surface of Dee, England. Common (Stolt.). East Coast of England (Norman).

*Note*.—The forms for which Ehrenberg constituted the genus *Actiniscus* were not diatoms, and subsequent authors who have written on these forms have not admitted them in their classification. Ehrenberg included the genus *Bacteriastrum* in his genus *Actiniscus*, but without any plausible reason, and he continued to do so until his last work, *Fortsetzung der Mikr. Studien*, 1875. All the forms of *Bacteriastrum* ought to be included in the genus *Chatoceros* (Note by Mr. Kitton).

Sub-genus III.—CORETHRON CASTR., 1886.

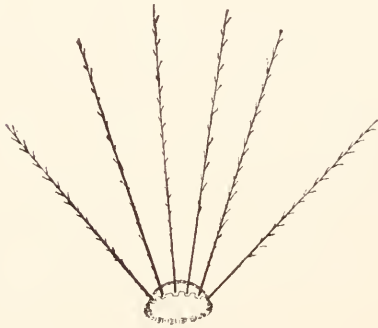


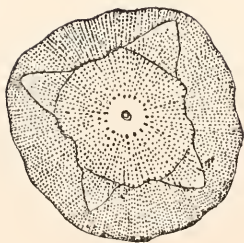
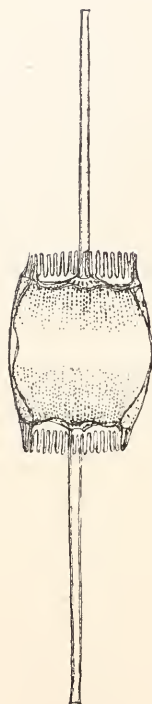
Fig. 140.—*Corethron hispidum* Castr.

Valves convex, furnished with a corona of erect spines. Frustules cylindrical.

As will be noticed, the difference between *Bacteriastrum* and *Corethron* consists in the spines of the first genus being placed horizontally, while in *Corethron* they are erect. Hitherto five

species have been described, none of which inhabit our shores.

## GENUS 90.—DITYLUM BAILEY, 1861.



Valve angular, furnished with a long central spine, with radiant puncta. Frustules distant, slightly silicious, with undulated margins.

## ANALYSIS OF SPECIES.

- |   |  |                         |
|---|--|-------------------------|
| { | Striae excessively fine; valves not bordered with indentations . . . . . | <b>D. intricatum.</b>   |
| { | Striae well marked; valves bordered with indentations . . . . .          | <b>D. Brightwellii.</b> |

**D. Brightwellii (West) Grun.**

(*Triceratium Brightwellii*, *W.st.*, T.M.S., 1858, viii., p. 149, pl. 8, f. 1, 5 and 8; *D. trigonum* and *inæquale* *Bail.*; *Triceratium undulatum*, *Brightw.*, Q.J.M.S., 1858, vi., p. 153, pl. 8; H.V.H. Atl., pl. 114, f. 4, 8 and 9\* ; in Type No. 529) **plate 17, fig. 606.**

Valves triangular or tetragonal, with margins straight or undulated, furnished with small spines, somewhat elevated in the centre, and bearing a long spine, surrounded by a small narrow hyaline area; striae radiant (12 in 1 c.d.m. at the margin of the valve), with very distinct puncta. Girdle face with connecting membrane apparently smooth. Breadth of side of frustule about 3·5 to 4·5 c.d.m.

Marine. Blankenberghe, rare; very abundant in some pelagic gatherings from the Scheldt (H.V.H.). England (W. Arnott! Kitton),

Fig. 141.—*Ditylum Brightwellii*.

**D. intricatum (West.) Grun.** (*Triceratium intricatum*, *West.*, T.M.S., 1858, viii., p. 148, pl. 7, f. 5; H.V.H. Atl., pl. 114, f. 2\*), **plate 17, fig. 607.**

Valve triangular with angles elevated, margin triundulate, without indentations ; a rather short spine in the centre ; striæ radiant, very fine, about 20 in 1 c.d.m. at the margin of the valve. Frustules distant, united in a filament. Length of side of frustule, about 6 c.d.m.

Marine.—Very rare. Blankenberghe, 2nd Basin.

*Note.*—These two *Ditylum* are probably forms of a single species.

### GENUS 91.—SYNDETONEIS GRUN., 1888.

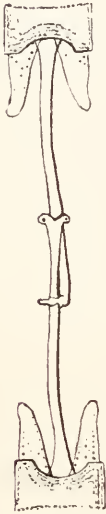


Fig. 142.—*Synetoneis amplexans* (Gr. and Sturt.) Grun.

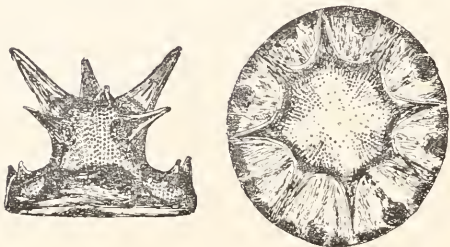
Valves dissimilar, with two marginal bidulphiform elevations, and having in the centre a long horn.

The horn of one of the valves with its apex dilated, somewhat bifid ; that of the other valve bifurcate, clasping the horn of the other valve.

The genus includes only a single form, *S. amplexans* (Gr. and Sturt.) Grun., found in the Oamaru Deposit (New Zealand), and figured in the margin.

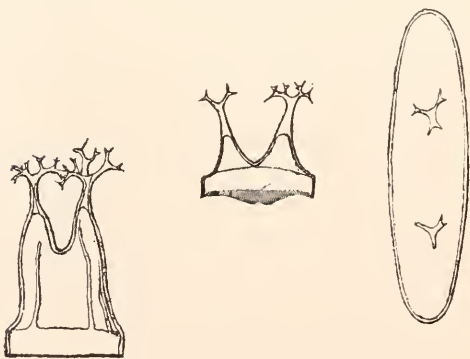


## GENUS 92.—PYRGODISCUS KITTON, 1885.

Fig. 143.—*Pyrgodiscus armatus*.

Valves orbicular, furnished with punctate lines, regular, radiant; showing a high central elevation, usually with eight angles, terminated by the same number of very robust, erect spines; with margins furnished with eight elevations, each crowned with a short robust awn, alternating with the spines of the central elevation, and connected with it by a ridge, or smooth, elevated line.

This genus was created for the fossil form *P. armatus* Kitt., represented in the figure in the margin (fig. 143), which is found in the marl (*Tegel*) from Brünn, in Moravia, and which is characterised by its size, which attains to 8 to 10 c.á.m. in diameter, while the *P. simplex*, afterwards created by Dr. O. Witt, is much more delicate, and hardly reaches in diameter the moiety of the preceding. It is found in Simbirsk.

Fig. 144.—*Dicladia Capreolus* Ehr.

**Dicladia** Ehr., 1844.—Frustule compressed, with sutural portion narrow, furnished with horns, more or less elongated, often ramous or furcate. Valves sometimes short and obtuse, at other times furnished with short, scattered spines.

*Dicladia Capreolus* (fig. 144 in margin), is the best known species of this genus. It is frequently met with in the living state (amongst others by Mr. Norman, in *Ascidinus*, off Hull), and in guanos and fossil deposits (Petersburgh, Naparima, Richmond, etc.). According to the observations of Count

Castracane, *D. Capreolus* is only a spore of a *Chaetoceros*, and consequently should be named *Ch. Di cladia* (*Ehr.*) *Cast.* See Castr. "Challenger," p. 81, pl. 19, f. 7.

I include the *Thaumatonema* of Greville in the *Di cladia*.

### GENUS 93.—SYRINGIDIUM EHR., 1845.



Fig. 145.—*Syringidium Americanum*

Frustules elongated, with valves furnished with mucronate horns. Valves usually dissimilar, one of them having only a single and the other two horns or processes.

The genus includes about a dozen forms; the *S. Americanum* *Bal.*, represented in the margin (fig. 145), is found in a living state in Brazil, at Trinidad, and in Bengal, and is also found in a fossil state in the deposit of Nankoori.

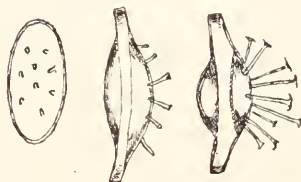


Fig. 146.—*Syndendrium Diadema*.

### *Syndendrium* Ehr., 1845.—

Valves dissimilar, one smooth, the other furnished with numerous elongated spines, often ramous.

According to Mr. Cleve and Count Castracane, *Syndendrium* are only spores of *Chaetoceros*.

*Syndendrium Diadema* *Ehr.*, represented in the margin (fig. 146), is found in Peruvian guanos. Mr. Lagerstedt has also noticed it at *Fiskebackii*, Bahnsie, and Mr. Norman in *Ascidinus* off Hull, England.

### GENUS 94.—HERCOTHECA EHR., 1844.

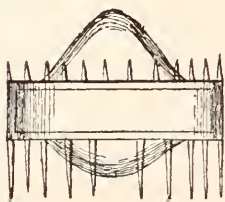


Fig. 147.—*Hercotheca mamillaris*.

Frustule with dissimilar valves, one slightly inflated with a rounded inflation, the other with a very strong elevation, subconical. Valves bordered with a marginal corona of spines or erect needles.

I give in the margin, after Ehrenberg, *Hercotheca mamillaris* *Ehr.*, which is found in a fossil state at the Bermudas.

## GENUS 95.—GONIOTHECIUM EHR., 1844.

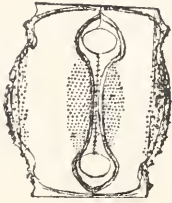


Fig. 148.—*Goniotechium*  
*Odontella* var. *Danica*.

genus to *Chaetoceros*. The *G. Odontella* Ehr. var. *Danica* Grun., found in the deposit of Mors (Jutland), is represented in fig. 148 in the margin.

Valves similar, smooth or hyaline, more or less irregularly elliptic, without spines. Sutural face often showing fine puncta ; frustules united in chains, inflated at the median portion, then constricted, and lastly, suddenly attenuate at the apices.

Brightwell and Castracane refer this



TRIBE XX.—MELOSIREÆ.

Frustules apiculate (the extremities of the margin drawn out into a point), not radiate.	{	Frustules cylindrical, with dissimilar valves.	{	Frustules showing in the girdle face a simple or alate apiculus . . . . .	<b>Pyxilla.</b>			
				Frustules showing in the girdle face a comb of alate spines welded at the base . . . . .	<b>Ktenodiscus.</b>			
				Frustules not cylindrical, apiculate in the valve face; valves similar . . . . .	<b>Peponia.</b>			
Frustules cohering by the spines.	{	{	{	One or more spines, central, coronal or scattered, robust, rather short; but no internal costæ . . . . .	<b>Stephanopyxis.</b>			
				Numerous scattered spines, sometimes also round the valve; valve with broad margins, furnished with internal costæ on the girdle face . . . . .	<b>Muelleriella.</b>			
				Valves furnished with narrow and very long marginal spines; spines simple or branches all of equal length . . . . .	<b>Skeletonema.</b>			
Frustules cylindrical, with somewhat large regular marginal teeth and a peculiar central clasping spine	{	{	{	Valves furnished with a peculiar hooked central nodule . . . . .	<b>Rutilaria.</b>			
				Valves linear, with median portion inflated, elliptic, without any peculiar nodule; linear portion smooth, with spines, without septa . . . . .	<b>Clavularia.</b>			
Valve elliptic or sub-linear, with spines or marginal teeth, and the median portion inflated elevated.	{	{	{	Frustules cylindrical; ends first constricted and finally expanded into a connecting nodule . . . . .	<b>Strangulonema.</b>			
				Frustules united by a delicate mucous thread; valves slightly silicious, having small marginal spines and radiating dichotomous striation . . . . .	<b>Thalassiosira.</b>			
Frustules not as above.	{	{	{	Frustules united into long filaments.	{	Frustules and valves with cellular structure . . . . .	<b>Endyctia.</b>	
				Frustules closely united, robust; valves circular, very silicious, often furnished with small teeth at the junction of the frustules.		Frustules and valves punctate, not cellular . . . . .	<b>Melosira.</b>	
Frustules and valves not as above.	{	{	{	Valves somewhat hyaline and conical or inflated in girdle view, showing costæ or ribbed lines in girdle view; apices often truncate or spinous; interspaces punctate . . . . .	<b>Mastogonia.</b>			
				Valves apparently hyaline and showing from 3 to 5 mammiform elevations . . . . .	<b>Pantocksekia.</b>			
Frustules not as above.	{	{	{	Frustules united by twos and threes.	{	Frustules compressed, subquadrangular; valve elliptic . . . . .	<b>Druridgea.</b>	
				Valves not as above.		Valves with areolate margin and hyaline, umbilicate centre . . . . .	<b>Centroporus.</b>	
				Valves round, convex, like a watch-glass.	{	Margin not arcoate.	Valves regularly striate-punctate throughout the surface . . . . .	<b>Podosira.</b>
						Valves with umbilicate centre, very finely striate, sub-hyaline . . . . .	<b>Hyalodiscus.</b>	

## GENUS 96.—PYXILLA (GREV, 1864), H.V.H. Emend.



Fig. 149.

*Pyxilla Barbadosis.*

Fig. 150.

*Kentrodiscus Hungaricus.*

Fig. 151.

*Pterotheca aculeifera.*

Frustules simple, cylindrical, pyxidiform ; valves often of unequal length, showing in the centre a simple or alate apiculus.

As we understand this genus, it includes three genera of other authors, which we consider as subgenera only, differing from one another as follows :—

{	Apiculus simple . . . . .	. . . . . <i>Pyxilla</i> Grev.
	Apiculus covered with small scattered spines . . . . .	. . . . . <i>Kentrodiscus</i> Pant.
	Apiculus laterally alate and branched . . . . .	. . . . . <i>Pterotheca</i> Grun.

I figure here *Pyxilla Barbadosis* Grev. (fig. 149), *Kentrodiscus Hungaricus*, Pant., (fig. 150), and *Pterotheca aculeifera*, Grun. (fig. 151). All these forms are fossil.

## GENUS 97.—KTENODISCUS PANT., 1891.

Fig. 152.—*Ktenodiscus Hungaricus.*

Valves rounded, convex, divided into compartments dichotomously, with margins surrounded by elliptic hyaline spaces. Frustules showing in girdle view the valves very inflated, crowned with a comb of alate spines fastened at the base.

I reproduce (fig. 152) after Dr. Pantocsek *Ktenodiscus Hungaricus* Pant., a curious fossil form from Hungary, which resembles a Prussian helmet.

The genus also includes *Kten. Rossicus Pant.*, which has been found at Kusnetz (Russia), which differs from the preceding form by its less developed comb and by the broad hyaline margin of the valve.

GENUS 98.—PEPONIA GREV., 1863.

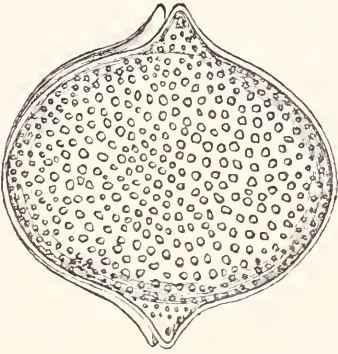


Fig. 153.—*Peponia Barbadensis*.

does deposits, Bridgewater (!) and Cambridge Estate.

Valves inflated, subcircular, with margin abruptly prolonged into a triangular apiculus, obtuse on the two opposite sides. Surface of the valve and of the apiculus areolate. Apiculus with apex raised into a short horn.

This genus only includes one species, *P. Barbadensis Grev.* (fig. 153), which has been found in Barba-



Fig. 154.

*Strangulonema  
Barbadensis.*

GENUS 99.—STRANGULONEMA  
GREV., 1865.

Frustules puncto-areolate, united into a cylindrical filament. Valves constricted near the apices, then spread out and enlarged into a nodule.

This genus was created for *S. Barbadensis Grev.* We reproduce the figure of this author (fig. 154), but in the specimen of this diatom in my possession the constriction is abrupt and not like the neck of a decanter, as designed by Greville. Nor can I recognise the undulated soldering of the adjacent nodules. This very rare diatom is found in the Cambridge Estate (Barbadoes).

GENUS 100.—SYNDETOCYSTIS RALFS. Manuscr.,  
1864.

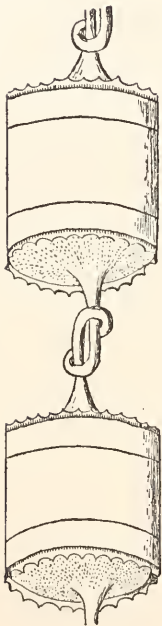


Fig. 155.  
*Syndetocystis Barbadensis.*

Valves subcircular, with dentate margins ; having in the centre a cylindrical process, curved into a hook, which unites the valves to that of the next frustule, and thus produces a filament.

We reproduce (fig. 155), after Walker and Chase, *Syndetocystis Barbadensis* Ralfs, a very curious form, found in the Cambridge Estate Deposit, Barbadoes.

In the Manuscript for the Fifth Edition of Pritchard, which forms part of my library, Ralfs thus expresses himself:—

“*Syndetocystis N. G. Ralfs.* Frustules as in *Biddulphia*, but connected in a chain-like manner by strong spines from the centre of their valves. The frustules in the front view resemble those of the other genera of this family, except in having from the centre of each valve a

stout central spine, which is suddenly bent near the end and curved in a link-like manner round a similar spine from the adjacent frustule. In the fossil state at least these spines slide upon each other, altering the distance between the frustules, as is well shown in fig. 155, taken from a very perfect specimen belonging to our friend Mr. Norman, of Hull.

“*S. Barbadensis* Ralfs., also from Cambridge Deposit, Barbadoes. Mr. Johnston.

“Valves broadly elliptical or suborbicular, with a process near each apex and one or more subulate spines, which are best seen in the front view. Surrounding the stout central spine is a large smooth portion, bordered by a circlet of pearly granules, from which radiate rows of granules.”

GENUS 101.—RUTILARIA (Grev., 1863). Emend Grev., 1866.

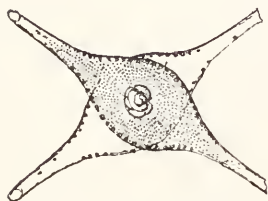


Fig. 156.—*Rutilaria* (*Epsilon* var.) *tenuicornis*.

in the text (fig. 156) represents *R. (Epsilon var.) tenuicornis* Grun., found in a living state at Manilla.

GENUS 102.—CLAVULARIA GREV., 1865.

Frustules free, linear, elongated, with numerous transverse divisions, an elevation at the median portion and numerous awns. Valves linear, dilated at the median portion, shewing somewhat scattered awns on the surface.

A single species, *Clavularia Barbadosis* Grev., found by C. Johnson in the Cambridge Deposit, Barbadoes (fig. 157).

This curious form disconcerts all preconceived ideas, and it is difficult to know where to class it.

In the specimens in my possession, the valve is smooth and shows no trace of striation; the spines are not situated in a straight line, as in Greville's drawing, whose figure we reproduce, but they are scattered on the valve.

We give below the description which Greville made of *C. Barbadosis*. The examination of my specimens, which are unfortunately few in number, suggests a doubt if *C. Barbadosis* be a true diatom.

The following is Greville's description:—

"Frustule '0060" to '0080" in length and scarcely '0002" in breadth, perfectly linear, except

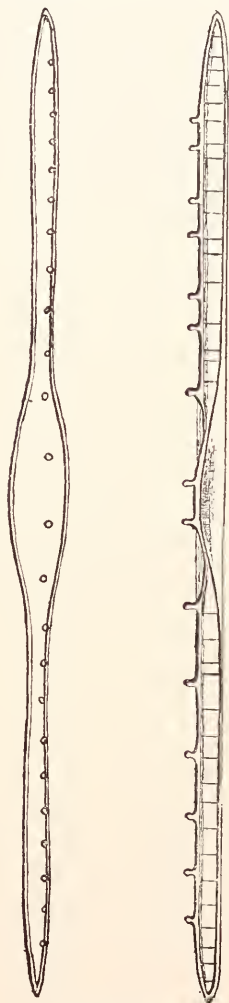


Fig. 157.  
*Clavularia Barbadosis*.

at the acute apices, having narrow margins, one of them (which I call the upper) strong and coloured. Numerous transverse dissepiments occur throughout the whole length, at irregular intervals, except for a space of about  $\cdot 0014''$  in the middle, which is occupied by a smooth lamina, folded up, as it were, and pressed against the surface, and so concealing the dissepiments, convex above, where it is on a level with the coloured margin, and gradually tailing off below into the uncoloured margin. Along the upper margin are situated a row of very short stout subcapitate processes, standing up like little nails, at irregular distances, evidently arising out of the substance of the margin itself, and of the same colour, and having no reference to the pseudo-dissepiments. The number of these processes varies; two generally, but sometimes three or four, belong to the centre, and between the centre and each apex there are from 6 to 9. The valve is the view which occurs most frequently, and strongly resembles a *Ceratoneis*, there being an oblong inflation or expansion in the middle which passes suddenly into the long exceedingly narrow sub-acute arms. The processes above described appear in the view of the valve as strong, brilliant puncta, seated on one of the margins; but the puncta which occur in the centre or inflated portion (nearly  $\cdot 0004''$  in breadth) are situated more or less in the middle of the space and not on the margin."

**GENUS 103.—STEPHANOPYXIS (EHR., 1844), Char.  
emend.**

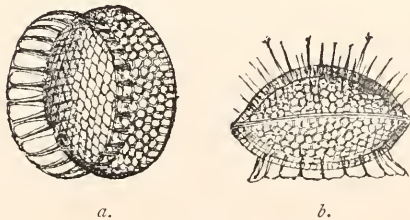


Fig. 158.—*Stephanopyxis corona*.  
a. Valve.      b. Frustule.

Frustules cohering by their spines. Valves rounded or elliptic, much inflated, with structure usually cellular, with either a central spine or coronal or scattered spines, very conspicuous.

As I understand it, *Creswellia Grev.* and *Trochosira Kitt* are included, according to the above definition, in the genus *Stephanopyxis*.

The species of this genus number more than 30, only one of which, *Stephanopyxis Turris (Grev.) Ralfs (Creswellia Turris)*, H.V.H. Atl., p. 83ter., f. 12\*), appears to have as yet been found on the British Coasts. This was found by Stolterfoth on the surface of the Dee, England, and by Norman, in

Ascidians, off Hull.

They are all fossil or marine, and inhabit especially the torrid and arctic regions. We give here the frustule (fig. 158*b*), and the valve (fig. 158*a*), of *Stephanopyxis corona* (Ehr.), *Grun.* (*Systephania* Ehr.), which is found in the Nottingham deposit. *Trochosira mirabilis* Kitt., (fig. 159*a*), and *Trochosira spinosa* Kitt. (fig. 159*b, c*), are both found in the "moler" of Mers (Jutland).



Fig. 159.—*a.* *Trochosira mirabilis*.  
*b. c.* *Trochosira spinosa*.

#### GENUS 104.—MUELLERIELLA, H.V.H., 1894.

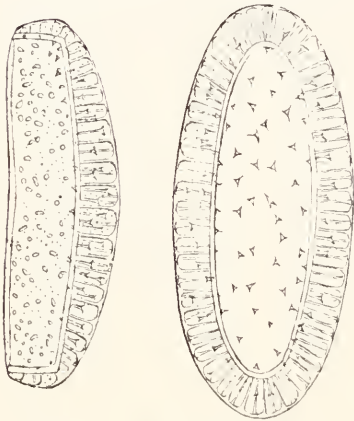


Fig. 160.—*Muelleriella limbata*.

by keeping me *au courant* with his works.

Valves elliptic, with non-cellular structure, the median portion apparently smooth, with short scattered spines, margins robust, divided into numerous rectangular compartments, formed by the presence of perpendicular costæ at the margin.

We have pleasure in dedicating this new genus to our friend the Baron and Dr. Ferd von Mueller, the learned explorer of Australia, who for more than twenty years has honoured me

**M. limbata** (Ehr.) H.V.H. (*Pyxidicula limbata* Ehr., H.V.H. Atl., pl. 83ter, f. 13-14\*).

Valve elliptic, much inflated, convex; central portion apparently smooth, but really covered with very fine puncta scattered here and there; other portions irregularly in quincunx; numerous robust short spines, bifid or trifid, alate, and anastomosing at the bases. Margins very robust, punctate like the median portion, divided into rectangular compartments, in consequence of the presence of internal costæ perpendicular to the margins of the valve. Major diameter of the ellipse, 8 to 10 c.d.m.; minor diameter, about 4 c.d.m.

Fossil.—Sta. Monica (Prep. Weissflog, Nos. 010 and 011), Richmond.

**var. Cristagalli** Brun. and Temp. (Diat. Japan, p. 40, pl. 8, f. 8).

Girdle face broad and like a hood, having the form of a cock's comb.

Limestone from Sendai and Yedo (Brun).

var. *delicatula* H.V.H., resembles somewhat the preceding variety, but differs from it by the margin in girdle view being narrower, and by the valve having only short simple spines at the central portion, and furnished on the margin with a row of long, slender, recumbent spines. Silica delicate; puncta scattered, conspicuous; costæ feeble, distant.

Fossil.—Sta. Monica (Weissflog, in prep., No. 011).

### GENUS 105.—THALASSIOSIRA CLEVE, 1872.

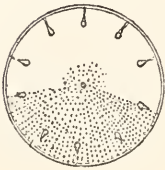


Fig. 161.

*Thalassiosira Nordenskiöldii*. This genus only includes *R. Nordenskiöldii* (fig. 161), a delicate species, whose valves are from 2 to 2.5 c.d.m. in diameter, and which is found floating on the surface of the Arctic seas in large quantities.

### GENUS 106.—SKELETONEMA GREV., 1865.



Fig. 162.

*Skeletonema mirabile*.

Frustules cylindrical, united into a filament; valves inflated, heuri-spherical or digitiform, with a marginal corona of long teeth or spines, simple or bifurcate at the summit.

The genus *Skeletonema* includes about a dozen species, of which only a single species belongs to our region; it is the:



**S. Costatum (Grev.) Cleve.** (*Melosira costata* Grev., T.M.S., 1864, iv., n.s., p. 77, pl. 8, f. 3-6; H.V.H. Atl., pl. 91, f. 4 and 6\*), plate 33, figs. 889, 890.

Valves slightly silicious, inflated convex, bordered by a corona of long simple, erect, parallel spines. Diam., 1 to 1.5 c.d.m.

Marine.—Found floating in the Scheldt, on a level with Hansweert (H.V.H.). English Coasts: Yorkshire (G. Norman), Teignmouth (Cresswell!). Baltic Sea. Found also in China, Java, and in Peruvian guano.

We represent in the text (fig. 162) *S. mirabile* Grun., a very curious species inhabiting Siberia.

#### GENUS 107.—STEPHANOGONIA EHR., 1844 Ch. Emend.

Valves somewhat hyaline and conical or inflated in girdle view, with costæ or ribs in valve view; apices often truncate or spinous; interspaces punctate.

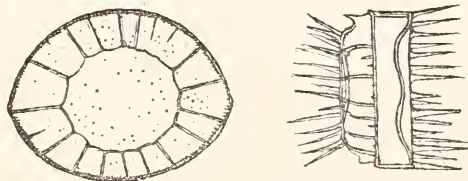
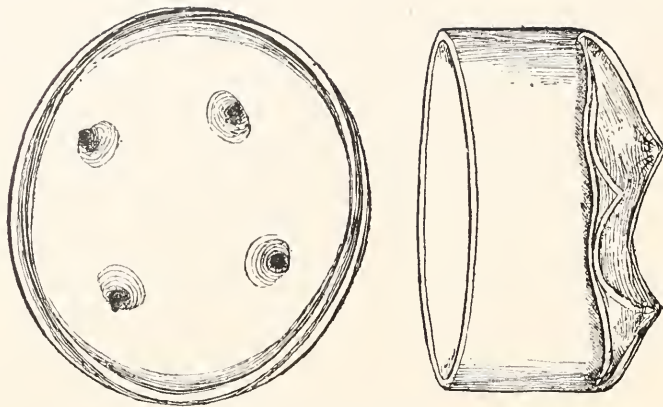


Fig. 163.—*Stephanogonia Actinoptychus*.

This genus only includes a few fossil species. We represent in the text (fig. 163), *Stephanogonia Actinoptychus* (Ehr.), (*Mastogonia* Ehr.), found in the Nottingham deposit.

#### GENUS 108.—PANTOCSEKIA GRUN., 1886.

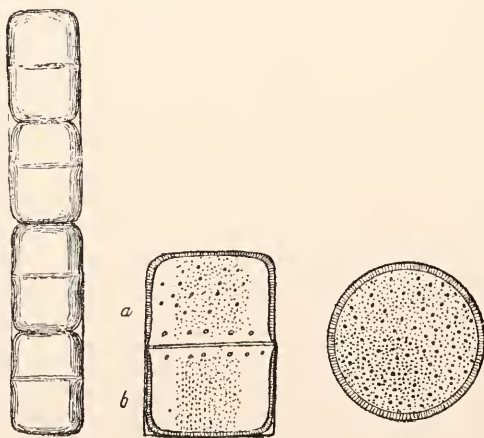
Frustules sub-cylindrical. Valves sub-circular, bearing 3-5 mammiform elevations arranged in a circle. Puncta excessively delicate, giving the valve the appearance of being hyaline, the silica of the valve being much thickened.

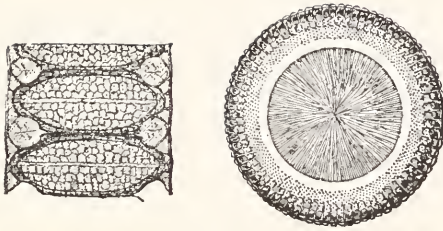
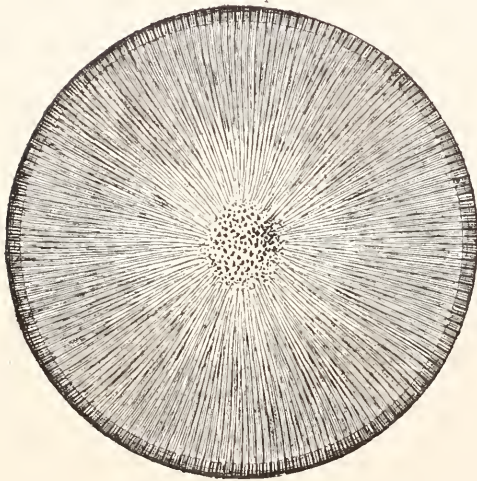
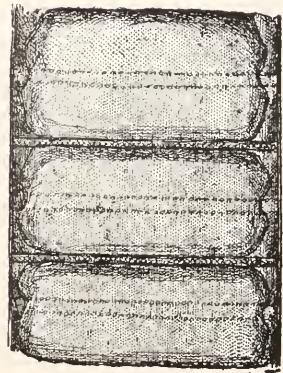
Fig. 164.—*Pantocsekia clivosa*.

The genus includes only a single species *P. clivosa* Grun., which is found in various deposits in Hungary.

#### GENUS 109.—MELOSIRA AGARDH, 1824.

Valves circular, plane or convex, often with small teeth at the junction of the frustules, which are united into a filament of greater or less length.

Fig. 165.—*Melosira varians*.

Fig. 166.—*Melosira sulcata*.Fig. 167.—*Melosira Roeseana*, var. *dentrotercs*.Fig. 168.—*Melosira arenaria*.

The species of the genus *Melosira* are scattered throughout the world. The genus includes a large number of species, which have been divided by various authors into several different genera. Without admitting these genera the *Melosira* may nevertheless be divided into various groups, viz. :—

*Gallionella*, the valves of which are carinate ;

True *Melosira* without keels, the valves being simply punctate ;

*Paralia*, the valves of which are both punctate and areolate.

We represent here *Melosira varians* Ag. (fig. 165), *Melosira* (*Orthosira*) *arenaria* Moore (fig. 168), *Melosira* (*Paralia*) *sulcata* (Ehr.) Kütz. (fig. 166), and lastly *Melosira Roeseana* Rabh., of which Ehrenberg made a special genus under the name of *Liparogyra* (fig. 167).

ANALYSIS OF SPECIES.

I. *Valves simply punctate*.—MELOSIRA.

\* Junction surfaces of frustules convex.

Valves with one or two projecting keels.	{	Valves with only a slight keel. Frustules globular, usually in long bands . . . . .	<b>M. nummuloides.</b>
		Valves with two subconical keels. Frustules usually solitary or united by two individuals . . . . .	<b>M. Westii.</b>
Valves without a keel.	{	Frustules very robust, breadth usually greater than length, subglobular or disciform, with valves not constricted between the sutural zone and the apices which are strongly convex . . . . .	<b>M. Borreri.</b>
		Frustules constricted between the sutural zone and the apices, which are more or less flattened.	{
		Frustule moderately robust, length usually slightly greater than breadth, apices much flattened . . . . .	
		Frustule slightly robust, length usually greater than breadth, apices very slightly flattened . . . . .	<b>M. Jurgensii.</b>

\*\* Junction surfaces of frustules plane, often denticulate.

1. FRUSTULE SHOWING A SULCUS NEAR THE SUTURAL MARGIN.

Frustule more or less narrow, delicate; valve entirely covered with granules.	{	Length of frustules usually not much greater than breadth. Valve with rather strong granules . . . . .	<b>M. distans.</b>
		Length of frustules usually greater than breadth. Valve with very fine puncta . . . . .	<b>M. crenulata.</b>
Frustule robust, broad; valve showing at the centre some coarse isolated granules . . . . .			<b>M. Roeseana.</b>

2. FRUSTULE WITHOUT SULCUS ON EACH SIDE OF THE CONNECTING ZONE.

Frustules very robust, walls very thick, breadth greater than length, finely striate; disc with costæ . . . . .		<b>M. arenaria.</b>	
Frustule moderately robust; disc granular, without costæ.	{	Filament formed of elongated frustules, with coarse conspicuous granules . . . . .	<b>M. granulata.</b>
		Filament formed of short frustules, with granules absent or only very delicate and obscure; frustule often containing imperfect septa . . . . .	<b>M. Dickiei.</b>

II. *Valves punctate and areolate*.—PARALIA.

A single form . . . . . **M. sulcata.**

I. *Valves simply punctate* : MELOSIRA.

\* Junction surfaces of frustules convex.

**M. nummuloides (Bory) Agardh.** (Syst. Alg., p. 8; H.V.H. Atl., pl. 85, f. 1 and 2\*; Type No. 457), plate 18, fig. 608.

Valve circular, very convex, with a rather elevated keel, covered with concentric, undulated striæ; puncta fine (18 to 20 dots in 1 c.d.m.); centre smooth. Frustules globular, elliptic, united in pairs, forming a long moniliform filament. Diameter, about 3 c.d.m.

Marine.—Covering the piles of the palisades at Blankenberghe; England (W. Sm., Norman, Kitton, Arnott, Comber, Stolt.); Scotland (Baxter Coll., No. 2748); Ireland (W. Sm.); South Wales (Baxter Coll., No. 2815); and on all the Coasts of the North Sea.

**M. Westii W. Sm.** (S.B.D., ii, p. 59, pl. 52, f. 333; H.V.H. Atl., pl. 91, f. 11 and 12\*; in Type No. 320), **plate 18, fig. 609.**

Valves circular, strongly convex, with two keels, one marginal, the other near the apex; external keel surrounded by a circle of puncta in quincunx, in the middle of which, on the internal side of the keel, is found a circle of coarse beads or small processes, inequally distant, about 2 in 1 c.d.m., excessively fine, centre dull. Frustules globular or subconical, solitary or united by twos. Diameter, 3 to 4 c.d.m.

Marine.—Blankenberghe, Antwerp (Scheldt); England (W. Sm., Kitton, Comber, Stolt., Norman); Scotland; and probably on all the Coasts of the North Sea.

**M. Borreri Grev.** (Hooker's British Flora, p. 401; H.V.H. Atl., pl. 85, f. 5-8\*; Type No. 458), **plate 18, fig. 610.**

Valves strongly convex, with coarse puncta, between which are found fine puncta irregularly in quincunx, visible only by oblique illumination, about 20 rows in 1 c.d.m.; junction-surface hyaline, sometimes showing some isolated dots. Frustules geminate, very robust, breadth usually more than length. Diameter, 2.5 to 4 c.d.m. Sporangial frustules much larger, about 6 c.d.m.

Marine and brackish water.—Blankenberghe; England (W. Sm., Kitton, Comber, Stolt., Norman); Scotland (Dickie, Arnott); Ireland (Arnott, O'Meara); and on all the Coasts of the North Sea.

**M. varians Ag.** (Consp., 1830, p. 64; H.V.H. Atl., pl. 85, f. 10, 11, 14, and 15\*; Type No. 459), **plate 18, fig. 611.**

Valve circular, almost plane, covered with fine puncta, between which are found some coarse dots. Frustules geminate, with fine puncta, intermixed with some coarser dots, with a row of submarginal, distant, coarse beads. Connecting zone enclosing two frustules, finely striate. Sporangial frustules almost globular. Diameter, 1.5 to 3.5 c.d.m.

Fresh water.—Very common throughout Europe.

**M. Jurgensii Ag.** (Syst. Alg., p. 9; *M. subflexilis* W. Sm.; H.V.H. Atl., pl. 86, f. 1-3 and 5\*; Type No. 460), **plate 18, fig. 612.**

Differs from the preceding by its more elongated frustules and its valves more convex, and very constricted near the margins.

Brackish water.—Belgium, Holland, England, Germany, etc.; Scotland (Kitton in Baxter Coll., No. 3846).

**var. octogona Grun.!** (H.V.H. Atl., pl. 86, f. 9\*; in Type No. 460), **plate 18, fig. 613.**

Connecting zone with blunted angles.

Brackish water.—Austruweel near Antwerp. Mixed with the type-form.

**\*\* Junction surfaces of frustules plane, often denticulate.**

I.—FRUSTULES SHOWING A SULCUS AT THE SUTURAL MARGIN.

**M. Roeseana Rabenh.** (Alg., Nos. 383 and 504, Sussw. Diat., pl. 10; *Orthosira spinosa* W. Sm.; H.V.H. Atl., pl. 89, f. 1-6\*; Type No. 465), **plate 19, fig. 614.**

Valves circular, with striæ radiant, punctate, puncta becoming more and more fine towards the centre, which is hyaline, and furnished with two to five coarse granules; striæ on the margin of the disc about 7 in 1 c.d.m. Frustules with valves constricted towards the disc, whose margins are denticulate, and having near the sutural margin a broad and deep sulcus. Connecting membrane very finely striate, about 21 striæ in 1 c.d.m. Diameter of valve, 1.25 to 4.5 c.d.m. Sporangial frustule almost spherical.

On moss, etc.—Frahan (Delogne), France (De Bréb.), England (W. Sm.), Scotland (Kitton in Baxter Coll., No. 3850), Ireland (O'Meara).

**var. spiralis (*Liparogyra spiralis* Ehr.)**; H.V.H. Atl., pl. 89, f. 7 and 8\*; in Type No. 465), **plate 19, fig. 616.**

Frustules narrow and very elongated, furnished internally with a spiral band transversely striate.

With the preceding.—Very rare. Norwich, England (Kitton).

**M. distans Kütz.** (Bac., p. 54, pl. 2, f. 12; H.V.H. Atl., pl. 86, f. 21-23\*; Type No. 461), **plate 19, fig. 616.**

Valve circular, with sparse, rather strong puncta. Frustules with very thick valves, sulcus rather broad, but very deep. Striæ, 14 in 1 c.d.m.

Fresh water.—Hatrival (Del.). Found throughout Northern Europe.

**var. nivalis** (W. Sm.), (*Coscinodiscus minor* W. Sm. nec Kütz.; H.V.H. Atl., pl. 86, f. 25-27\*; Type No. 462), **plate 19, fig. 617.**

Valve with stronger and more approximate puncta.

Marine.—Scotland (Baxter Coll., No. 2699).

**M. crenulata** Kütz. (Bac., p. 35, pl. 2, f. 8; *M. orichalcea* W. Sm.; H.V.H. Atl., pl. 88, f. 3-5\*; in Types No. 401, 481, etc.), **plate 19, fig. 618.**

Valve with finely punctate disc, puncta scattered, margins showing numerous well-marked denticulations. Frustule much longer than broad, showing on the margin of the valves a slightly marked sulcus, striate, with striæ generally somewhat oblique, about 18 in 1 c.d.m., consisting of somewhat elongated puncta. Diameter, .67 to 2.0 c.d.m.

Fresh water.—Probably not rare. Found throughout our regions.

**forma tenuis** (*M. tenuis* Kütz.; H.V.H. Atl., pl. 88, f. 9 and 10\*), **plate 19, fig. 619.**

Differs from the type-form by the greater length of the frustules and smaller diameter, which does not exceed .5 c.d.m.

Fresh water.—Lake in Park at Antwerp (H.V.H., Type No. 190).

**forma Binderiana** (*M. Binderiana* Kütz.; H.V.H. Atl., pl. 88, f. 16\*), **plate 19, fig. 620.**

Frustules excessively elongated. Length equal to 5-8 times the diameter.

Fresh water.—Rouge-cloître (Delogne).

All these forms are sometimes met with in the same gathering and even in a single filament; they are therefore only forms deserving of being ranked as varieties (Kitton).

## 2. FRUSTULE WITHOUT A SULCUS ON EACH SIDE OF THE CONNECTING ZONE.

**M. arenaria** Moore (in Ralfs Ann., xii., pl. 9, f. 4; H.V.H. Atl., pl. 90, f. 1, 2 and 3\*; Type No. 468), **plate 19, fig. 621** (left-hand figures).

Valve with very thick walls; disc furnished with costæ, which add to the breadth and height, from near the centre to the circumference, where they simulate spines; centre slightly depressed and covered with puncta; costæ about 6 in 1 c.d.m., fitting perfectly with those of the adjoining disc. Frustule broader than long, finely striate; striæ punctate in quincunx (about 18 longitudinal rows in 1 c.d.m.). Valve with sutural margin furnished with costæ on its thickened portion, and of which the apices fit together and simulate two rows of beads. (In fig. 1 of H.V.H. Atl., pl. 90, these rows of

beads are, in error, drawn separated; they should touch one another). Diameter, 6 to 10 c.d.m.

In humid mosses, &c., rare?—Alle (Delogne) Schooten near Antwerp (H. Van den Broeck), England (W. Sm., Kitton, Arnott, Norman), Scotland (Greville), Ireland (Dickie, O'Meara).

**M. granulata (Ehr.) Ralfs.** (in Pritch., p. 820; H.V.H. Atl., pl. 87, f. 10-12\*; Type No. 463), **plate 19, fig. 621** (right-hand figures.).

Valve disc with large granules, scattered, distant, slightly marked, margin much indented. Frustules elongated, with valves marked with very coarse, strongly marked granules, arranged in longitudinal lines, 7 to 9 in 1 c.d.m. Diameter, '5 to 1'75 c.d.m.

Fresh water.—Brussels, Antwerp, rare? France, England.

**var. curvata Grun.** (H.V.H. Atl., pl. 87, f. 18\*), **plate 19, fig. 622.**

Valves very long, filament very narrow, curved.

Fresh water.—Antwerp. Mixed with type-form.

**M. Dickiei (Thwaites) Kütz.** (Spec. Alg., p. 889; *Orthosira Dickiei* Thw.; H.V.H. Atl., pl. 90, f. 10, 12, 15 and 16\*; Type No. 469), **plate 19, fig. 623.**

Valves with fine granules only occupying the central portion. Frustules short, with very fine puncta and a row of stronger puncta through the length of the connecting zone. Typical frustules are often mixed with other elongated, ellipsoidal frustules, formed of several individuals incompletely partitioned, emboxed one in the other. Diameter, 1'25 to 1'75 c.d.m. Length of typical frustules, 1'25 to 2'5 c.d.m. and of partitioned frustules up to 5 to 6 c.d.m.

Fresh water.—Very rare? Frahan (Delogne), Scotland (Dickie!), Ireland (O'Meara).

## II. *Valve punctate and areolate*: PARALIA.

**M. sulcata (Ehr.) Kütz.** (Bac., p. 55, pl. 2, f. 7; *Orthosira marina* W. Sm.; *Paralia sulcata* Heib.; H.V.H. Atl., pl. 91, f. 16\*; in Types Nos. 470, 490, etc.), **plate 19, fig. 624.**

Valve disc bordered with a series of coarse beads, alternating with a series of smaller and more or less visible beads, and of a broad circle of fine puncta in quincunx. Central portion entirely hyaline (*var. genuina Grun.*) or having round the hyaline centre a series of fine radiant costæ of greater or less length (*var. radiata Grun.*). Frustule showing at the sutural margin a series of large elongated alveoles, followed by smaller alternating alveoles. Diameter, 3 to 5 c.d.m.

Marine.—Rather rare. Blankenberghe, Antwerp (Scheldt); England! (Brightwell, Kitton Capron, Oliver, Stolt., Norman); Scotland (H.V.H., Type No. 101); Ireland (W. Sm., O'Meara). Probably should be found on all the Coasts of the North Sea.



## GENUS 110.—ENDYCTIA EHR., 1845.

Frustules cellular, simple, or forming a short filament. Valves circular, reticulate, or areolate, with raised denticulate margins.

The genus *Endyctia* is related on one side to *Stephanopyxis* and *Melosira*, and on the other to *Coscinodiscus*. We represent in the text (fig. 169) *Endyctia*

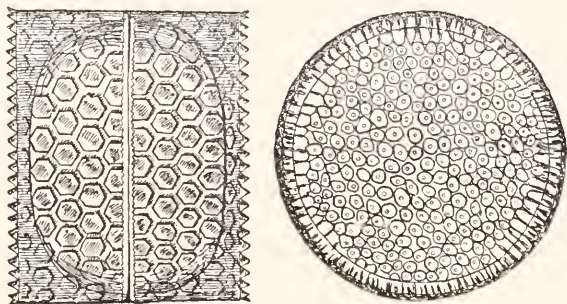


Fig. 169.—*Endyctia oceanica*.

*oceanica* Ehr., found in Peruvian guano, and found also by Dr. Pantocsek in a fossil state in Hungary. The genus includes about a dozen species, all of which (with the exception of *Endyctia Campechiana* Grun.) have been found in Hungary.

## GENUS 111.—CYCLOTELLA KÜTZ. 1833.



Fig. 170.

*Cyclotella Kützingiana*  
var. *Schumanni*.

Valve disc divided into two portions, the exterior annular, with striæ smooth (costæ) or punctate, more or less fine, sometimes intermixed with small spines; always without a pseudo-nodule; centre often bullate, smooth or granular, with granules sparse or radiating. Girdle face straight or undulate. Frustules not united in a band.

Some fifty *Cyclotella* have been described or named. These diatoms are spread over the whole world, and are found in a fossil state as well as living; a considerable number of species are small and the greater number have undulated valves; they are especially differentiated from *Melosira* by never being joined by long bands, but, at most, are only found united by two or three individuals. The species figured in the text is *Cyclotella Kützingiana* var. *Schumanni* Grun. (fig. 170.)

## ANALYSIS OF SPECIES.

Valves not as above.	Valve having in the central portion a rosette of elevated triangular dots	Valve with margin strongly striate, with centre coarsely punctate and usually near the margin of the latter a demi-circle of coarse puncta . . . . . <b>C. striata.</b>		
		Valve having in the central portion a rosette of elevated triangular dots . . . . . <b>C. antiqua.</b>		
	Valves without elevated triangular dots.	All the striæ equally well marked.	Marginal striæ intermixed with much stronger striæ, at regular distances . . . . . <b>C. comta.</b>	
			Marginal striæ intermixed with small spines . . . . . <b>C. operculata.</b>	
		Striæ without small spines.	Marginal striæ intermixed with small spines . . . . . <b>C. Meneghiniana.</b>	
			Marginal striæ very robust; puncta radiant . . . . . <b>C. Meneghiniana.</b>	
			Marginal striæ feeble; centre with fine scattered puncta sometimes mixed with some coarse dots . . . . . <b>C. Kützingiana.</b>	

**C. striata (Kütz.) Grun.** (*Coscinodiscus striatus* Kütz.; *Cyclotella Dalasiana* W.Sm.; H.V.H. Atl., pl. 92, f. 6-10\*; in Type No. 320; *var. stylorum*, Type No. 474), **plate 22, fig. 651.**

Valve with margin strongly striate, centre coarsely punctate, puncta scattered. Centre often bordered with a semi-circle of more distant puncta; 7 to 12 costæ in 1 c.d.m. at the margin of the valves. Diameter, 3 to 8 c.d.m.

Marine.—Antwerp (Scheldt, H.V.H.), England (Dallas, Kitton, Norman).

**C. antiqua W. Sm.** (S.B.D., i, p. 28, pl. 5, f. 49; H.V.H. Atl., pl. 92, f. 1\*), **plate 22, fig. 652.**

Valves with well-marked marginal costæ, intermixed with spines or coarse dots, centre finely granular, with 6 to 15 triangular elevations. Diameter, 1.5 to 3 c.d.m.

Fresh water.—Not yet found in Belgium. England (Norman); Western Islands (Baxter Coll., Nos. 2733, 2734); Peterhead Deposit (Baxter Coll., No. 2737); Aberdeen Deposit (T. and P., No. 443); Ireland (W. Sm.); Norway, Finmark, &c.

**C. comta (Ehr.) Kütz.** (Spec. Alg., p. 20; *Discoplea comta* Ehr.; H.V.H. Atl., pl. 92, f. 16-22\*; in Type No. 424), **plate 22, fig. 653.**

Valve with well-marked marginal costæ, each third or fourth costæ being much more vigorous than the others; central portion finely striate, striæ punctate or more or less radiant. Girdle face somewhat inflated in the middle. Frustule plane, not undulated. Diameter, .75 to 3 c.d.m.

Fresh water.—Antwerp (H.V.H.), England (Kitton).

**var. radiosa Grun.** (H.V.H. Atl., pl. 92, f. 23, and pl. 93, f. 1-9\* ; in Type No. 475), **plate 22, fig. 654.**

Larger than the type-form, with centre showing punctate striæ distinctly radiant. Attaining as much as 4 c.d.m.

Not yet found in Belgium. Scotland (H.V.H., Type No. 475).

**C. operculata Kütz.** (Bac., p. 50, pl. 1, f. 1, 12 and 15 ; H.V.H. Atl., pl. 93, f. 22-28\* ; Type No. 476, *var. mesoleia*), **plate 22, fig. 655.**

Valves with rather marked marginal costæ, intermixed with small spines arranged regularly. Centre finely punctate, puncta scattered (*var. mesoleia Grun.*) or radiant (*var. radiosa Grun.*). Girdle face undulate, 16 or 17 costæ in 1 c.d.m. Diameter, 1.25 to 3 c.d.m.

Fresh water.—Not yet recorded in Belgium, but found in France, England (Kitton, Comber, Norman), Ireland (Dickie, O'Meara).

**C. Meneghiniana Kütz.** (Bac., p. 50, pl. 30, f. 68 ; *C. Kutzingiana W. Sm. !* ; H.V.H. Atl., pl. 94, f. 11-13\* ; in Type No. 478 ; *forma minor* : Type No. 479 ; *var. rectangulata Breb.* : Type No. 480), **plate 22, fig. 656.**

Valve with robust marginal striæ, delicately punctate, transversely ; centre with fine radiant dots and one or two coarse dots placed almost in the middle of the ray. Girdle face undulated. Striæ, 7 to 9 in 1 c.d.m. Diameter, 1 to 2 c.d.m.

Fresh water.—Antwerp, Holland, England (Kitton, Norman), Ireland (O'Meara).

**C. Kutzingiana Chauvin.** (H.V.H. Atl., pl. 94, f. 1, 4 and 6\* ; Type No. 477), **plate 22, fig. 657.**

Valve with fine marginal costæ, centre very finely punctate, puncta scattered, with sometimes 1 to 3 coarse isolated dots. Girdle face strongly undulated. Striæ, 12 to 14 in 1 c.d.m. Diameter, 1.25 to 2.5 c.d.m.

Fresh water.—Antwerp, and probably in many other localities in Belgium ; Falaise (France, Breb. ! ) ; England (various localities : Thwaites, Norman, Kitton, Comber, Shadbolt, W. Arnott, etc.) ; Scotland (Baxter Coll., No. 2530) ; Ireland (O'Meara).

**GENUS 112.—PODOSIRA EHR, 1840.**

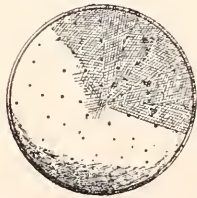


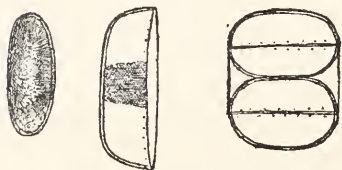
Fig. 171.—*Podosira Adriatica*.

Valves very convex, hemi-spherical, finely punctate or subareolate, puncta extending regularly throughout the valve. Frustules stipitate, solitary, or united by 2 or 3 by means of a gelatinous neck.

Marine.

The genus *Podosira* only comprises living diatoms, or those found fossil in deposits of marine origin. There are about 20 species, none of which belong to our regions. The form represented in the text (fig. 171), is *Podosira Adriatica* (Kutz.) Grun., which lives in the Adriatic.

#### GENUS 113.—DRURIDGEA DONK., 1861.

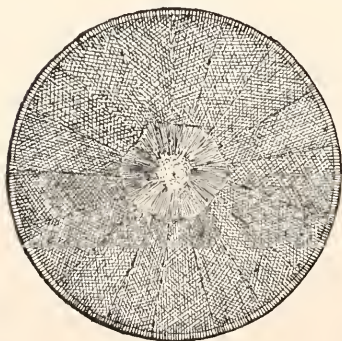


Only differs from *Podosira* by its elliptic valves and more compressed subquadrangular frustules.

Fig. 172.—*Druridgea geminata*.

This genus only comprises a single species, *D. geminata* Donk. (Q.J.M.S., 1861, i, n.s., p. 13, pl. 1, f. 15; H.V.H. Atl., pl. 91, f. 25, 26\*), represented in the text (fig. 172), and which has been found in various localities in England: Cresswell Sands (W. Arnott !); Tynemouth, Northumberland; Druridge Bay, Yarmouth Sands. We have never met with it on the Belgian shores, but it will probably be found there. It is always found on the sand of the sea-shore in frustules united in twos.

#### GENUS 114.—HYALODISCUS EHR., 1854.



Valve orbicular, with a very distinct and finely-marked umbilicus, furnished with rays or decussating lines.

Fig. 173.—*Hyalodiscus Stelliger*.

The *Hyalodiscus* are not essentially different from *Podosira* except in the umbilicus, which is more or less distinct according to the species. The genus includes about half a dozen very characteristic species, some living, some fossil, only two of which inhabit our regions: *H. Stelliger* Bail. (fig. 173), and *H. subtilis* Bail. var. *Scotica*.

## ANALYSIS OF SPECIES.

- |   |   |                         |
|---|---|-------------------------|
| { | Valve apparently divided into compartments, striation very distinct | . <i>H. stelliger</i> . |
| { | Valve not divided into compartments, striation extremely delicate   | . <i>H. subtilis</i> .  |

**H. subtilis Bail.** (New spec., 1854, p. 10, f. 12; Cl. and Möll. Diat., No. 2, sub. *H. Franklini E.*)

Valve orbicular, convex, not apparently divided into compartments; umbilicus, very distinct, coarsely punctate, with irregular, jagged margins. Valve apart from the umbilicus, apparently hyaline, with very delicate structure, puncta in lines crossing one another, forming 24 to 26 striæ in 1 c.d.m. at the median part of the valve, and attaining as much as 30 at the extreme marginal portion. Diameter, 2 to 10 c.d.m.

*Marine*.—Authors have not recorded the large form from our regions, but I have found rare specimens, possibly reaching there accidentally, not only on the Belgian coast (Blankenberghe), but also in the mud of the Scheldt. The smaller form inhabits our country, and has been recorded from Scotland, North Wales (Stolterfoth), and has been described under the name of *H. scoticus* (Kütz) Grun. (= *Cyclotella Scotica* Kütz. in Coll. H.V.H.; H.V.H. Atl., pl. 84, f. 15-18\*), plate 35, fig. 917 (× 600).

**H. stelliger Bail.** (New Spec., 1854, p. 10; *Podosira maculata* W. Sm.; H.V.H. Atl., pl. 84, f. 1, 2\*; Type No. 454), plate 22, fig. 650.

Valve orbicular, apparently divided into a large number of compartments. Umbilicus very distinct, finely granular, with irregular margins often lacinate, prolonged so as to form the margins of the compartments. Valve with granules arranged in quincunx, forming about 16 lines in 1 c.d.m. Diameter, 3.5 to 8.5 c.d.m.

*Marine*.—Frequent: Blankenberghe, Ostend, Heyst, Antwerp (Scheldt). England: Norfolk (Kitton); Surface of Dee, (Stolt.); Hull (H.V.H., Type No. 529). Bahnsa. Probably found on all the coasts of the North Sea.

## GENUS 115—CENTROPORUS PANT., 1889.



Fig. 174.—*Centroporus crassus*.  
found in a fossil state at Ananino in Russia.

Valves convex, orbicular, with broad margin decorated with small arcuate compartments, striolate and separated from the disc by a hyaline annulus. Disc punctate, with fine puncta arranged in radiant rows, centre rounded, without puncta.

This genus only comprises a single form, *C. crassus* Pant., which we reproduce here (fig. 174), and which has been

TRIBE XXI.—BIDDULPHIÆ.

		Valves unlike; frustules with one neck-like process, generally oblique, cohering irregularly .		<i>Isthmia.</i>									
Valves alike.	Frustules very silicious.	Frustules furnished with processes, often elongated, usually straight, placed at the external margin on the girdle face, sometimes obscure.	Valve with apices raised, mucronate.	Valve oval, elliptic.	Apices raised on the major diameter	Apices terminating in a hood . . . . .	<i>Bacteria.</i>						
						Apices terminating in a point or mucron.	Processes of equal length . . . . .	<i>Hemiaulus.</i>					
							Processes of unequal length, frustules cuneate . . . . .	<i>Corinna.</i>					
						Margins raised on the minor diameter; valve with small distinct umbilicus . . . . .		<i>Graya.</i>					
						Valve angular.	Valve triangular, furnished with three processes . . . . .	<i>Trinacria.</i>					
							Valves quadrangular, furnished with four processes . . . . .	<i>Solium.</i>					
				Apices not raised, no mucron; valve oval elliptic . . . . .				<i>Ploiaria.</i>					
				Valves not as above.	Frustules showing internal septa.	Frustules and valves not as above.	Septa not scalari-form.	Apices with capitate septa in girdle view, and resembling musical notes.	Valve linear-lanceolate, with several constrictions . . . . .		<i>Terpsinoe.</i>		
										Valve with three processes like nipples . . . . .		<i>Hydrosera.</i>	
										Valves with scalari-form septa.	Valves not arcuate.	Valves composed of numerous joints, cells, or pseudo-cells; gradually diminishing from the median, which is very large . . . . .	<i>Pseudo-Rutilaria.</i>
												Valves elliptic or with straight apices . . . . .	<i>Anaulus.</i>
												Valves vermiform, sigmoid . . . . .	<i>Helminthopsis.</i>
											Valves arcuate . . . . .		<i>Eunotogramma.</i>
											Valves triangular, septa numerous, in the centre of the valve a triangular figure, with different striation . . . . .		<i>Entogonia.</i>
											Valves not triangular, septa few.	Valves oblong, with inflated centre, and apices raised into obtuse processes . . . . .	<i>Porpeia.</i>
								Valves arcuate, with 2-3 septa, sometimes absent or obscure. Puncta very coarse, radiant . . . . .	<i>Euodia.</i>				
Valves elliptic circular, 3, 4, or 5 angular, etc., having elevated obtuse processes at the apices and sometimes also simple horns . . . . .								<i>Biddulphia.</i>					
Frustules scarcely silicious.	Frustrules without internal septa.	Valves not as above.	Valves not as above.					Valves elliptic, showing four elevations and transverse and radiant hyaline spaces (canaliculi?) . . . . .			<i>Tabulina.</i>		
										Valves showing 7-8 elevations, mammiform and marginal . . . . .		<i>Grovea.</i>	
										Valves showing two elevations alternating with ocelli . . . . .		<i>Huttonia.</i>	
										Valves furnished with spinous ridges . . . . .		<i>Odontotropis.</i>	
										Valves furnished with horns.	Valves bearing tortuous, often bifurcated, horns . . . . .	<i>Keratophora.</i>	
							Valves bearing long horns, terminating in cup-shaped expansion . . . . .	<i>Kittonia.</i>					
				Filament twisted round itself like a cork-screw. Valve without processes . . . . .				<i>Streptothea.</i>					
				Frustrules furnished with robust awns . . . . .	Filament not twisted spirally.	Frustrules with processes short, obtuse; valves without awns.	Valves with two processes obscure or absent.	Filament curved spirally . . . . .			<i>Eucampia.</i>		
								Filament straight . . . . .			<i>Climacodium.</i>		
								Valves with three processes, filament straight . . . . .			<i>Bellerochea.</i>		

I. ISTHMIÆ.—Frustules with valves alike, furnished with a neck-like process.

GENUS 116.—ISTHMIA AG., 1830.

Frustules compressed trapezoidal, with valves furnished with a neck-like process, usually oblique, cohering irregularly.

ANALYSIS OF SPECIES.

- |  |                     |
|--|---------------------|
| Valves furnished with nerves or interior costæ . . . . . | I. <i>nervosa</i> . |
| Valves without interior costæ . . . . .                  | I. <i>enervis</i> . |

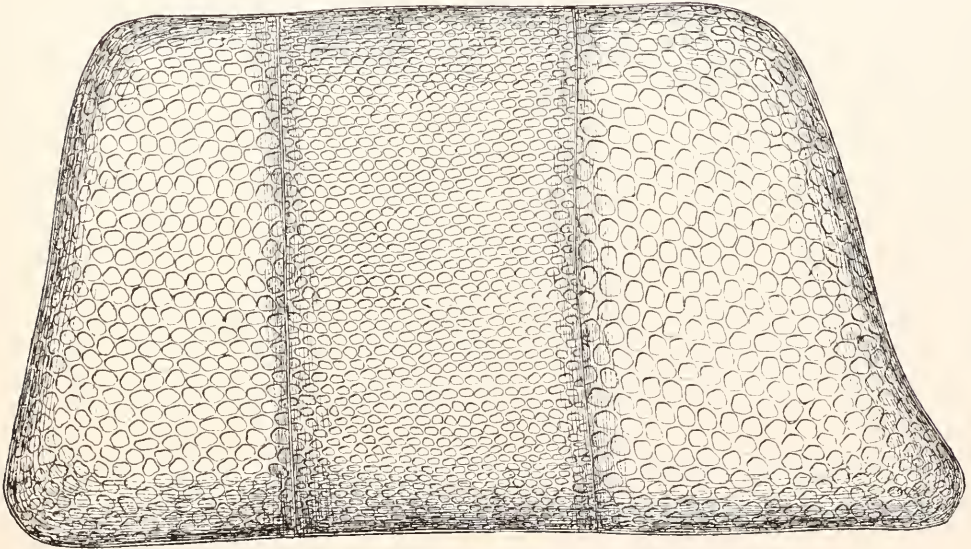


Fig. 175a.—*Isthmia Enervis*.  
Girdle view.

**I. enervis Ehr.** (Inf., p. 209, pl. 16, f. 6; H.V.H. Atl., pl. 96, f. 1-3\*; Type No. 486), plate 19, fig. 625.

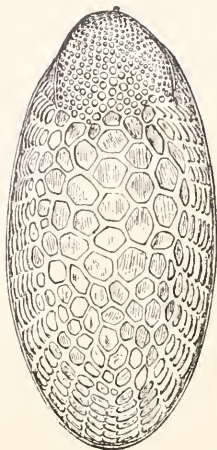


Fig. 175b.—*Isthmia enervis*.  
Valve view.

Marine, parasitic.—Very rare in Belgium, and hitherto only found in the washings of mussels. England (W. Sm. ! Ralfs, Kitton, Mrs. Griffiths, Okeden); Ireland (W. Sm., Dickie); Channel Islands (Baxter Coll. No. 3825); France (Desmazières); Finmark and Spitzbergen (Clève).

**I. nervosa** Kütz. (Bac., p. 137, pl. 19, f. 5; W. Sm., S.B.D., ii, p. 52, pl. 47\* ; H.V.H. Types, No. 485), **plate 34, fig. 89i.**

Differs from the preceding by interior costæ, which consolidate the valve and are very visible in the girdle face.

Marine.—Parasitic on other algæ. Not yet found in Belgium. England (W. Sm. ! Kitton). Ireland (O'Meara, Mrs. Lyon, Moore). Shetland Islands (Edmonstone), Denmark. Iceland (C. Agardh).

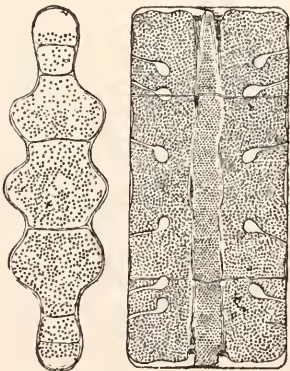


Fig. 176  
*Terpsinoë musica*.  
a. Valve view.  
b. Girdle view.

II. HEMIAULIDEÆ.—Valves simple or septate, often showing various abnormal inflations or with apices raised into a mucronate point.

**GENUS 117.—TERPSINÖE EHR.,**  
1843.

Valves furnished with transverse costæ, without spines or any trace of pseudoraphe. Frustules showing in girdle view transverse costæ, capitate, resembling musical notes. Frustules united in bands.



My genus *Terpsinoë* comprehends the genus *Pleurodesmium* Kütz., 1846, which is only differentiated by the frustules being united by the intermediary of short processes in the form of feet, and also the genus *Tetragramma* Ehr., 1843, which has as its unique characteristic, the possession of valves with fine costæ.

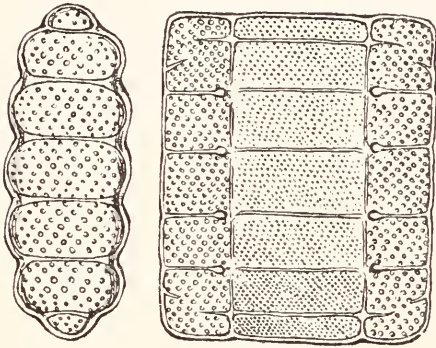


Fig. 177—*T. (Pleurodesmium) Brebissonii*.  
a. Valve view. b. Girdle view.

We figure in the text *T. musica* (fig. 176), the typical form of the genus and *T. (Pleurodesmium) Brebissonii* (Kütz.) (fig. 177). These forms belong essentially to the torrid regions. On one occasion I found a specimen of *T. (Pleurodesmium) Brebissonii* in the mud of the Scheldt at Antwerp, but it had evidently, in my opinion, been brought there by a ship coming from tropical regions.

#### GENUS 118.—HYDROSERÆ WALL., 1858.

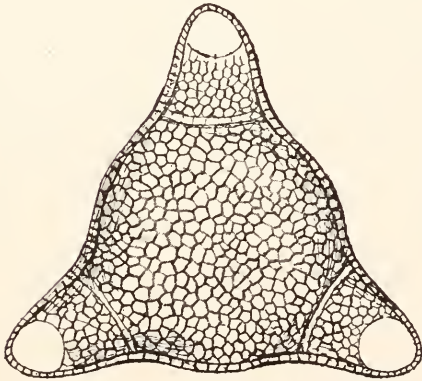


Fig. 178.—*Hydrosera triquetra*.

Valve triangular or compressed, with cellular structure, constricted at the apices which are broadly rounded. Girdle face quadrangular, areolate, with connecting membrane finely punctate. Frustules united in bands.

Grunow and H. L. Smith unite the genus *Hydrosera* with *Pleurodesmium* and *Terpsinoë*, which have the same structure. It appears to me that the angular asymmetrical form enables this genus to be distinguished from the preceding as is done by Deby and De Toni.

Three forms inhabiting Asiatic tropical seas are included in the genus *Hydrosera*, one of which, *H. Whampoense* Schw., has also been found in a fossil state in Hungary by Dr. Pantocsek.

The best known species usually found in collections is *H. triquetra* Wall., which is represented in the text (fig. 178).

**GENUS 119.—ANAULUS (Ehr., 1844), Char. emend.**

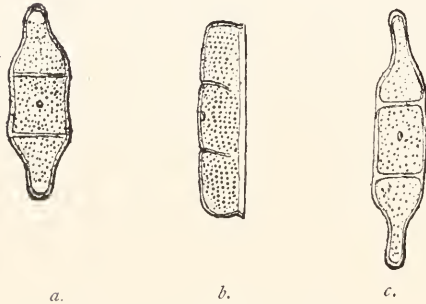


Fig. 179.—*Anaulus birostratus*.  
a., c. Valve view. b. Girdle view.

Frustule simple, with girdle face subquadrangular, furnished with costæ transverse or scalariform, not capitate: connecting zone smooth or finely striate. Valve oblong, often lunate, with margins straight or undulate.

I divide this genus into the subgenera *Eu-Anaulus* and *Eunotogramma* Auct., the latter being distinguished by the form of the valve being lunate (more or less crescent-shaped).

No true *Anaulus* (there are about a dozen species) has hitherto been found in our regions; they are found either fossil or living in the torrid or Arctic regions. Such is *Anaulus birostratus* Grun. (fig. 179), which has been found in California, Peru, Oamaru, the Balearic Islands, &c.

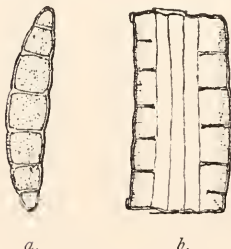


Fig. 180.—*Eunotogramma laevis*.  
a. Valve view. c. Girdle view.

As to *Ennotogramma* (fig. 130 = *E. laevis* Grun.), of which about a dozen species have been described, the following has been found in Belgium:—

**A. debilis (Grun.) H. Van. Heurck** (*Eunotogramma* Grun., H.V.H. Atl., pl. 126, f. 17-19\*), plate 34, fig. 892; plate 19, fig. 626.

Valve with ventral margin straight, dorsal margin undulate, furnished with 6 to 14 transverse costæ, finely striate, striæ forming transverse lines, 17 to 21 in 1 c.d.m. Length, 2.75 to 4.5 c.d.m.

Marine.—Ostend (Grunow).

**GENUS 120.—HELMINTHOPSIS, H.V.H. IN LITT, 1892.**



Valve very elongated, with apices sub-acute, curved in contrary directions, divided by transverse septa into rounded compartments. Surface punctate, with puncta small but very conspicuous and scattered.

This curious diatom, the name of which reminds one of its resemblance to an intestinal worm, was found by Mr. Weissflog in the Oamaru Deposit where it is very rare. I have dedicated it to my old and excellent friend under the name of *H. Weissflogii*.

Fig. 181.—*Helminthopsis Weissflogii*.

**GENUS 121.—HEMIAULUS (Ehr., 1844), H.L. Sm. Emend.**

Valve punctate, often furnished with constrictions or interior costæ, median portion often inflated, furnished with processes, often elongated, generally straight, placed on the outer margin in girdle view and tipped with a spine or mucro, which is sometimes obscure.

Heiberg created many different genera at the expense of *Hemiaulus*. Prof. H. L. Smith in the first case, and Grunow afterwards, proposed to restore Heiberg's genera to the original genus, and this I have done here, while subdividing the genus into four sub-genera as follows:—

{ Valve symmetrical.	{	Valve elliptic, oval, or sub-lanceolate, furnished with two processes . . . . .	<b>Hemiaulus.</b>
		Valve triangular, with three processes . . . . .	<b>Trinacria.</b>
		Valve quadrangular, with four processes . . . . .	<b>Solium.</b>
	Valve cuneate, with two processes, one of which much longer than the other		<b>Corinna.</b>

The figures in the text represent *Hemiaulus bifrons* (Ehr. ?) Grun. (fig. 182) from the Nottingham deposit; *Trinacria Regina* Heib. (fig. 183); *Solium exculptum* Heib. (fig. 184) and *Corinna elegans* Heib. (fig. 185), the three latter being found in a fossil state in the "Moler" of Mors.

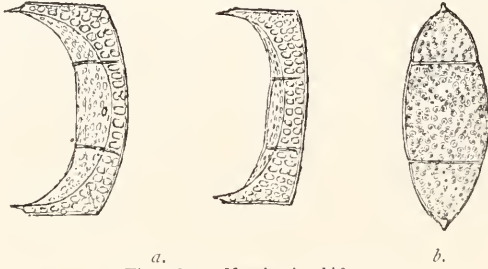


Fig. 182.—*Hemiaulus bifrons*.  
a. Valve view. b. Girdle view.

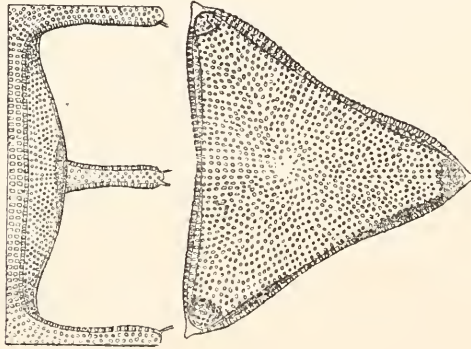


Fig. 183.—*Trinacria Regina*.  
a. Girdle view. b. Valve view.

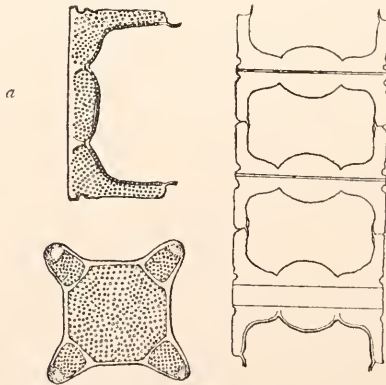


Fig. 184.—*Solium exculptum*.  
a. Girdle view. b. Valve view. c. Filament.

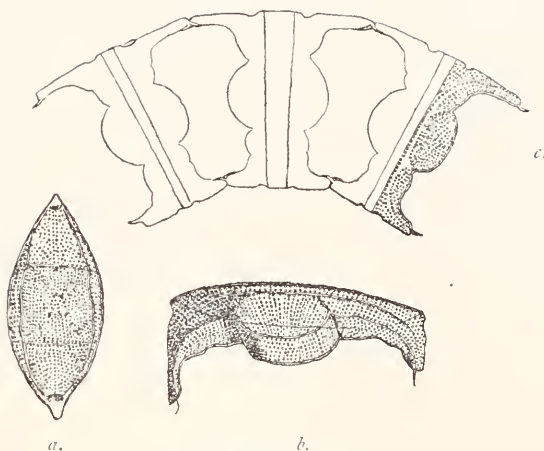


Fig. 185.—*Corinna elegans*.  
 a. Valve view.      b. Girdle view.      c. Filament.

The true *Hemiaulus*, of which more than 70 species are recorded, is rarely found in a living state. Some few species, such as *H. Heibergii*, *membranacea* and *Hauckii* have been so found in the Java Sea and the Adriatic, but the remainder are fossils, the greater number being found in the deposits of Mors, Barbadoes, Simbirsk, Oamaru, &c. The true type-forms belonging to the three other sub-genera have not yet been found elsewhere than in the deposit of the Island of Mors.

The *Hemiaulus* are large diatoms with strong silica; they form very interesting objects when viewed as a dry preparation with dark ground illumination under a low power objective and a binocular microscope. This is the best means which a beginner can employ in order to obtain a good idea of what a diatom really is.

GENUS 122.—PLOIARIA PANT., 1889.



Fig. 186.  
*Ploiaria petasiformis*.  
 a. Girdle view.      b. Valve view.

Valve lanceolate, elliptic, with apices broadly rostrate, puncta well marked and distinct, valve convex in girdle view and median portion abruptly inflated, almost hemispherical.

A single species.

**Ploiaria petasiformis** Pant. (Bacill. Mag., I., 1886 ; p. 48, pl. 29, f. 295, *sub Hemiaulo* ; II., 1889, p. 83, pl. 28, f. 403, 405), represented in the text (fig. 186). Dr. Pantocesek has found this form in the deposits of Hungary. The valve is about 5 to 6 c.d.m. in length, and about 2·5 c.d.m. in breadth.

**GENUS 123.—GRAYA BRUN & GROVE, 1892.**

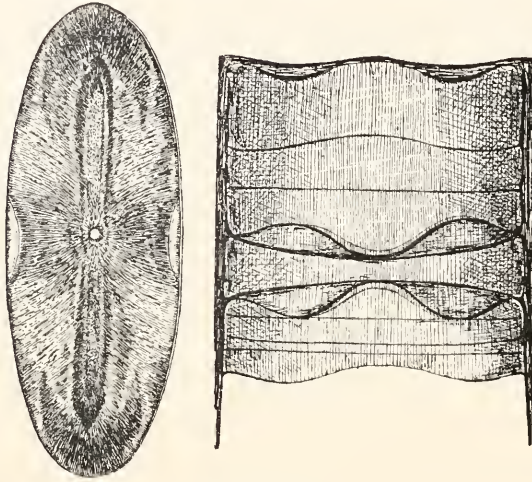


Fig. 187.  
*Graya Argonauta.*

a. Girdle view.    b. Valve view.

Valve broadly elliptic, with margin much elevated near the median portion. Centre umbilicate, often surrounded with a small area sometimes linear narrow, at other times subrhomboidal. Striæ delicate, finely punctate, radiating round the umbilicus. Girdle face very broad, appearing to be undulate in consequence of the margin of the valve being elevated ; connecting membrane very delicately punctate, Frustules united into very short filaments. A single species :—

**Graya Argonauta** Br. and Gr. (fig. 187), after Professor Brun's specimen. This form, which has only been found and named since 1892, appears to have escaped the observation of diatomists, since it is not excessively rare. It has been found in the fossil deposits of Maryland (Brun !), Sta. Monica (Thum. !), and Oamaru (Weissflog). In the specimens from Maryland the median area is elongated ; in those I have from Sta. Monica, it is rhomboidal, and lastly, it is absolutely wanting in my specimen from Oamaru.

GENUS 124.—PSEUDO-  
RUTILARIA, Grove  
and Sturt, 1886.

Valves furnished with spines, consisting of 8 to 12 cells or loculi, circular or subcircular, somewhat apiculate laterally at their median portion, arranged in a longitudinal series, the median cell very large, the others decreasing gradually. Girdle face subrectangular, showing the median cell inflated and the terminal prolonged projecting. Frustules united many together, and cohering by the terminal cells and by the spines of the median cell. A single species.

*P. Monile* Gr. and St., represented in the text (fig. 188), and which is found in the Oamaru deposit (New Zealand).

Messrs. Grove and Sturt think that *Rutilaria recens* Cleve should be added to

this genus. In my opinion the latter form differs from the *Rutilaria*, especially by the absence of the peculiar nodule and from the *Pseudo-Rutilaria* by its unique cell. This form appears to me to be intermediate between the two preceding genera, and I shall therefore make a special genus, to which I give the name of

GENUS 125.—RUTILARIOPSIS, H.V.H., 1894.

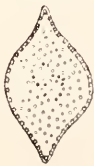


Fig. 189.—*Rutilariopsis*  
*recens*.

Valves elliptic, with apices diminuate, prolonged, raised into a point; surface with strong puncta, distant, scattered, intermixed in the median portion with some strong spines. Margin of valve furnished with a circling of spines. Girdle face very slightly convex from the apices towards the median portion; apices raised into a point and spines marginal. A single species, represented in the text (fig. 189).

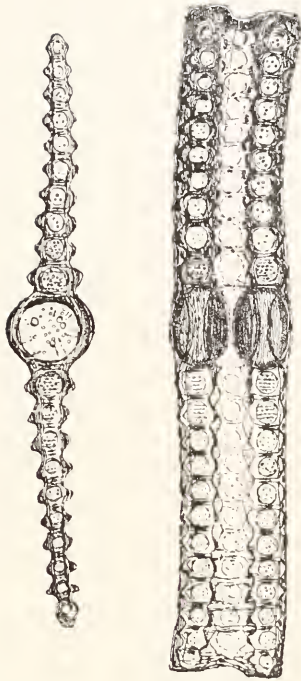


Fig. 188.—*Pseudo-Rutilaria monile*.  
a. Valve view.  
b. Girdle view.

**Rutilariopsis recens** (Cleve) H.V.H. (*Rutilaria recens* Cleve. On some new or little known Diat., p. 19, pl. 4, f. 57; H.V.H. Atl., pl. 105, f. 9). Length, 3.5 to 10 c.d.m. Breadth, 1.5 to 2.5 c.d.m. Characteristics of genus).

Inhabits the Galapagos Isles (Eugene Expedition; Weissflog).

**GENUS 126.—BACTERIA, H.V.H., 1893.**

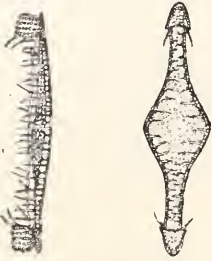


Fig. 190.  
*Bacteria Brunii*.  
a. Girdle view.  
b. Valve view.

Valve very elongated, with median portion subrhomboidal, very gently attenuated up to the apices, which are inflated-rounded, with punctate subareolate structure. Girdle face flattened, showing numerous elongated spines, which edge the valve. The two apices terminated by a species of cap, large, very projecting, with strong puncta.

I have dedicated this very curious and strongly marked genus to my kind and learned translator, Mr. Wynne E. Baxter, as a slight evidence of my recognition of all the trouble he has taken, and the sacrifices he has made, in the publication of the English Edition of this work.

**Bacteria Brunii, H.V.H.** Characteristics of the genus. Length of valve, 5 to 5.5 c.d.m. Breadth at the median portion about 1.5 c.d.m.

Fossil.—Cambridge Estate, Barbadoes (E. Weissflog).

In the unique preparation in my possession of this interesting form, the valves were disarranged and placed aslant, rendering it difficult either to design or photograph. Before attempting to return it (which I ultimately succeeded in doing) to a convenient position for photographing, and which attempt, if unsuccessful, might have caused its destruction, I solicited my friend Professor Brun to assist me, with his great talent as a draughtsman, in order that a satisfactory representation of it might be produced, and I have therefore felt it but my duty, while thanking him for his kindness, to dedicate the species to him. The figure in the margin, therefore, is a combination of the drawing of Professor Brun and the photograph which I subsequently made of it.



III. EUCAMPIEÆ.—Pelagic diatoms, with frustules slightly silicious.

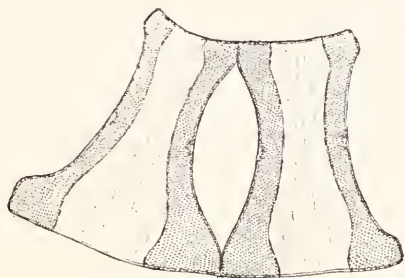


Fig. 191.—*Eucampia Zodiacus*.

GENUS 127.—  
EUCAMPIA EHR. (1839),  
Char. emend.

Frustules imperfectly silicious, cuncate, united in a spiral filament. Valve elliptic, with process slight or absent.

ANALYSIS OF SPECIES.

{	Valves apparently excavated in the girdle face	. . . . .	. <i>E. Zodiacus</i> .
	Valves plane, not excavated	. . . . .	. <i>E. Britannica</i> .

**E. Zodiacus Ehr.** (Kreideth, p. 71, No. 41, pl. 4, f. 8; H.V.H. Atl., pl. 95, f. 17, 18\*; pl. 95 *bis*, f. 1 and 2\*), plate 19, fig. 628.

Valve elliptic, rising gently towards the apices so as to form two robust rounded processes, furnished with a central pseudo-nodule, striæ delicate, radiant, finely punctate, above 16 to 18 at the margin of the valve. Girdle face cuneate, at the valve portion striate, with connecting zone showing some longitudinal plicæ. Length of valve, 4 to 5.5 c.d.m. Frustules united into a perforated filament.

Marine.—Rare. Blankenberghe 2nd Basin. In June, 1893, while engaged in pelagic dredging in the Scheldt opposite Hansweert I found this *Eucampia* in considerable quantity. Some of these were good specimens, being joined in a spiral filament of more than one complete whorl. England (Kitton, Comber, W. Sm. ! Stolterfoth !), France (De Bréb.), Holland (Suringar), near Cuxhaven (Kütz.).

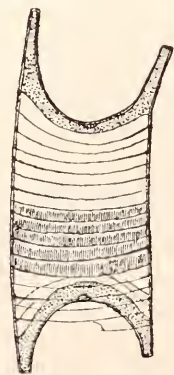


Fig. 192.—*Molleria cornuta*.

**E. Britannica W. Sm.** (S.B.D., ii., p. 25, pl. 61, f. 378\*), plate 34, fig. 893.

Valves plane, frustules united into a continuous filament, not excavated.

Marine.—Sussex, England (W. Sm.), Yarmouth (Kitton).

**Molleria cornuta Cleve.** (fig. 192) is a true *Eucampia*; it is characterised by its valves being excessively excavated, and by the apices of the valves being consequently prolonged into horns.

## GENUS 128.—CLIMACODIUM GRUN., 1868.

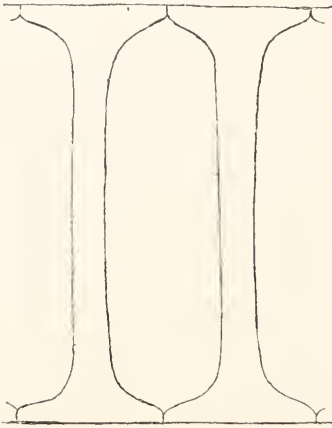


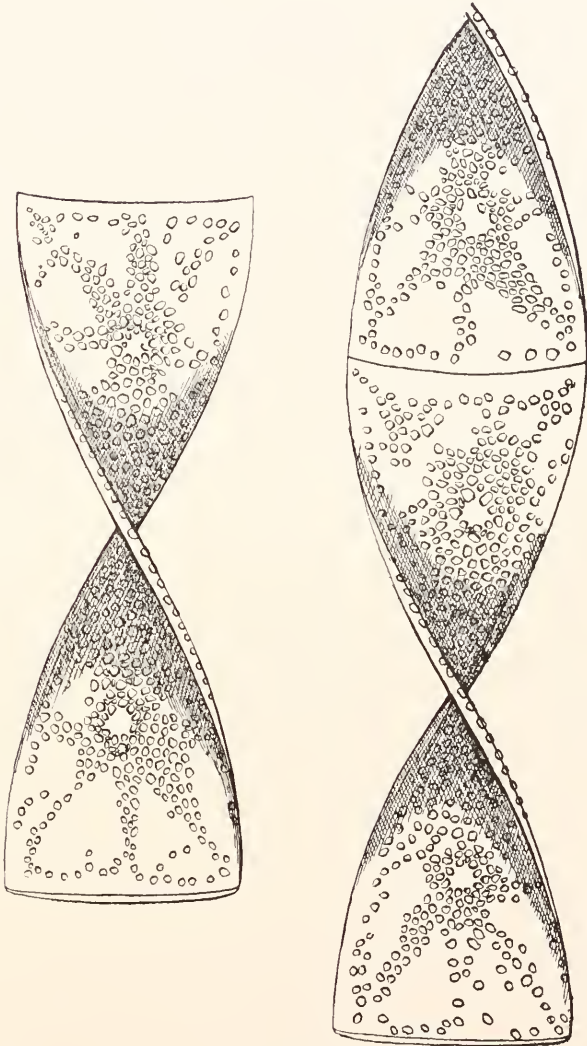
Fig. 193.

*Climacodium frauenfeldianum.*

Frustules straight, slightly silicious, united into long perforated chains. Valves with apices elevated, of equal length. *Climacodium* differs from *Eucampia* in the frustules being straight, and consequently the chains also are not curved spirally.

Only one species of this genus has been described *Cl. frauenfeldianum* Grun. (fig. 193), which was found by Frauenfeld near Tilan Shong.

## GENUS 129.—STREPTOTHECA CLEVE, 1890.

Fig. 194.—*Streptotheca Tamesis*.

Frustules not silicious, forming a long flat ribbon, twisted on itself at regular intervals. One species:—

**Streptotheca Tamesis Cleve** (in Shrubsole "On a new Diatom in the Estuary of the Thames," J.Q.M.C., 1890, iv., n.s., p. 259, pl. 13, f. 4-6).

Marine.—In the Thames at Sheerness-on-Sea (Shrubs.!).

This curious form, of which, in consequence of its fragileness and transparency, no durable preparation has hitherto been made, must be accepted as a diatom with caution, as the arrangement of the endochrome alone enables us to rank it with diatoms. Further study should be able to determine the question.

**GENUS 130.—BELLEROCHEA. H. VAN HEURCK, 1885.**

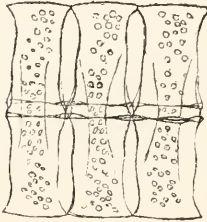


Fig. 195.  
*Bellerochea Malleus.*

Frustules scarcely silicious, united into a long narrow filament, leaving elliptical openings between one another. Valve triangular or quadrangular, with margins unequal, deeply excavated, undulate and apices slightly raised into a not very robust process.

**B. Malleus (Brightwell) H. Van Heurck.** (*Triceratium Malleus Brightw.*; Q.J.M.S., 1858, vi., p. 154; H.V.H. Atl., pl. 114, f. 1\*).

Characteristics of genus. Length of valves from one angle to another, 10 c.dm.

Marine.—Very rare? Scheldt at Antwerp (Belleroche!) Eastern and Western Scheldt (H.V.H.) England, stomachs of Noctiluce (Brightwell, Kitton). Thames.

This species encloses a greenish endochrome; the valves appear quite smooth; all kinds of illumination have failed to discover any detail whatsoever. This form is closely allied to *Eucampia*. I ventured to form this as the type of a new genus which I dedicated to the memory of my former excellent friend the late Professor John Belleroche, an enthusiastic diatomophile, who found the only recorded Belgian specimen which has been in my possession for a long time. The species therefore appeared to be very rare up to June, 1893, when I found specimens which had suddenly developed in a gathering from the Thames. Some weeks afterwards I found some rather numerous examples in one of my pelagic gatherings from near Hansweert

(Western Scheldt); then in the August of the same year, I obtained a very abundant pelagic gathering in the Eastern Scheldt, between Ouwerkerk and the red buoy of Sandcreek (Holland).

This species, therefore, does not appear to be excessively rare, but entirely pelagic, and found only at certain periods of the year.

GENUS 131.—LITHODESMIUM EHR., 1840.

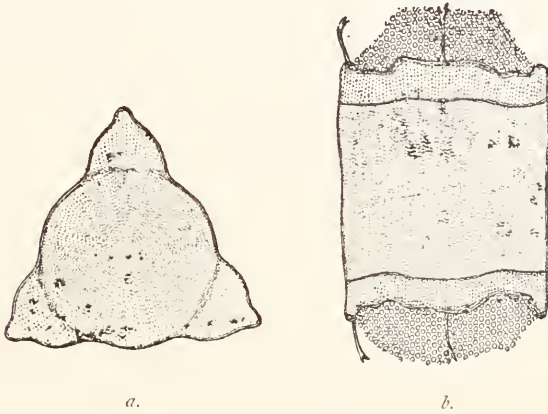


Fig. 196.—*Lithodesmium undulatum*.  
a. Valve view. b. Girdle view.

Valve triangular, with angles inflated, raised and terminated by a robust awn. Frustules very slightly silicious, united into a long filament, and connected with one another by a cellular membrane.

**L. undulatum Ehr.** (Kreideth, p. 75, No. 49, pl. 4, f. 13; H.V.H. Atl., pl. 116, f. 8-11\*; Type No. 506), **plate 19, fig. 627.**

Valve triangular, with undulated margins, apices raised and ending in a robust awn, simple or bifurcated, centre elevated and furnished with a strong spine; striæ delicate (about 10 to 14 in 1 c.d.m. at the margin of the valve), radiant, finely punctate. Length from one apex of the valve to another, 4 to 6 c.d.m. Girdle face quadrangular, connecting zone with excessively delicate longitudinal striæ, about 20 in 1 c.d.m, interrupted by transverse hyaline lines. Frustules united into a filament and closely connected to one another by a membrane marked with coarse puncta in quincunx, and forming 10 to 12 longitudinal striæ in 1 c.d.m.

Marine.—Not rare. Blankenberghe in the 2nd Basin.

IV. EUBIDDULPHIÆ.—Valves having at the apices processes more or less obtuse, and of greater or less length.

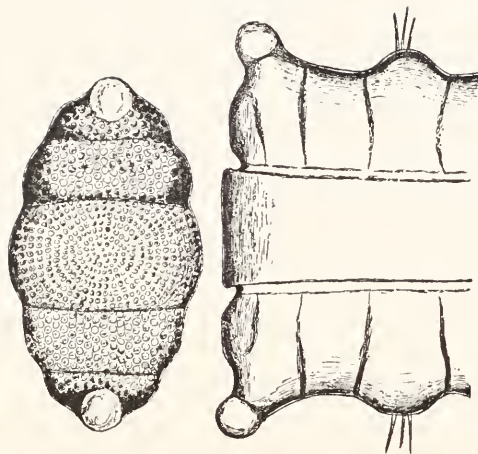
GENUS 132.—BIDDULPHIA GRAY, 1831.

Frustules free or united into filaments either continuous or in zig-zag. Valves elliptic, suborbicular, triangular, quadrangular, etc.; margins even or undulated, usually more or less inflated at the median portion, rarely depressed, showing elevated, obtuse processes at apices, and having also sometimes hornlike processes. Girdle face more or less quadrangular, showing distinctly processes which are not so visible in the valve face. Connective zone very obvious.

The genus *Biddulphia* is of vast proportions; it includes some hundreds of species and the genus requires a serious monograph written by a thoroughly competent specialist who shall have devoted a very considerable time to its examination and study.

Many of the forms belonging to the genus *Biddulphia* have been arranged in different genera. Genera have even been established, founded simply on the number of angles of the valve, such are *Triceratium*, *Amphitetras*, *Amphipentas*, *Polyceratium*; forms which are found at the same time, and both rhomboidal and angular in form, for example, *Biddulphia rhombus* (Ehr.) W. Sm., and its *forma trigona* Cleve (*Triceratium striolatum* Ehr.) show that these groups are not admissible. Although, according to the general plan of this work, we are only concerned with the species inhabiting the shores of the North Sea, I shall, nevertheless, give a figure of the type-form of each Genus group which has been established by authors in the genus *Biddulphia* as I understand it. These groups are as follows:—

- GROUP.—*Biddulphia* (fig. 197, *Biddulphia pulchella* Gray).  
 „ *Odontella* (fig. 198, *B. (Triceratium) consimile* Gr.).  
 „ *Odontella Lampriscus* (fig. 199, *B. (Triceratium) Shadboltianum* Grev.).  
 „ *Zygoceros* Ehr. (fig. 200, *B. (Zygoceros) circinnus* Bail.).  
 „ *Denticella* Ehr. (fig. 201, *B. (Denticella) granulata* Roper).  
 „ *Cerataulus* Ehr. (fig. 202, *B. (Cerataulus) Smithii* Ralfs).  
 „ *Pseudo-stictodiscus* (fig. 203, *B. (Pseudo-stict.) Eulensteinii* Grun.).  
 „ *Triceratium* (fig. 204, *B. (Triceratium) Favus* (Ehr.) H.V.H.).  
 „ *Amphitetras* (fig. 205, *B. (Amphitetras) antediluviana* (Ehr.) H.V.H.).  
 „ *Amphipentas* (fig. 206, *B. (Amphipentas) punctata* Brightw.).



a.   
 Fig. 197.—*Biadulphia fulchella*.   
 b. Girdle view.

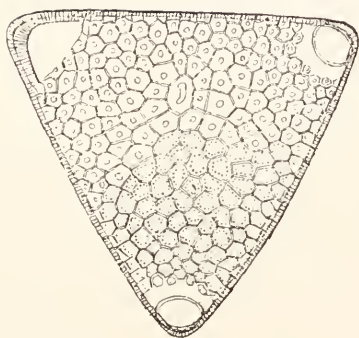
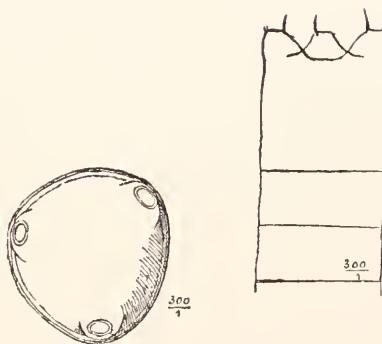


Fig. 198.—*B. (Triceratium) consimile*.



a.   
 Fig. 199.—*B. (Triceratium) Shadboltianum*.   
 b. Girdle view.

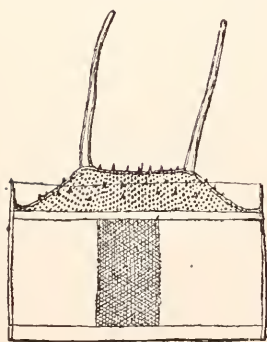
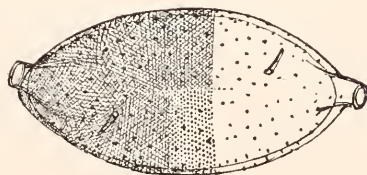
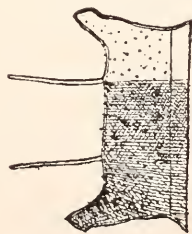


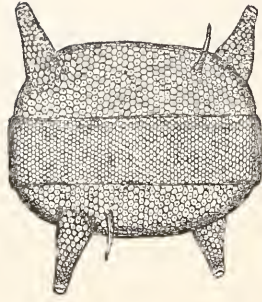
Fig. 200.—*B. (Zygoceros) concinnus*.



a.   
 Fig. 201.—*B. (Denticella) granulata*.   
 b. Valve view.



a.



b.

Fig. 202.—*B. (Cerataulus) Smithii*.  
a. Valve view. b. Girdle view.

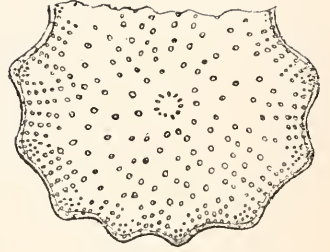
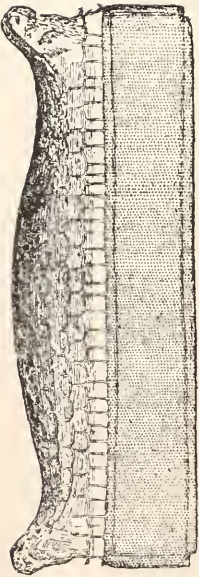
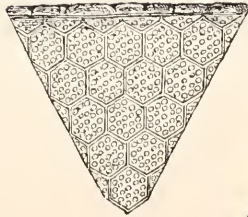


Fig. 203.—*B. (Pseudo-stictodiscus) Eulensteini*.

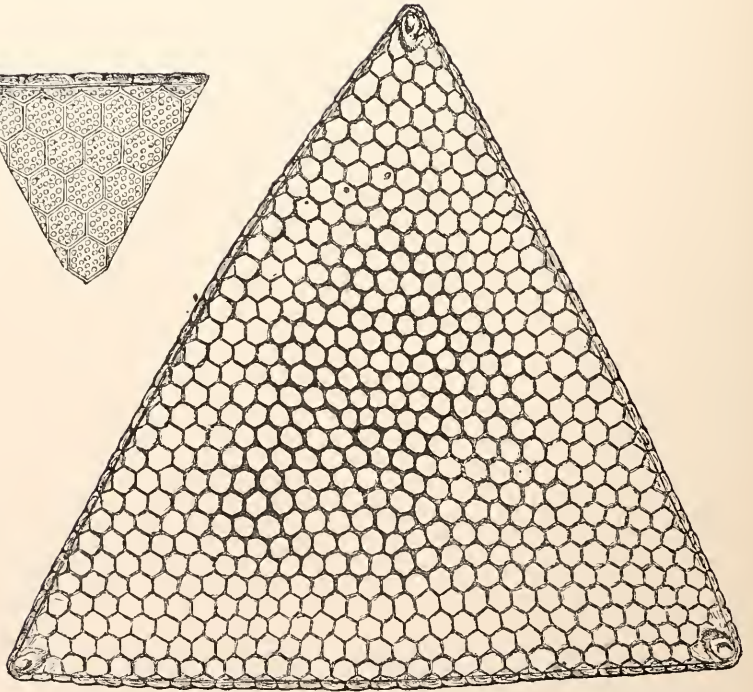
b.



a.



b. Portion of valve with puncta  $\times 1000$ .



c.

Fig. 204.—*B. (Triceratium) Favus*.  
a. Girdle view. c. Valve view.



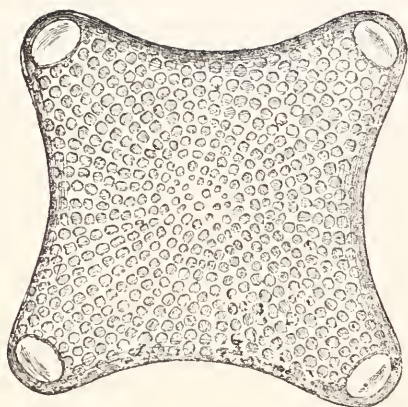


Fig. 205.—*B. (Amphitetras)*  
*antediluviana.*

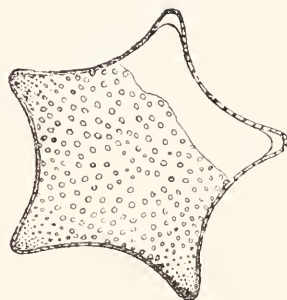


Fig. 206.—*B. (Amphipentas)*  
*punctata.*

Under the name of *Capsula*, Prof. Brun (Le Diat., ii., 1896, p. 235), has separated from *Triceratium* certain exotic forms having an internal valve with a triangular space curiously fashioned so as to recall the structure of the *Entogonia*. In this genus Mr. Brun includes two new species, *C. Barboi* J. Br. and *C. biformis* J. Br., both from "Colonial" as well as some old forms *T. denticulatum* Grev., etc.

Lastly, Mr. H. Peragallo has doubtfully suggested the genus *Cerataulina* (in Monog. Rhizosolenia) which is differentiated from *Cerataulus* by the relatively great length of the sutural zone, and by its uninterrupted annulation. He includes in it the single form *C. Bergonii*, found in a pelagic state at Trouville and in the Mediterranean.

We shall proceed to the examination of the forms from our district.

ANALYSIS OF SPECIES.

Valves furnished with costæ		. . . . .		<b>B. pulchella.</b>
		Valve divided into several compartments by very deep constrictions.		{ All the compartments equally elevated and level with the processes, which are very obtuse . . . . . <b>B. Regina.</b> { Median compartment considerably more elevated than the others; processes slender, with inflated apices . . . . . <b>B. Tuomeyi.</b>
Valves without costæ.		Valves (viewed in girdle face) divided by terminal and median elevations into three portions, almost equal . . . . .		<b>B. aurita.</b>
		Valves furnished with spines.		{ Valve furnished with two long awl-shaped spines; median portion flat or rounded. { Valve imperfectly silicious; not furnished with small spines . . . . . <b>B. Baileyi.</b> { Valve very silicious, bearing numerous small spines . . . . . <b>B. granulata.</b>
Valves without constrictions.		Median elevation (or depression) much broader than the terminal elevations.		{ Several spines placed between the processes, which are abruptly dimiuate towards the apex. Valves broadly lanceolate and inflated at the apices, or trigonal . . . . . <b>B. Rhombus.</b> { Spines alternating, with robust processes, which are not abruptly diminuate; valves not lanceolate. { Valves suborbicular, with cellular girdle . . . . . <b>B. Smithii.</b>
		Valve with elevated and rounded centre, without two very long awl-shaped spines.		{ Valves usually elliptic, not cellular. { Spines obscure, placed near the centre of the valve . . . . . <b>B. lævis.</b> { Spines conspicuous, submarginal, very robust, with apices often flattened or bifurcated . . . . . <b>B. turgida.</b>
Valves without spines.		Valves with cellular structure.		{ Valves triangular, with cells arranged in straight lines . . . . . <b>B. Favus.</b> { Valves quadrangular, with cells arranged in concentric rows . . . . . <b>B. antediluviana.</b>
		Valves punctate, not cellular.		{ Valves furnished with vein-like lines, which traverse the valve irregularly and separate the angles from the median portion . . . . . <b>B. alternans.</b> { Valves without vein-like lines, with medium-sized puncta in the median portion, and very fine puncta at the angles . . . . . <b>B. sculpta.</b>

I.—Valves furnished with costæ.

**B. pulchella** Gray (Arrang. of Brit. Plants, i., p. 294; H.V.H. Atl., pl. 97, f. 1-3\* ; Type No. 487), plate 20, fig. 630.

Valve elliptic, with undulate margins, undulations 3 to 7, each of which arise at one of the costæ. Valve with cellular structure, cells arranged in concentric rows round the centre of the valve, becoming gradually smaller as they approach the centre, where there are 2 to 3 short horns generally awl-shaped, sometimes capitate; processes punctate, puncta becoming gradually finer towards the apex. Girdle face subquadrangular, showing at the apices undulations on a level with the valve, each of which corresponds with one of the costæ; connecting zone with small cells arranged in straight lines (about 5 to 6 in 1 c.d.m.), interrupted by some irregular hyaline lines. Length of valve, 5 to 17 c.d.m. Breadth, 6 to 9 c.d.m. at the median portion.

Marine.—Found only once in Belgium in the washing of mussels, but it will probably be found more abundantly, as it exists on all the coasts of the North Sea. England (Ralfs, Griffiths, W. Sm., Bleakley). Ireland (O'Meara). Scotland.

## II.—*Valves without costæ.*

### a. Valves furnished with processes in the form of spines.

**B. Regina, W. Sm.** (S.B.D., ii., p. 50, pl. 46, f. 323; H.V.H. Atl., pl. 98, f. 1\*), **plate 34, fig. 894.**

Valves lanceolate, with undulate margins, showing three unequal compartments between the processes. Girdle face with deep constrictions, which divide the valve into three portions, mammiloid, hemispherical, with coarse puncta arranged in regular lines, intermixed with small short spines. Processes short, obtuse, mammiloid, with puncta becoming gradually finer towards the apices. Connecting membrane with medium-sized scattered puncta. Breadth of valve, 8 to 15 c.d.m.

Marine.—Isle of Skye (W. Sm.). Guernsey (Wallich!).

**B. Tuomeyi Bail.** (Am.J.S., 1843, p. 138, f. 3-4; H.V.H. Atl., pl. 98, f. 2-3\*), **plate 34, figs. 895, 896.**

This species differs essentially from the preceding, first, by the median compartment being considerably more elevated than the two lateral, and surmounted by 2 to 3 long spines, and next by the processes which are elongated, narrow, reflexed and inflated at the apices.

Marine.—This form, so far as I know, has never yet been found on our shores. I only mention it in consequence of some authors having considered that the preceding species is only a variety of *B. Tuomeyi*. The examination of numerous specimens does not enable me to agree with this opinion.

**B. aurita (Lyng.) Bréb.** (Consid. sur les Diat., 1838, p. 12; H.V.H. Atl., pl. 98, f. 4-9\*; Type No. 488), **plate 20, fig. 631**

Valve elliptic, lanceolate, with apices often diminuate, furnished at the centre with three rather long awl-shaped spines, with coarse puncta (about 10 to 12 in 1 c.d.m.) arranged in radiating lines, about 10 to 12 in 1 c.d.m. Girdle face showing at its apices the three spines and the three elevations: the median of considerably less height than the terminal, the latter abruptly attenuate at the apex, punctate, with puncta becoming gradually finer. Connecting zone with puncta of almost the same size as those of the valves, and arranged in longitudinal lines. Frustules forming very long chains. Length of valve, 3 to 8 c.d.m.

Marine.—Rather frequent. Blankenberghe, Antwerp (Scheldt), England (Kitton, Stolt., Norman, Comber, Jenner, W. Sm., Roper, Okeden), Scotland (Hennedy, Greville), Ireland (W. Sm., O'Meara), South Wales (Baxter Coll., No. 2815, 2816), North Wales (Shadbolt), and on all the Coasts of the North Sea.

**var. minima** Grun. (H.V.H. Atl., pl. 98, f. 10\*), **plate 20, fig. 632.**

Smaller, about 1.25 c.d.m.; puncta fine, about 14 or 15 striæ in 1 c.d.m.

Marine.—Blankenberghe.

**var. miniscula** Grun., **plate 20, fig. 633.**

Very small; valve with apices longly rostrate diminuate.

Marine.—Blankenberghe.

**B. Rhombus (Ehr.) W. Sm.** (S.B.D., ii., p. 49, pl. 45, f. 320; pl. 61, f. 320; H.V.H. Atl., pl. 99, f. 1 and 3\*; Type No. 489), **plate 20, fig. 634.**

Valve rhomboidal elliptic, with apices abruptly rounded, diminuate, furnished with short, awl-shaped submarginal spines of variable number; striation confused at the centre of the valve, radiant on the remainder, but convergent on the portion corresponding to the apices; striæ at the centre of the valve, about 9 in 1 c.d.m., formed of coarse puncta slightly arranged in quincunx. Girdle face with the middle valve portion rounded, slightly elevated, processes entirely punctate, with ends gently truncate capitate. Connecting membrane regularly punctate in quincunx, with puncta formed of longitudinal striæ, 12 to 14 in 1 c.d.m. Length of valve, 5 to 18 c.d.m.

Marine.—Rarer than the preceding. Blankenberghe, Antwerp (Scheldt), England (W. Sm., Bridgman, Roper, Okeden, Kitton, Stolt., Norman, Comber), Ireland (O'Meara). On all the Coasts of the North Sea.

**var. trigona** Cleve. (*Triceratium striolatum* (Ehr.) Roper; H.V.H. Atl., pl. 99, f. 2\*; Type No. 490), **plate 20, fig. 635.**

Differs from the type-form by the triangular shape of the valves, and by its three processes.

Marine.—Blankenberghe, Antwerp (Scheldt). Surface of the Dee (Stolt.), Hull (Norman). Thames at Southend (Baxter Coll. No. 2577).

**B. Baileyii W. Sm.** (S.B.D., ii., p. 50, pl. 62, f. 322; *Zygoceros mobilensis* Bail.; H.V.H. Atl., pl. 101, f. 4-6\*), **plate 20, fig. 636.**

A delicate, very imperfectly silicious diatom. Valve broadly lanceolate, bearing two spines alternating with the terminal processes, and situated at the lower and upper third near the longitudinal axis of the valve; puncta in quincunx very delicate, about 12 to 14 striæ in 1 c.d.m. Girdle face showing the valve portion with centre flat or concave, the conical terminal processes completely punctate, with truncate, somewhat capitate, ends, they and the spines very long, somewhat bifurcated at the apex, each being borne on a small elevation of the valve. Connecting membrane with puncta in quincunx, excessively delicate, about 18 striæ in 1 c.d.m. Length of valve, 7 to 16 c.d.m.

Marine.—Blankenberghe (H.V.H.), England (W. Sm., Williamson, Kitton, Stolt., Norman, Comber), Ireland (O'Meara).

**B. granulata Roper** (T.M.S., 1859, vii., p. 13, pl. 1, f. 10-11, pl. ii., f. 12; H.V.H. Atl., pl. 99, f. 7 and 8, and pl. 101, f. 4\*. In the latter figure the general outline is very exact, but in the fair copy of the drawing the small spines on the valve have been accidentally omitted; Type No. 492), **plate 20, fig. 637.**

Valve elliptic-lanceolate, bearing two very long spines alternate with the terminal processes, approximate to them and to the longitudinal axis of the valve; striated in quincunx (about 13 or 14 in 1 c.d.m.), and bearing numerous small awl-shaped spines, about 4 in 1 c.d.m., placed in irregular lines. Girdle face quadrangular, showing the valve portion with the centre flat or concave, the processes inflated, then abruptly attenuate on the external side, punctate up to the apex, which is somewhat rounded, and the spines very long, often flexed at an obtuse angle near their middle. Connecting zone with puncta in quincunx, with 14 striæ in 1 c.d.m. Length of valve, 5 to 8 c.d.m. (in the specimens observed).

Marine.—Very rare. Antwerp (Scheldt), Blankenberghe, England (Coll. W. Arnott!, Comber, Stolt., Norman).

**B. turgida W. Sm.** (S.B.D., ii., p. 50, pl. 62, f. 38; *Cerataulus turgida* Ehr.; H.V.H. Atl., pl. 104, f. 1 and 2\*; Type No. 495), **plate 21, fig. 638.**

Valve varying from a round to a longly elliptic form; sometimes furnished near the margin with a circlet of very short spines, bearing diagonally two broad truncate processes and two stout spines; striæ undulate, 9 in 1 c.d.m.,

formed of rather coarse beads and intermixed with innumerable abbreviated spines. Girdle face subquadrangular, slightly twisted, at the median portion showing terminal processes very broad, truncate, completely punctate, and the two spines very robust, with apices often bifurcated. Connecting zone with striæ formed of puncta, placed in quincunx; somewhat undulated, delicate, about 12 in 1 c.d.m. Length of valve, 7 to 13 c.d.m.

Marine.—Very rare. Antwerp (Scheldt), Blankenberghe, England (Okeden, Kitton, Stolt., Norman, Comber), Ireland (O'Meara). Found on all the Coasts of the North Sea.

**B. lævis Ehr.** (Ber., 1843, p. 122; *Odontella polymorpha* Kütz.; H.V.H. Atl., pl. 104, f. 3 and 4\*; Type No. 496), plate 20, fig. 639.

Valve suborbicular or broadly elliptic, bearing near the longitudinal axis two spines opposite, short, obscure, with punctate, radiate striæ, somewhat undulate and as if engine-turned, delicate, about 15 or 16 in 1 c.d.m., intermixed with abbreviated scattered spines. Girdle face with terminal processes very short, obtuse, truncate, punctate up to the margin. Connecting zone with delicate striæ (about 16 in 1 c.d.m.), punctate in quincunx. Length of valve, 5 to 12 c.d.m.

Marine.—Antwerp (Scheldt), England (W. Arnott).

**forma minor.** (H.V.H. Atl., pl. 105, f. 4\*), plate 20, fig. 640.  
Smaller, terminal processes scarcely marked.

**B. Smithii (Ralfs) H. Van. Heurck.** (*Biddulphia radiata* Roper; *Cerataulus Smithii* Ralfs; *Eupodiscus radiatus* W. Sm., nec Bailey; H.V.H. Atl., pl. 105, f. 1 and 2\*; Type No. 497), plate 21, fig. 641.

Valve almost orbicular, sometimes bearing numerous spines, with hexagonal cells, furnished with two marginal processes and two awl-shaped spines rather short, submarginal, forming an angle of 90° with the terminal processes. Girdle face showing in the valve portion the two long terminal processes which are conical, truncate, and entirely punctate, and the two awl-shaped spines not very robust. Connecting zone finely punctate, with puncta in regular lines, about 10 in 1 c.d.m. Frustules free. Length of valve, 4 to 12 c.d.m.

Marine.—Very rare. Blankenberghe (2nd Basin), 1878; Antwerp (Scheldt), England (W. Sm., Stolt., Norman, W. Arnott!), the Thames (Baxter Coll., No. 2579, 3450).

## b. Valves without spines.

## \* VALVES WITH CELLULAR STRUCTURE.

**B. antediluviana (Ehr.) H. Van Heurck.** (*Amphitetras Ehr.*; H.V.H. Atl., pl. 109, f. 4 and 5\* ; Type No. 501), plate 21, fig. 642.

Valve quadrangular, with margins straight or concave, centre depressed, four robust processes, finely punctate ; structure cellular, cells in concentric circles, allowing the puncta of the inferior layer of the valve to be slightly seen in the transparent portion. Girdle face quadrangular, with valves constricted near the sutural zone. Connecting membrane with coarse puncta forming irregular longitudinal lines, about 4 to 5 in 1 c.d.m., interrupted by transverse hyaline spaces. Frustules forming bands, generally in zig-zag. Length of valve, 2.5 to 14 c.d.m. (in the latter measurement the concavity of the valve has not been subtracted ; from one excavation to another, the length would not be more than 11 c.d.m.).

Fossil.—Potter's clay at Ostend (Deby). Found not only on all the Coasts of the North Sea, but also on all the Coasts of Europe, America, etc. England (W. Sm., Okeden, Ralfs, Griffiths, Kitton), Orkney Islands (Baxter Coll., No. 3111, 3112), Ireland (O'Meara), Guernsey (Baxter Coll., No. 3114).

**var. pentagona.** (*Amphipentas Ehr.*). Valve with five angles.

Not yet found in Belgium. England (Hodgson), Scotland (Hennedy).

**B. Favus (Ehr.) H. Van Heurck.** (*Triceratium Favus Ehr.*; H.V.H. Atl., pl. 107, f. 1-4\* ; Type No. 500), plate 21, fig. 643.

Valve triangular, with centre convex ; three terminal processes robust, elevated, finely punctate up to the ends ; sides straight or somewhat convex. Structure with coarse hexagonal cells allowing the fine puncta of the inferior surface of the valve to be seen. Partitions of the cells embellished with small spines. Length of girdle face much greater than the breadth ; connecting zone delicately striate lengthways (about 16 striæ in 1 c.d.m.), with puncta in quincunx. Length at the margin of a valve of medium size, 9 to 15 c.d.m.

Marine.—Rather common. Blankenberghe, Ostend, Antwerp (Scheldt), and found almost everywhere. England (Shadbolt, Hodgson, Kitton, Stolt., Norman, Comber).

## \*\* VALVES PUNCTATE, NOT CELLULAR.

**B. alternans (Bail.) H. Van Heurck.** (*Triceratium alternans Bailey*; Mic. Observ., South Carol.; H.V.H. Atl., pl. 113, f. 4, 5 and 7\* ; Type No. 505), plate 21, fig. 644.

Valve triangular, with straight margins, three terminal processes slightly elevated, separated by nerve-like lines from the median portion and having in addition, here and there, some nerve-like lines which extend across the valve entirely or partially. Structure cellular; cells irregular, gradually diminishing towards the margins and the processes, which are punctate up to the end. Girdle face much broader than the length, showing 3 to 4 costæ, with undulated margins, cells small, in longitudinal rows, about 12 rows in 1 c.d.m. Connecting zone very narrow. Frustules usually united in twos. Length of valve, 4.5 to 5 c.d.m.

Marine.—Rather frequent. Blankenberghe, Antwerp (Schedt). England (W. Sm., Capron, Kitton, Norman, W. Arn.). Courseulles, France (Bréb.). Holland (Suringar). Ireland (O'Meara).

**B. sculpta (Shadb.) H. Van Heurck.** (*Triceratium sculptum* Shadb., T.M.S., 1854, ii., pl. 1, f. 4; H.V.H. Atl., pl. 109, f. 7 and 8\*; Type No. 502), plate 21, fig. 645.

Valve triangular, with straight sides, three terminal processes slightly elevated; structure cellular, cells irregular, of almost equal size throughout the valve; processes finely punctate. Girdle face longer than the breadth; valve portion undulated, with cells arranged in longitudinal rows; 6 lines in 1 c.d.m. Connecting zone rather broad, having 7 or 8 longitudinal rows of coarse dots in 1 c.d.m. Length of the valve margins, about 4 c.d.m.

Marine.—Rare. Antwerp (Schedt); Potter's clay from Ostend (Deby); Sweden (Lagerstedt).

I think this form has escaped collectors, and will be found elsewhere.

### GENUS 133.—ENTOGONIA GREV., 1863.

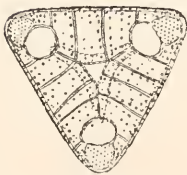


Fig. 207.—*Entogonia inopinata*.

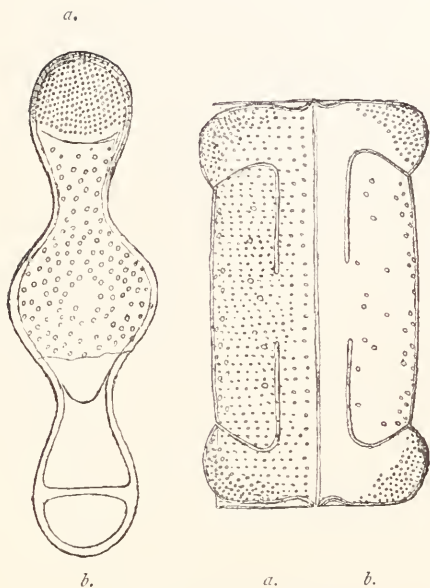
Valves angular, usually with three angles leaving at the centre a smooth portion, with the marginal portion divided into compartments by false costæ, which correspond with internal septa; angles of the valve more or less elevated into processes.

The genus *Entogonia* includes about 20 species, all fossil, and found especially in the deposits from Barbadoes and Jeremie (Hayti). I give in the text (fig. 207) *E. inopinata* Grev., from the Cambridge Estate (Barbadoes).

The genus *Heibergeria*, according to Mr. Bergon, should be suppressed; the genus being in his opinion founded only on a biangular form of *E. Davyana* Grev.



GENUS 134.—PORPEIA BAILEY, 1861.



b. a. b.

Fig. 208.—*Porpeia quadrata*.

It is represented in *a* with, and in *b* without, the sutural membrane which covers it.

Valves oblong, with strong distant puncta, inflated at the median portion, constricted at the apices, which are inflated, rounded, obtuse, capitate, finely punctate. Girdle face compressed, showing flexed internal septa.

The genus *Porpeia* includes four species, all fossil, except *P. quadriceps* Bail. which has been found in a living state in the Gulf stream and at the Galapagos Islands.

I give in the text (fig. 208) *P. quadrata* from Sta. Monica.

GENUS 135.—TABULINA BRUN, 1889.

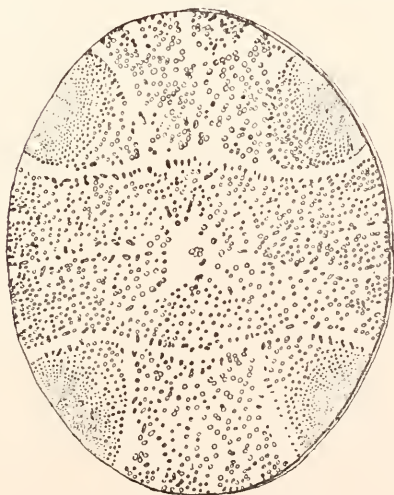


Fig. 209.—*Tabulina Testudo*.

Valve flattened, tabular, broadly elliptic, furnished with hyaline channels, radiant and transverse ; four protuberances rounded and striated. Girdle face rectilinear.

I give in the text (fig. 209) from one of my photographs a drawing of *Tabulina Testudo* Brun., the unique species of the genera. It is a very rare form which was discovered by Professor Brun. in the Limestone of Yedo (Japan).

## GENUS 136.—ODONTOTROPIS GRUN., 1884.

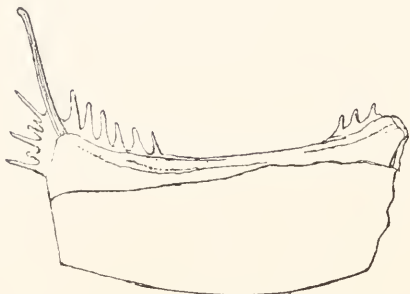
Fig. 210.—*Odontotropis cristata*.

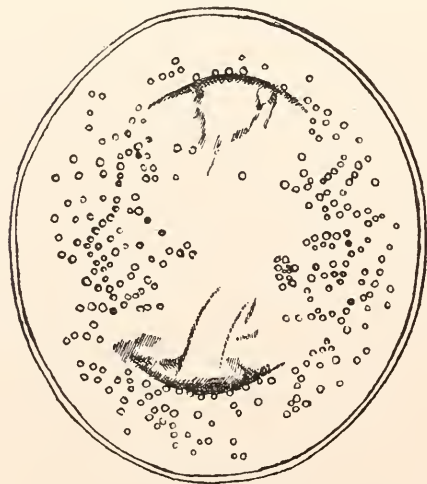
Figure 210 in the text represents *O. cristata*. It has unfortunately been made from an imperfect specimen. It should appear as if the right side was similar to the left, and the dentated comb should extend throughout the surface, which separates the two horns.

Valve biddulphoid, furnished with two long aculeate horns, connected by a pectinate, dentate or smooth keel.

This genus includes about half a dozen curious forms, two of which, *O. carinata* Grun. and *O. cristata*, are found in the Cemenstein of Mors.

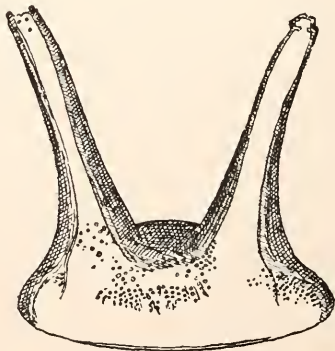
## GENUS 137 —KERATOPHORA PANT., 1889.

Valve biddulphoid, broadly elliptic, with coarse puncta, furnished with two very long robust, tortuous horns, often bifurcated.



a.

a. Valve view.



b.

b. Girdle view.

Fig. 211.—*Keratophora robusta*.

The genus includes two species, *K. nitida* P. and *K. robusta* P. (fig. 211), represented in the text, after one of my photographs, taken from a specimen forwarded by Dr. Pantocsek. The two species are found in a fossil state at Kusnetz (Russia).

GENUS 138.—KITTONIA GROVE & STURT, 1887.

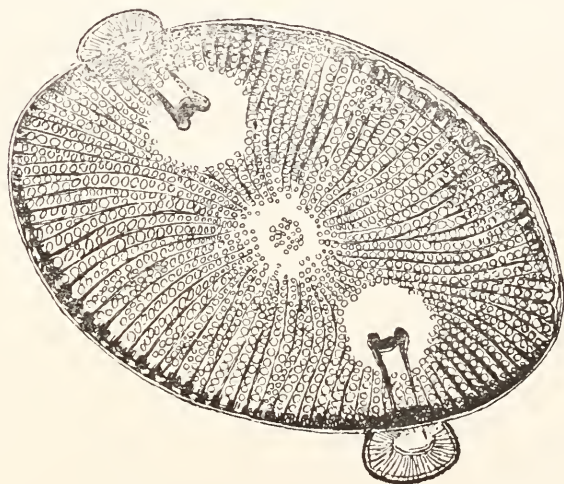
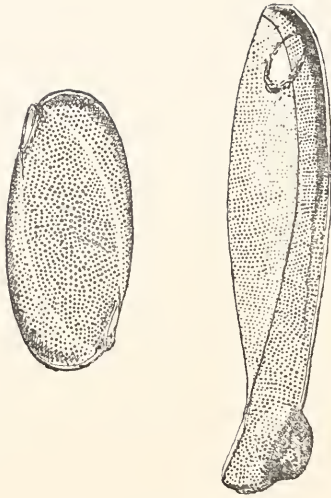


Fig. 212.—*Kittonia elaborata*.

Valve biddulphoid, elliptic, furnished with two processes, the apex of each being enlarged and widened into a cup.

This genus comprises three species, one of which (*K. gigantea* Grev.) is found in the deposit of Cambridge Estate, Barbadoes, while the other two have been found in the deposit of Oamaru, New Zealand. I give in the text (fig. 212), one of them, the most beautiful, *K. elaborata*, Grove and Sturt, drawn from one of my photographs.

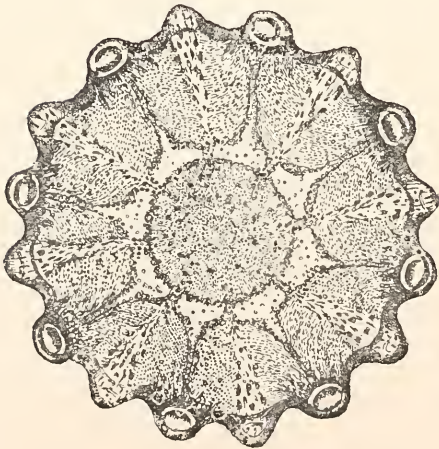
Fig. 213.—*Huttonia alternans*.

**GENUS 139.**  
**HUTTONIA, GROVE &**  
**STURT, 1887.**

Valve showing two alternate elevations or ocelli.

This genus appears intermediate between the *Biddulphiae* and the *Eupodisciae*, and requires further examination. The figure in the text is of *H. alternans*, *Gr. and St.*, from one of my photographs. This diatom is found in the deposit of Oamaru.

**GENUS 140.—GROVEA AD. SCHMIDT, 1890.**

Fig. 214.—*Grovea pedalis*.

intermediate portions very delicately punctate and bearing here and there coarse puncta.

The figure in the text is *Gr. pedalis* (*Gr. and St.*) *Ad. Schm.*, having its origin in the Oamaru deposit, and which Messrs. Grove and Sturt described under the name of *Biddulphia pedalis*, a name also adopted by Grunow. I, however, find this diatom differs sufficiently to justify the name given it by Dr. Ad. Schmidt.

Valve discoid, showing 7 to 8 mammiform-ocelliform marginal elevations, between each of which is an obtuse rounded marginal projection, placed lower than the preceding, and apparently turned in an opposite direction. Centre occupied by a broad umbilicus surrounded by a clear space communicating by clear radiant spaces with the margin of the valve,

TRIBE XXII.—EUPODISCEÆ.

TABLE OF GENERA.

Valves with mammi- form elevated ocelli, surrounded by a hyaline zone, whence emerge solid or granular rays, usually arranged like feathers of a quill pen.	Valves round or elliptic.	{ Generally 2, rarely 1 or 3 ocelli A single ocellus, eccentric	. <b>Auliscus.</b>	
			. <b>Monopsis.</b>	
		Valve subquadrangular, having an ocellus at each angle		. <b>Glyphodiscus.</b>
	Valves round or elliptic, cellular or granular, with median hyaline space absent or very small; striation usually radiant; two to nine processes surrounded by a hyaline zone			. <b>Pseudo-auliscus.</b>
	Valves with striation radiant, interrupted at the median por- tion by a linear hyaline space			. <b>Fenestrella.</b>
	Valves with coste, moniliform rays or well marked sulci connecting the processes or tubercles, which usually much project			. <b>Aulacodiscus.</b>
	Valves circular or oval, with ocelli placed in com- partments			. <b>Craspedoporus.</b>
	Valves with very fine puncta, indistinctly radiant, showing near the centre a circle of coarser dots and at the margin a corona of dots and a small elongated process			. <b>Micropodiscus.</b>
	Valves circular, with radiating rows of small puncta and coarse marginal tubercles			. <b>Perithyra.</b>
	Tubercles marginal, rather small, all similar, forming a complete circle; valves granular, with granules radiating, circular or oval or angular			. <b>Cestodiscus.</b>
Tubercles unequal, 2-3 large, placed at an equal distance between the smaller			. <b>Isodiscus.</b>	
Valves with ocelli small, nu- merous, each of them being separated by a small process from the next			. <b>Ratrayella.</b>	
Ocelli, tubercles or pro- cesses usually very large, not numerous and usually submarginal; valve cellular or granu- lar; granules rarely radiating or small			. <b>Eupodiscus.</b>	
Valves with two large elevations, of very slight height, united or covered with radiating puncta; puncta very fine, ar- ranged in radiating or anastomosing rows			. <b>Pseudo-cerataulus.</b>	
Ocelli very large or very prominent, few in number and usually submarginal, cells rarely radiating			. <b>Eupodiscus.</b>	
Ocellus single, submarginal; valve showing according to the focus either hexagonal cells or fine puncta			. <b>Roperia.</b>	
Ocelli two, placed on the same side of the valve in a large elongated hyaline depression			. <b>Bergonia.</b>	

## GENUS 141.—AULISCUS (EHR.) Bailey emend., 1854.

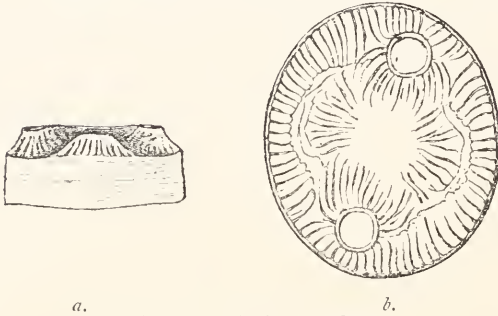


Fig. 215.—*Auliscus sculptus*.  
 a. Girdle view. b. Valve view.

Frustule cylindrical or discoid. Valve with rays either plumose plaits or with granules arranged round two mastoid processes (or ocelli), rarely obscure, sometimes with a sub-quadrated central portion or with a radiant cellulation interrupted by a linear series terminating in the ocelli.

The beautiful genus *Auliscus* comprises about 100 species, among which *A. sculptus* figured in the text (fig. 215) is the only form hitherto found on our coasts, but to this should be added *var. cœlata* (*A. cœlatus* Bail.), which certainly belong to us, as I have in my possession specimens from different localities. Lastly, I have to record *A. punctatus* Bail., which I discovered on the mud of the Scheldt at Antwerp, but until further specimens have been found, I shall consider this one as having been accidentally brought by a vessel. The specimen found belonged to the *var. Carpentariæ*.

## ANALYSIS OF FORMS.

{	Valve divided into four compartments by two series of plicæ placed at a right angle.	{	The plicæ of each compartment robust and similar	A. sculptus.
	The plicæ of compartments with ocelli robust, entire; those of the intermediate compartments delicate, and resolving into fine granules		. var. cœlata.	
{	Valve without any distinct compartments, plicæ very delicate, regularly radiating and bearing coarse distant granules	. A. punctatus.		

**A. sculptus** (W. Sm.) Ralfs. (in Pritch. Inf., p. 845, pl. 4, f. 3; *Eupodiscus sculptus* W. Sm.; H.V.H. Atl., pl. 117, f. 1 & 2\*; Type No. 507), plate 21, fig. 646.

Valve suborbicular, marked at the margin with radiating plicæ and leaving in the centre a quadrilobal space. In this space arise four other series of plicæ, of which the two bearing the ocelli radiate from them towards the centre of the valve, while the two others radiate from the centre towards the margin of the valve. Length of the valve, 4 to 9.5 c.d.m.

Marine.—Antwerp (Scheldt). Blankenberghe (H.V.H.), Bed of a dam (Potter's clay (fossil) at Bruges (Deby), Holland (H.V.H., Suringar), England (W. Sm. ! Gregory ! W. Arnott, Kitton, Norman, etc.), Ireland (O'Meara.).

**var. cœlata** (*A. cœlatus* Bail.). See the description in the analytical table above.

Antwerp (Scheldt), Blankenberghe (H.V.H.)

**Auliscus punctatus Bail.** (Smith's Contr., 1853, p. 5, f. 9: Ad. Sch. Atl., pl. 67, f. 7-8 and various plates) is a tropical species which is only included in our Table of Forms in consequence of a slight similarity of certain of its forms with *A. cœlatus Bail.*

**GENUS 142.—PSEUDO-AULISCUS LEUD-FORT., 1879.**

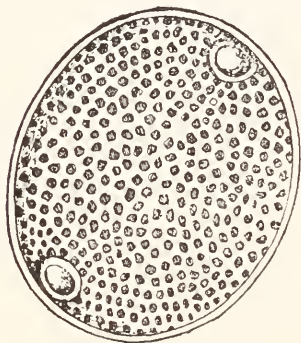


Fig. 216.—*Ps. Auliscus ambiguus.*

Valves round or elliptic, cellular or granular, with median hyaline space absent or very small; striation usually radiate, 2 to 9 processes surrounded by a hyaline zone.

This genus includes about 25 species, all exotic and for the most part fossil, found in Oamaru, Barbadoes, Hungary, etc. The figure in the text (fig. 216) is *Ps. ambiguus (Grev.) Rattray*, from the Cambridge Estate, Barbadoes.

**GENUS 143.—PSEUDO-CERATAULUS PANT., 1889.**

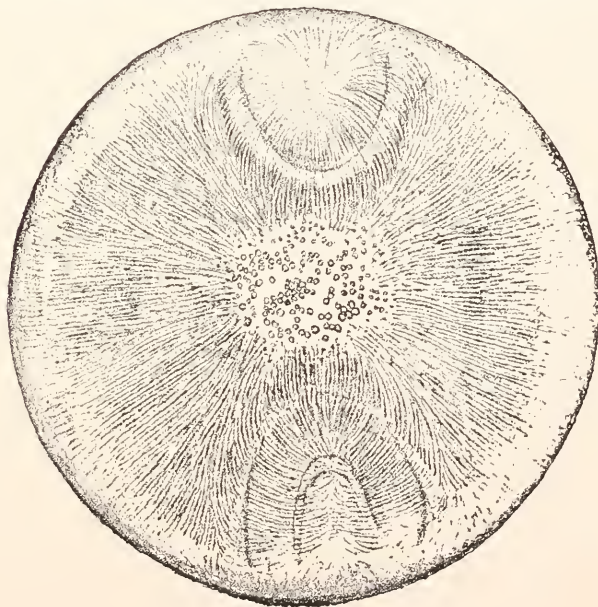


Fig. 217.—*Ps.-Cerataulus Kinkeri.*

Valves elliptic or rounded, furnished with two slight elevations, very large, plain, or covered with radiating puncta. Valve with very fine puncta, arranged in radiating rows, anastomosing. Central puncta sometimes robust, scattered.

The genus *Pseudo-Cerataulus* comprehends three fossil forms from Hungary. In the text will be found *P. Kinkeri Pant.* (fig. 217), reproduced from one of my photographs made from a type specimen that Dr. Pantocsek was good enough to forward me.

GENUS 144.—MONOPSIS, GROVE & STURT, 1887.



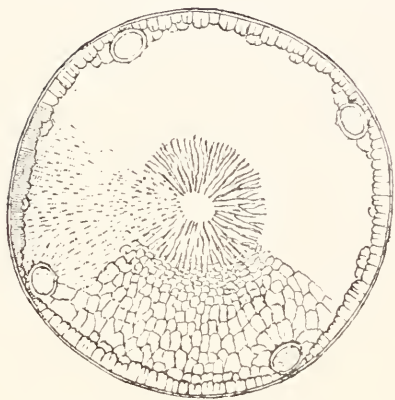
Fig. 218.—*Monopsis mammosa*.

Valves circular, with centre depressed, margins slightly elevated. A pseudo-ocellus or process, eccentric, round, covered with elongated puncta arranged in radiating rows. Striæ very delicate, finely punctate, plumose, arranged in radiating flexed rows, arising from the process.

A single example, *Monopsis mammoso Gr. and Sturt*, having its origin in the Oamaru deposit, and shown in the text (fig. 218), after my photograph.



## GENUS 145.—GLYPHODISCUS GREV., 1862.

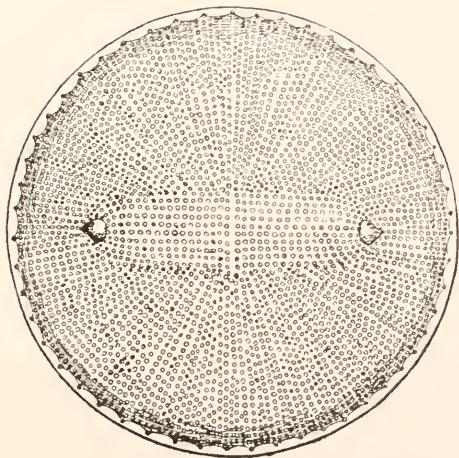
Fig. 219.—*Glyphodiscus stellatus*.

*Grev.*, which is found in very different localities (Oamaru, Cape of Good Hope, Sta. Monica, etc.), and is the type-form of the genus.

Valve irregularly circular, generally subquadrangular, with a pseudo-ocellus at each angle centre umbilicate, more or less smooth, umbilicus surrounded by radiating striæ, very delicate, terminating in a fine reticulation.

This genus includes three fossil species, all found in the Oamaru deposit. The figure in the text represents *Glyphodiscus stellatus*

## GENUS 146.—FENESTRELLA GREV., 1863.

Fig. 220.—*Fenestrella Barbadosis*.

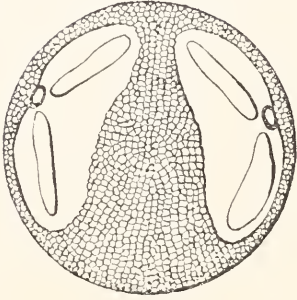
species from the Cambridge Estate, Barbadoes. Professor Brun has added to it two other fossil species from Oamaru and Yeddo (Japan) respectively.

Valve circular, slightly convex, with a border of small semi-circular hyaline areas, and having two ocelli opposite one another, towards the inner third ; striæ radiant, except between the two ocelli, where they form straight lines, interrupted at the central portion by a transverse hyaline line.

This genus was created by Greville for *F. Barbadosis*

*Grev.* (fig. 220), a beautiful

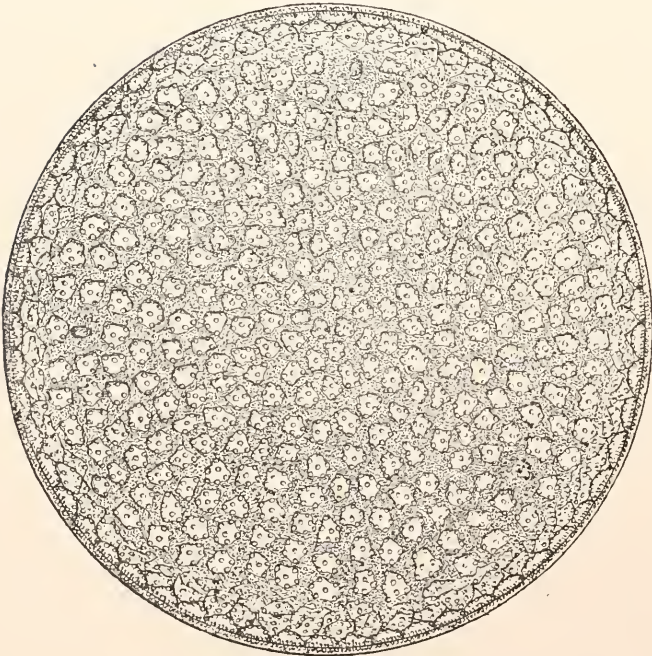
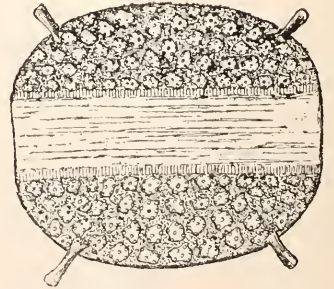
## GENUS 147.—BERGONIA TEMPÈRE, 1891.

Fig. 221.—*Bergonia Barbadensis*.

Valve almost circular, slightly convex, with cellular structure, interrupted by two large hyaline spaces, subreniform, opposite one another, and inclined to one another at an angle of  $40^{\circ}$ . Each hyaline area encloses at its median and dorsal portions a small oblong ocellus, whence arise two silicious inflations, running in a direction towards the apices of the hyaline spaces.

This genus only comprises one species, *Bergonia Barbadensis* Temp. (fig. 221), from the Barbadoes deposits. My figure is drawn from a photograph which I made from a valve Mr. Tempère was good enough to entrust to me.

## GENUS 148.—EUPODISCUS EHR., 1844.

Fig. 222a.—*Eupodiscus Argus*,  
Valve view.Fig. 222b.—*Eupodiscus Argus*,  
Girdle view.

Valves disciform, with cellular or granular structure, without a median area, furnished with 1 to 4 processes, which are not connected with one another by costæ or sulci. Girdle face rather narrow.

The genus includes about 15 species, only one of which belongs to our coasts, *E. Argus* (fig. 222), which Mr. Rattray ranks among the *Aulacodiscus*. I find the structure much too peculiar to rank in that genus, and I shall therefore preserve it here. A certain number of the *Eupodiscus* are fossil. They are found in the Barbadoes deposits. Others again are found living, and belong especially to warmer regions than ours.

**E. Argus Ehr.** (Kreideth, p. 77, No. 60; H.V.H. Atl., pl. 117, f. 3-6\*; Type No. 508), plate 21, fig. 647.

Valve orbicular, convex, furnished with 3 to 5 rather robust processes, inflated at the apices: formed of two very different layers; the superior with coarse irregular alveoles with openings from above, the inferior with puncta arranged in radiating rows. Girdle face with convex margins; connecting zone showing some transverse plicæ and longitudinal striæ, punctate, delicate, about 18 to 20 in 1 c.d.m. Diameter of valve, 8 to 20 c.d.m.

Marine.—Blankenberghe, Ostend, Antwerp (Scheldt), and on all the coasts of the North Sea. England (Shadbolt, Kitton, Stolt., Norman). Ireland (O'Meara).

*E. commutatus* Grev. and *E. Fonesianus* Grev. are only forms of *Coccinodiscus concinnus*, a description of which will be found in a later page.

#### GENUS 149.—AULACODISCUS EHR., 1845.

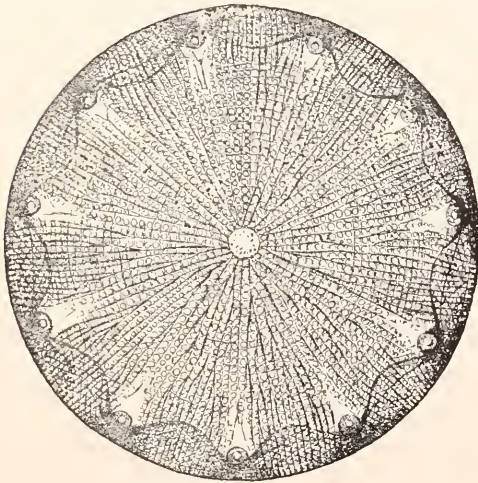


Fig. 223.—*Aulacodiscus orientalis*.

Valves generally circular, granular, furnished with processes, variable in number, connected with one another through the centre, either by a sulcus or by costæ, or by granules arranged in special lines

This genus includes a considerable number of forms almost all remarkable for their beauty, as may be seen from figure 223, which represents *A. orientalis* Grev., after Ad. Schmidt.

A large number of the *Aulacodiscus* are found in fossil deposits, others inhabit tropical seas, where they are sometimes found in immense numbers ; it was in this way that my friend, Mr. Hens, in his Botanical expedition to the Congo, found the sea coasts at Banana covered with a greenish bed of *A. Africanus* Cott. (*A. Kittoni* Arnott var.), and was able at once to fill a large vessel with this species, absolutely pure.

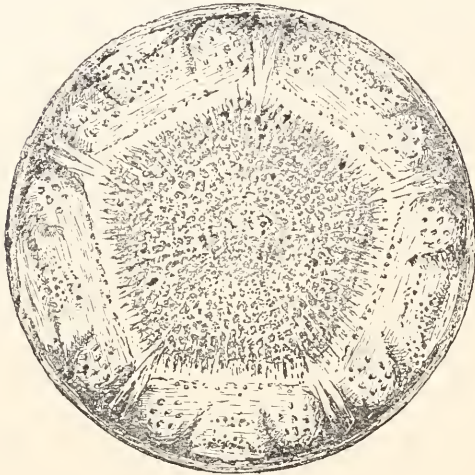


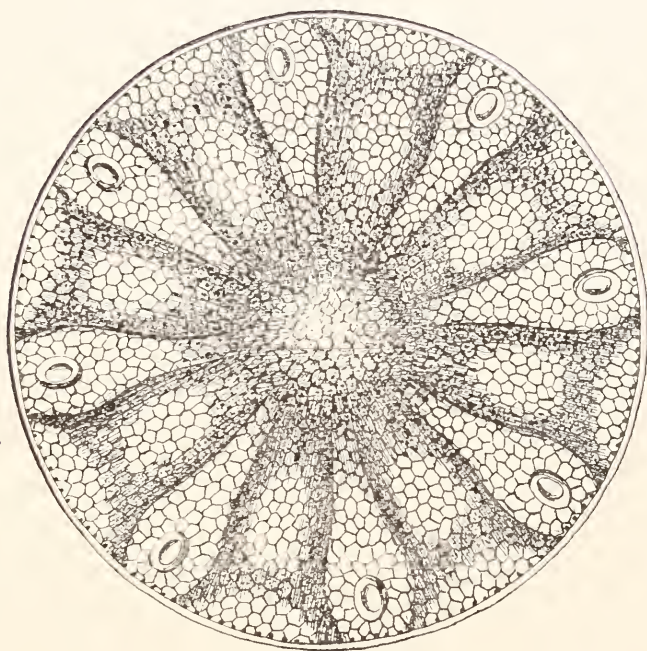
Fig. 224.—*Aulacodiscus zonulatus*.

the year 1888. It is necessary to refer to it in studying this genus.

The first general aspect of *A. zonulatus* Rattr. is quite different from an ordinary *Aulacodiscus*, while Dr. Pantocsek has made a special genus of it under the name of *Tchestnovia* (fig. 224).

Mr. A. Rattray has published a good monograph of this genus under the title of "A revision of the genus *Aulacodiscus* Ehr." It will be found in the Journal of the Royal Microscopical Society for

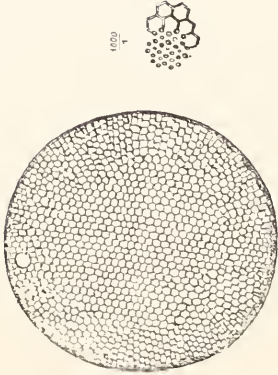
## GENUS 150.—CRASPEDOPORUS GREV., 1863.

Fig. 225.—*Craspedoporus Ralfsianus*.

Valves circular, with cellular structure, apparently divided into compartments, in consequence of portions of the valve being elevated, each of which portions (5 to 11 in number), bears an ocellus or pseudopore at a more or less approximate distance from the margin. Central portion of the valve forming a paler-coloured area, with small and less distinct cells.

This genus comprises about half a dozen species, all fossil. In the text will be found (fig. 225), after Greville, *Cr. Ralfsianus Gr.*, from the Cambridge Estate, Barbadoes. I have never seen this form, but I think that the contrast between the compartments is much exaggerated.

## GENUS 151.—ROPERIA GRUN., in H.V.H. Atl., 1885.

Fig. 226.—*Roperia tessalata*.

Hyaline spot, about .25 c.d.m. in diameter.

Marine.—England: Caldy, Pembrokeshire (Roper), Hull (Norman, Gregory, Greville). Cape Finistere (Greville). West Coasts of Africa ("Gazelle" Expedition, Weissflog).

Valve circular or subcircular, with plane surface, structure cellular, cells punctate, puncta decussate, furnished near the margin with a round hyaline spot or pseudo-ocellus.

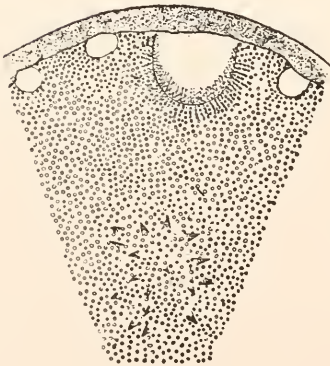
A single species.

***R. tessalata* (Roper) Grun.**

(in H.V.H. Atl., pl. 118, f. 6\*, *Eubodiscus tessalatus* Roper; Q.J.M.S., 1858, vi., p. 19, pl. 3, f. 1 a-b), fig. 226 in text.

Valve from 6 to 7 c.d.m., having about 6 cells in 1 c.d.m. near the middle of the valve, smaller and more approximate near the margin.

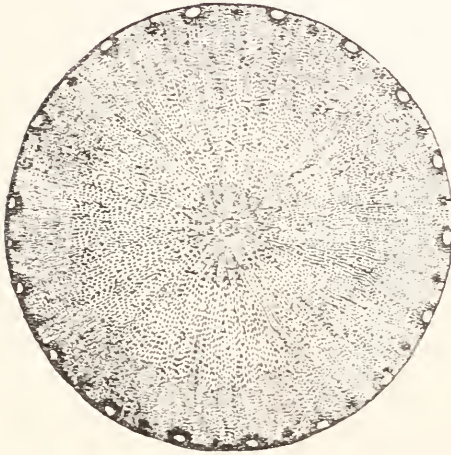
## GENUS 152.—ISODISCUS, RATTRAY, 1888.

Fig. 227.—*Isodiscus mirificus*.

Valves circular, with coarse puncta, furnished at the margin with 2-3 large processes, surrounded by fine radiating puncta, and between them several pseudo-ocelli.

This genus only includes two species, both fossil, from Oamaru. I give in the text *I. mirificus* Ratt., after Rattray (fig. 227).

## GENUS 153.—RATTRAYELLA, DE TONI, 1889.

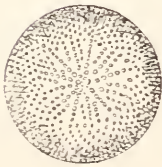
Fig. 228.—*Rattrayella Oamaruensis*.

*ensis* (Grun), De Toni, found in the fossil deposits of Sysran, Simbirsk and Ananino (Russia), as well as in the deposit of Oamaru. The figure in the text (fig. 228), is drawn from one of my photographs.

Valves circular, plain in the median portion, then gently convex towards the margin, very finely punctate, with puncta arranged in radiating lines and often covered with a kind of vague network. Margin showing small processes, rounded or elliptic, between each of which is one or two apiculi.

This genus only comprises a single species, *R. Oamaruensis*.

## GENUS 154.—CESTODISCUS GREV., 1865.

Fig. 229.  
*Cestodiscus Proteus*.

This genus only comprises a small number of species, the greater part being fossil. I include in my generic diagnosis *Triceratium cinnamomeum* Grev., which should, perhaps, form a special genus.

The figure in the text (fig. 229), represents *Cestodiscus Proteus* Hardman, after an authentic example of the author. Mr. Rattray classes the *Cestodiscus*, *Perithyra*, and *Micropodiscus* among the *Coscinodiscus*.

Valves disciform, circular, oval, rarely angular, granular, with granules arranged in radiating rows, furnished with round or elongated tubercles, forming a complete circle, near the margin of the valve.

## GENUS 155.—PERITHYRA EHR., 1854.

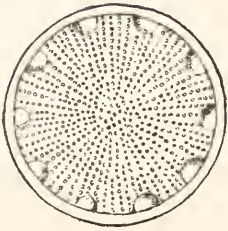


Fig. 230.  
*Perithyra denaria*.

Valves circular, with fine puncta arranged in radiating rows, and with coarse marginal tubercles.

This genus, which appears rather doubtful, includes, according to Ehrenberg, two forms, *P. denaria* Ehr. (fig. 230) and *P. quarternaria* Ehr., which only differs in having four tubercles. These forms are found in the Ganges. For anything I know, they have never been seen by anyone but Ehrenberg.

## GENUS 156.—MICROPODISCUS, GRUN., 1883.

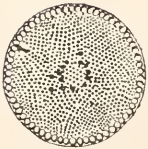


Fig. 231.  
*Micropodiscus*  
*Weissflogii*.

Valve with margin furnished with a circlet of dots (or small awl-shaped spines) and of a small elongated process. Puncta very fine, indistinctly radiant; a circle of coarser dots near the central portion.

A single species.

***M. Weissflogii* Grun.!** (in H.V.H.'s Types, Nos. 11 and 416), fig. 231 in the text.

Characteristics of the genus; the awl-shaped spines of the circlet 10 to 13 in 1 c.d.m. Diameter, .5 to 1.5 c.d.m.

Brackish water—Blankenberghe.



TRIBE XXIII.—HELIOPELTEÆ.

TABLE OF GENERA.

Undulated portion only occupying the marginal portion of the valve.	{	Valves with triangular or cuneate compartments, equal, alternately depressed and elevated, usually two layers, one reticulate, the other punctate . . . . .	<b>Actinoptychus.</b>
		Valve very finely punctate, over the whole surface, elevated portions ending in an edge, giving the appearance of spokes of a wheel, each terminated by a large ocellus . . . . .	<b>Actinodiscus.</b>
		Umbilical area covered with scattered coarse blurs. Valve with coarse puncta divided into cuneate compartments by the interposition of elevated plicæ . . . . .	<b>Truania.</b>
		Valve with numerous marginal compartments, separated by septiform depressions; umbilicus rounded, hyaline. Intermediate portion finely punctate, puncta radiating, interrupted at certain distances by blank spaces . . . . .	<b>Anthodiscus.</b>
		Valve with unequal compartments; elevated compartments very narrow, ending in a process; depressed compartments broad, reticulated, triangular, interrupted at the base by a short elevation, elongated into the umbilical hyaline portion . . . . .	<b>Actinodyction.</b>
		Margin showing numerous elevations (they themselves being subdivided) and separated by deep sulci; sulci in the form of scales at the edge of the margin and extending towards the interior as far as the umbilicus . . . . .	<b>Lepidodiscus.</b>
		Valve similar to the preceding, from which it differs by the whole median portion being occupied by striæ, radiant, flame-like, very finely punctate, and by the finely granular umbilicus, surrounded by a hyaline circle . . . . .	<b>Wittia.</b>

GENUS 157.—ACTINOPTYCHUS EHR., 1838, Char. emend.

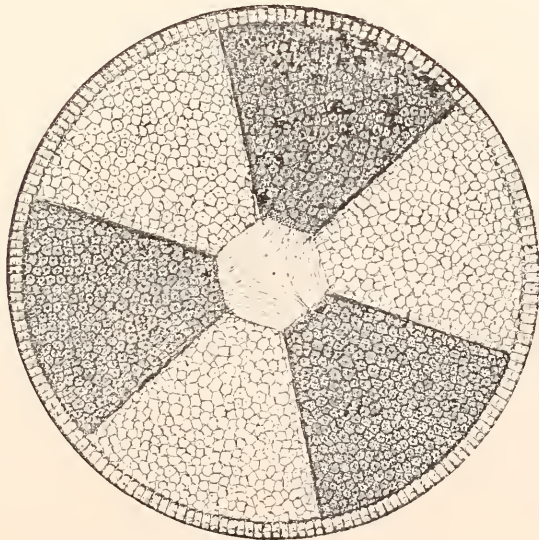


Fig. 232.—*Actinoptychus undulatus*.

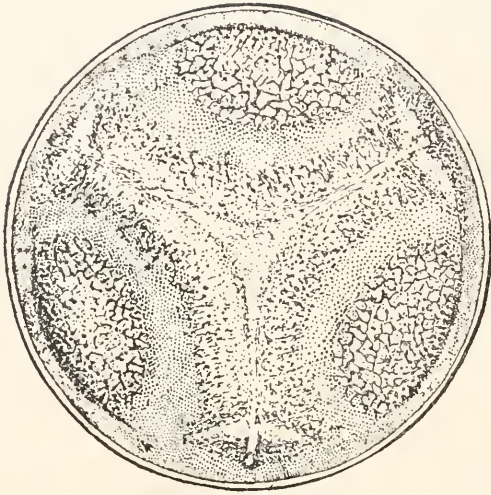


Fig. 233.—*A. (Debya) undulatus*,

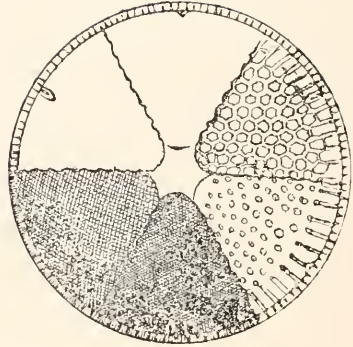


Fig. 234.—*A. (Omphalopelta) undulatus*.

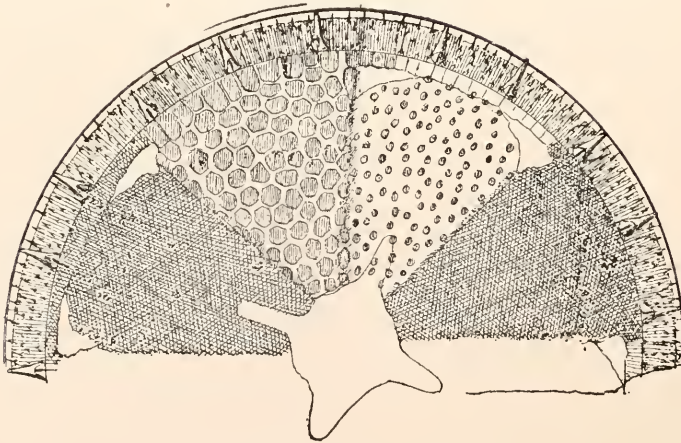


Fig. 235.—*Actinoptychus Heliopelta*.

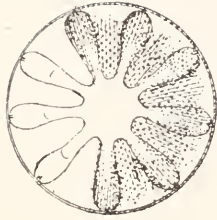


Fig. 236.  
*A. (Polymyxus) pulchellus.*

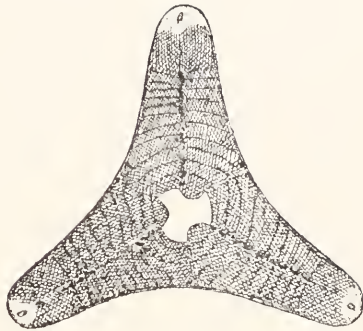


Fig. 237.—*A. (Schnettia) annulatus.*

Valves circular, rarely triangular, with triangular compartments alternately smooth, elevated or depressed, structure usually alveolar and with a central polygonal umbilicus. Alveoli placed on a punctate lamina (which is sometimes the only one present), with or without hyaline spaces and small submarginal spines at the circumference of the valve. Frustule disciform, undulated, divided into compartments, with girdle face narrow.

The genus *Actinoptychus* is widely extended, embracing more than 100 species, the greater number of which are fossil, and remarkable for their beauty or elegance. A typical valve of *A. undulatus* *Ralfs.* is represented in figure 232.

Several genera have been created at the expense of the genus *Actinoptychus*, amongst which we may mention :—

**Debya Pant., 1886** (non Rattray) (fig. 233), drawn from one of my photographs, which is founded on the interior valves of *A. undulatus* *Ralfs.* I have frequently found these valves in the mud of the Scheldt and the sediment of the North Sea, and I have in my possession specimens where this internal valve can be clearly seen through the normal valve.

**Gyroptychus contabulatus. Ad. Schm.,** described hereafter among the *Asterolamprea*, is probably only the interior lamina of an *Actinoptychus*.

**Omphalopelta Ehr., 1844,** comprehends the *Actinoptychus* with a spine or process in alternate compartments. *A. undulatus* is very often found in this state.

*Symbolophora* Ehr., 1844 (non Grunow), with valves having an angular centre.

*Heliopelta* Ehr., 1854, the type-form of which is *A. Heliopelta* Grunow (fig. 235), characterised by its numerous spines or teeth on the margin.

*Halionyx* Ehr., 1854, includes such of the *Actinoptychus* as have the central portion rounded.

*Polymyxus* Bail, 1885, are the *Actinoptychus* without a cellular layer, and with strongly undulated valves. In the text (fig. 236), will be found *Polymyxus pulchellus*, Gr., which deviates somewhat from the normal type-form (*P. coronalis* L.W. Bail.). A figure of the latter will be found in H.V.H. Atl., pl. 123, f. 4, which is identical with an *Actinoptychus*, where the cellular layer is absent.

*Schuetzia* De Toni, 1894, are *Actinoptychus* with triangular valves; the figure in the text (fig. 237), represents *A. annulatus* (Wall.) Grun., which is the type-form of this new genus. This form is met with at Java and in the China Sea. If a new genus is to be constituted for triangular forms, the name given by Dr. De Toni is untenable, but it should be called *Cymatogonia*, which was proposed by Mr. Grunow in 1883, in the "Botanisches Centralblatt," No. 36 (vol. xv., No. 10).

There are only two *Actinoptychus* to be found in our regions.

#### ANALYSIS OF SPECIES.

{	Valve having usually six compartments, with large hexagonal central umbilicus . . . . .	<b>A. undulatus.</b>
	Valve having from 12 to 20 compartments, with umbilicus dentate, teeth truncate . . . . .	<b>A. splendens.</b>

**A. undulatus** Ehr. (*Act. biternarius* Ehr., Mik., pl. 18, f. 20; H.V.H. Atl., pl. 122, f. 1 and 3, and pl. 22 *bis*, f. 14\* ; Type No.514), plate 22, fig. 648.

Valve usually with six compartments, a large umbilicus, polygonal, central, smooth, and usually furnished with a small process, placed on the submarginal median portion of each alternate compartment. Alveolate lamina, with large hexagonal alveoli; punctate lamina, with puncta fine, in quincunx; about 16 striæ in 1 c.d.m. Diameter of valve, about 4 to 12 c.d.m.

Marine.—Common, Blankenberghe, Ostend, Antwerp (Scheldt.), and in all mud deposits of the North Sea. England (W. Sm., Hodgson, Kitton, Stolt., Norman, Comber), London clay (Baxter Coll., No. 2309), Northumberland (Baxter Coll., No. 2829), Devonshire (Baxter Coll., No. 2841),

**A. splendens (Shad.) Ralfs.** (in Pritch., p. 840; *Actinophenia splendens Shad.*, T.M.S., 1854, ii., p. 16; H.V.H. Atl., pl. 119, f. 1, 2, and 4\*; Type No. 511), plate 22, fig. 649.

Valve with 12 to 20 compartments, rising gently from the middle up to the margin, where a costa separates each compartment from the adjoining; furnished with a submarginal band, apparently smooth (in consequence of being placed out of focus); costæ having a small spine at their marginal apex; umbilicus dentate, with teeth truncate, each dentlet corresponding with the base portion of a compartment. Alveolar lamina feebly developed, inferior lamina with very distinct puncta in quincunx, forming about 12 striæ in 1 c.d.m. Diameter of valve, 7 to 18 c.d.m.

Marine.—Found in the same localities as the preceding, but is not so common.

#### GENUS 158.—TRUANIA PANT., 1886.

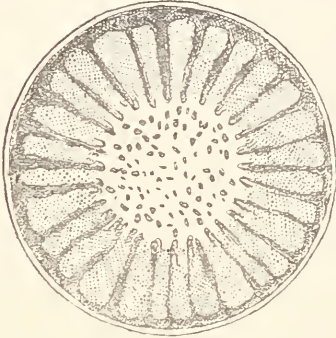


Fig. 238.—*Truania Archangelskiana*.

Valve disciform, with strong puncta, divided into cuneate compartments by the interposition of raised plicæ. Umbilical area covered with coarse scattered blurs.

This genus only comprises a single form *T. Archangelskiana Pant.* from Archangel, Russia, a figure of which is given (fig. 238) drawn from my photograph, taken from the original specimen of the author.

#### GENUS 159.—ACTINODISCUS GREV., 1863.

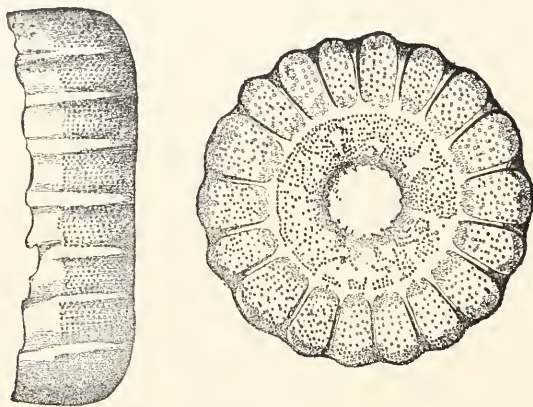


Fig. 239.—*Actinodiscus Barbadosis*.

Valves very finely punctate throughout their surface, with the elevated portions finishing in an edge (which gives the appearance of spokes of a wheel), and terminated by a coarse ocellus or pseudo-nodule.

This genus includes two species, *A. Barbadosis Grev.*, (fig. 239) found in the fossil deposits of Barbadoes and Oamaru, and *A. Atlanticus Kain and Schultze*, which has only 4-6 rays, and is found in a fossil state at Atlantic City, New Jersey, U.S.A.

## GENUS 160.—ANTHODISCUS, Grove and Sturt, 1887.

Fig. 240.—*Anthodiscus floreatus*.

Valve with numerous marginal compartments, separated by septiform depressions; umbilicus rounded, hyaline. Intermediate portion finely punctate, with puncta radiating, interrupted at a certain distance by blank spaces.

A single species.

*A. floreatus* Gr. and St., fossil in the Oamaru deposit. Figure 240 reproduces my photograph of this beautiful form.

## GENUS 161.—ACTINODICTYON PANT, 1889.

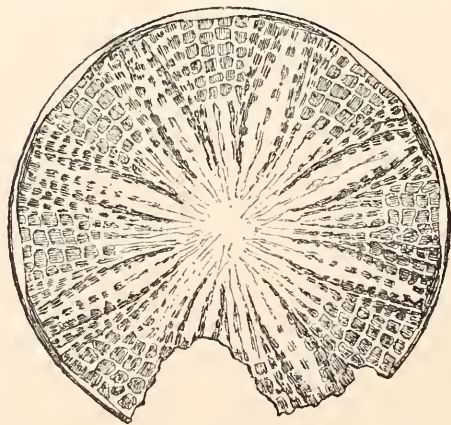


Fig. 241.  
*Actinodictyon antiquorum*.

photographed from the author's specimens.

Valve with unequal compartments; the elevated compartments very narrow, terminated by a process; depressed compartments broad, reticulate, triangular, interrupted at the base by a short elevation elongated into the hyaline umbilical portion.

Two species both fossil from Ananino, Russia, *A. Weissflogii* Pant., and *A. antiquorum* Pant. (fig. 241)

## GENUS 162.—LEPIDODISCUS WITT, 1885.

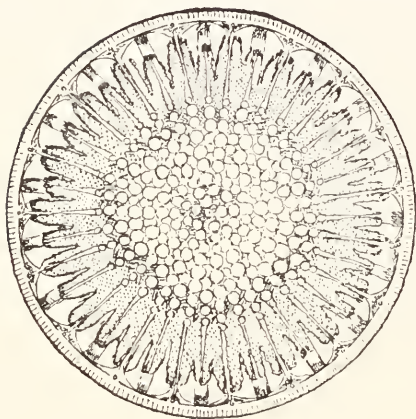


Fig. 242.  
*Lepidodiscus elegans.*

This genus only comprehends a single species, excessively curious and very rare *L. elegans* Witt. (fig. 242), found at Archangelsk by Dr. O. N. Witt and in Ananino deposit by Dr. Pantocsek.

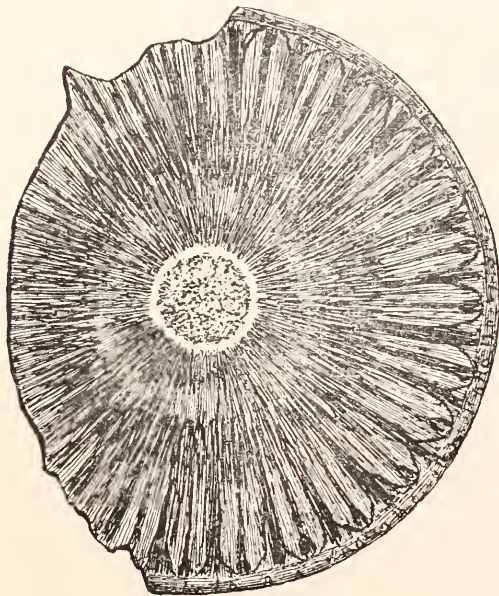


Fig. 243.—*Wittia insignis.*

WITTIA PANT.,  
1889.

Valve similar to that of *Lepidodiscus* from which it principally differs by the striæ radiant, flame-like, very finely punctate, occupying the whole median portion of the valve, and by the centre being finely punctate, separated from the median portion by a hyaline circle.

A single species.

*W. insignis* Pant., fossil at Ananino, Russia (fig. 243), drawn from my photograph of Dr. Pantocsek's specimen.

This genus appears to me to be very closely approximate to the preceding. It will be necessary to examine a larger number of quite perfect valves to identify or differentiate the two genera definitely.

TRIBE XXIV.—ASTEROLAMPREÆ.

TABLE OF GENERA.

	Valve furnished with strong internal costæ, united to one another at the centre and sides by a robust internal lamina, centre hyaline . . . . .	<b>Arachnoidiscus.</b>		
Valves not as above.	Valves hyaline, angular or circular, without costæ or straight rays not enlarged near the margin or near the centre, and not touching the margin . . . . .	<b>Liostephania.</b>		
		Disc radiated, punctate, cellular or granular, with centre granular, not stellate, with marginal portion divided into numerous compartments by enlarged costæ in the form of spokes of a wheel . . . . .	<b>Gyroptychus.</b>	
	Valves not as above.	Valves inflated, hyaline or punctate, with centre sometimes stellate, rays linear, more or less bifurcated and somewhat irregular; interspaces hyaline or with flexed or sinuous lines . . . . .	<b>Cladogramma.</b>	
			Valves hyaline, divided by simple rays; centre hyaline or granular, reticulate, or finely punctate . . . . .	<b>Mastogonia.</b>
	Valves not as above.	Rays formed by plicæ.	Rays simple, straight, never reaching to the centre; puncta more or less large and scattered . . . . .	<b>Stictodiscus.</b>
			Rays irregular both as to length and division, often divided dichotomously; valves with cells small, uniform throughout the surface . . . . .	<b>Radiopalma.</b>
	Valves only showing rays.	Rays arising neither from a circle or central rosette.	Rays straight, marginal portion of the valve punctate, and traversed by sectors, radiant, very narrow . . . . .	<b>Stelladiscus.</b>
			Rays curved like the letter S; valve completely hyaline . . . . .	<b>Gyrodiscus.</b>
	Rays more or less solid, not formed by plicæ.	GROUP ASTEROLAMPREÆ : Rays arising from a circle or central rosette.	Valve with hyaline area, divided by straight rays, arising either from the centre or from a central rosette and terminating at the base in areolated marginal segments; such segments being formed by the subdivision of the margin, aided by the continuation of the hyaline area . . . . .	<b>Asterolamprea.</b>
			Valves as in the preceding, but with two compartments approximate and one ray narrower, interrupted, not going beyond the centre . . . . .	<b>Asteromphalus.</b>
		Valve showing robust septa, radiant, and with concentric circles of cells . . . . .	<b>Asterodiscus.</b>	
	Valve as in <i>Asterolamprea</i> , but with only two rays and these inflated near the central rosette . . . . .	<b>Rylandsia.</b>		



## LIOSTEPHANIA EHR., 1847.

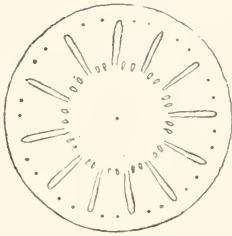


Fig. 244.—*Liostephania magnifica*.

Valves hyaline, angular, or circular, without costæ or straight rays, not enlarged near the margin, or near the centre, and not touching the margin.

In the text will be found (fig. 244) a drawing of *Liostephania magnifica* Ehr., found in the Barbadoes deposit.

We are far from a full knowledge of the genus *Liostephania*, and I am much disposed to believe that they are internal valves of forms not yet determined, probably of an *Asterolampira*.

## GYROPTYCHUS AD. SCHM., 1890.



Fig. 245.—*Gyroptychus contabulatus*.

Disc radiating, punctate, cellular, or granular, with centre granular, not stellate, marginal portion divided into numerous compartments by costæ, enlarged in the form of spokes of a wheel.

*Gyroptychus contabulatus* (fig. 245) is Dr. Adam Schmidt's figure. I think this also is an internal valve, probably of an *Actinoptychus*.

## GENUS 163.—CLADOGRAMMA EHR., 1844.

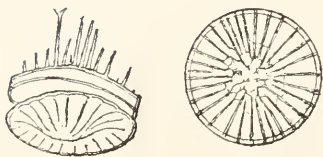


Fig. 246.  
*Cladogramma Cebuense.*

Valve discoid, with margins and centre raised, hyaline or punctate, centre sometimes stellate, rays linear, more or less bifurcated, and somewhat irregular; interspaces hyaline, or with curved or sinuous lines.

This genus includes four species, three of which are fossil and all four circular. I give above (fig. 246), *Cl. Cebuense* Grun., which is found in the island of Cebu (Phillippine Islands).

## GENUS 164.—MASTOGONIA EHR., 1844.

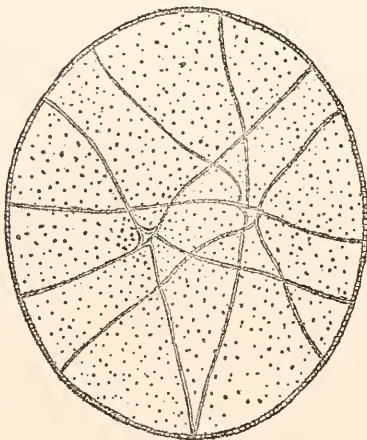
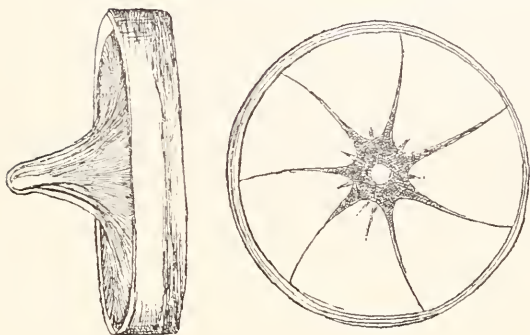


Fig. 247.—*Mastogonia Crux.*

Valves hyaline, divided by simple rays, centre very small, almost obsolete, hyaline or granular. Valves convex, without spines. Frustules solitary.

This genus is approximate to *Stephanogonia* which we have placed, in consequence of its spines, with the *Melosireæ*. I give (fig. 247), *Mastogonia Crux* Ehr., from the Bermuda Archipelego and a specimen of which from Richmond (Virginia), I have in my possession,

## GENUS 165.—GYRODISCUS WITT, 1885.

Fig. 248.—*Gyrodiscus Vortex*.

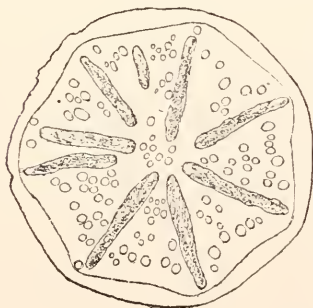
Valve discoid, somewhat cap shaped ; margins very slightly elevated, centre much raised into a conical apiculus, with truncate apex. Arising from the apiculus are rays bent in opposite directions near the two apices of the same diameter. Sur-

face of valves very delicately granular, apparently hyaline.

This genus includes only two species, *G. Vortex* Witt. (fig. 248) found by Dr. Witt, at Simbirsk, and by Dr. Pantocsek, at Kusnetz, and *G. Hungaricus* Pant., found in Hungary by Dr. Pantocsek.

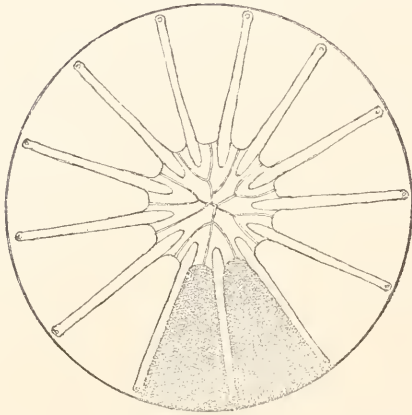
*Group* ASTEROLAMPRA (EHR., 1844), CH. EM.—Valve with hyaline area, divided by straight rays, arising either from the centre, or from a central rosette, and terminating at the base in areolate marginal segments ; such segments being formed by the sub-division of the margins by means of a continuation of the hyaline area.

The Group *Asterolampira* comprehends the genera *Asterolampira* *Asteromphalus*, as well as the doubtful genus *Asterodiscus* and the pseudo-genera *Actinogonium* and *Liostephania*.

Fig. 249.—*Actinogonium Septenarium*.

The genus *Actinogonium* consists of the internal valves of *Asterolampira*, and by examining carefully several valves of *Asterolampira* these internal valves can be seen. They can also be recognised by the figure given by Greville of his *A. punctata* (T.M.S., 1862, pl. 8, fig. 32). The figure in the text (fig. 249) represents a similar internal valve, which Ehrenberg has named *Actinogonium Septenarium*.

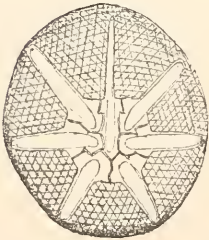
## GENUS 166.—ASTEROLAMPRA EHR., 1844.

Fig. 250.—*Asterolampra Grevillei* var. *Adriatica*.

Rays all equal or emanating from the centre of the valve.

This section consists of 36 species, the greater part of which are fossil, and most are found in the Barbadoes deposit. Fig. 250 represents one of the forms living at the present day, *A. Grevillei* Wall., var. *Adriatica* Grun.

## GENUS 167.—ASTEROMPHALUS EHR., 1844.

Fig. 251.—*Asteromphalus reticulatus*.

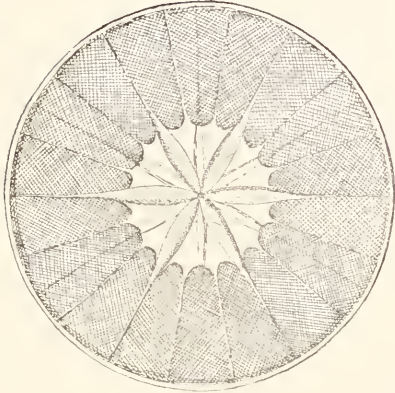
Valve having two of the compartments punctate, approximate, separated by a narrower ray, and on one side not going quite to the margin, and on the other side often going beyond the centre of the valve.

About forty species of *Asteromphalus* have been described, a good number of which are still found living, many also in the Arctic Ocean as well as in the tropical seas. Some species are very cosmopolitan, such as *A. flabellatus* (Breb.) Grev., the only species which has been met with in the North Sea (at Teignmouth by Grove), in Ascidians, and also found in Campeachy Bay, Yokohama (Japan) as well as in Corsican moss, from the Mediterranean, in Peruvian Guano, and in the Java Sea.

*Asteromphalus flabellatus* (Breb.) Grev. is characterised by its sub-elliptical valves, its conical finely reticulated compartments, often transversely truncate, and by its median ray straight or very gently curved. Its diameter varies from 4 to 6 c.d.m., the minor axis never being more than 4 to 5 c.d.m.

Figure 251 represents *A. reticulatus* Cleve, remarkable for the large cells of its compartments. It is found in a living state at Java.

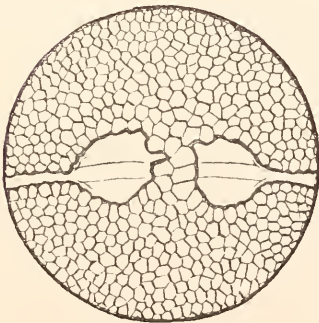
## GENUS 168.—STELLADISCUS RATTRAY, 1890.

Fig. 252.—*Stelladiscus Stella*.

This diatom should be found at Sierra Leone, according to Norman, who, however, only saw one specimen, and no one since him has again seen this singular form.

**Asterodiscus**, Johns, 1852, in Amer. Journ. Sc., 1852, p. 33, is a very doubtful genus. According to the author it should be characterised by similar valves, with central ray bifurcated, and there should be three species, *A. quinarius*, *senarius*, and *nonarius*, according as it has 5, 6, or 9 rays. As these forms are not figured it is impossible to know what Johnson has seen.

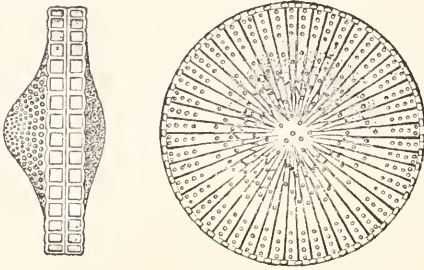
## GENUS 169.—RYLANDSIA GREV., 1861.

Fig. 253.—*Rylandsia biradiata*.

Valve disciform, with cellular structure, cells interrupted by two opposite rays surrounded by a hyaline space, very dilated at the base, not reaching to the centre of the valve.

A single species: *R. biradiata* Gr. (fig. 253), which is found in the Barbadoes deposit. It is a very rare form; the figure in the text was drawn from one of my photographs.

## GENUS 170.—STICTODISCUS GREV., 1861.



a.

b.

Fig. 254.—*Stictodiscus*.  
 a. *S. Kittonianus* (girdle face).  
 b. *S. Johnsonianus* (valve).

Valve disciform or angular, with median portion inflated, inflation unequal in the two valves; centre more or less hyaline; the remainder of the valve more or less strongly punctate, puncta arranged in radiant rows, separated by plicæ.

This beautiful genus includes about 50 species, the greater number of which are fossil. In the text will be found, after Greville, the valve of *S. Johnsonianus* Gr., and the girdle face of *S. Kittonianus* Gr. These two species are fossil, the first is found in the Naparima deposit (Trinity Island), the second in the deposits of South America, specially Nottingham, Richmond, &c.

## GENUS 171.—ARACHNOIDISCUS EHR., 1849.

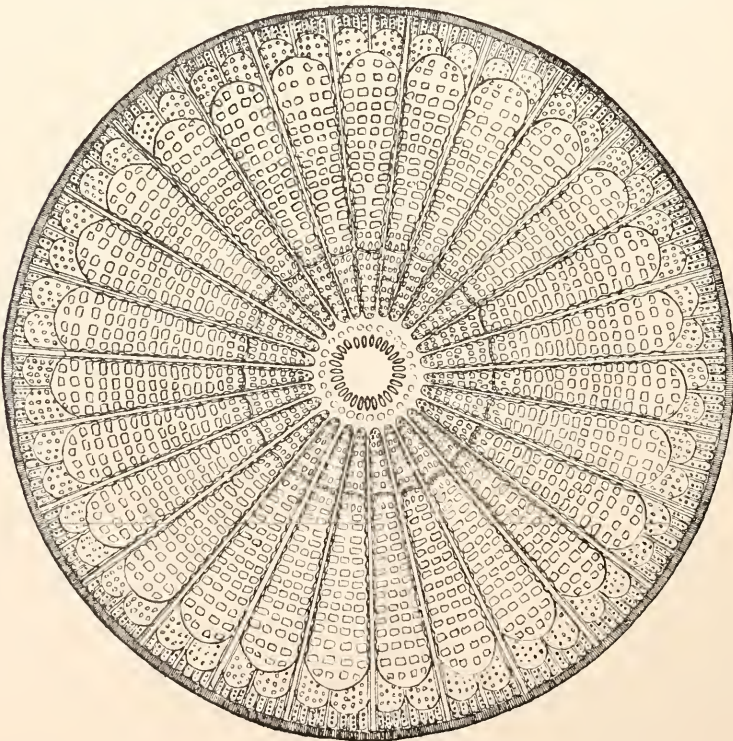


Fig. 255.—*Arachnoidiscus ornatus*.

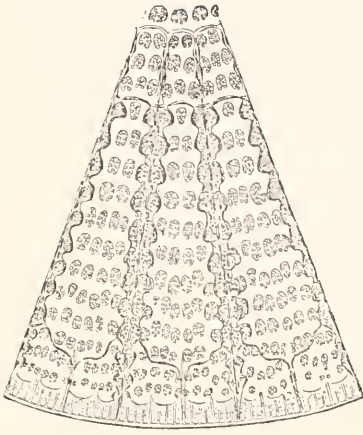


Fig. 256.  
*Arachnoidiscus Ehrenbergii.*

showing fine granules, mostly corresponding to the thinnings of the other lamina.

The *Arachnoidiscus* are amongst the most interesting diatoms known. Nine species have been described, many of which appear to us to be only varieties. The most characteristic and best known are *A. ornatus* Ehr., and *A. Ehrenbergii* Bail. and Harv., which are figured in the text (figs. 255 and 256), the general outline and structure being taken from my photographs. The latter *Arachnoidiscus* has erroneously been stated by William Smith as belonging to England. All the *Arachnoidiscus* found are either fossil or from the tropical seas.

#### GENUS 172.—RADIOPALMA BRUN., 1891.

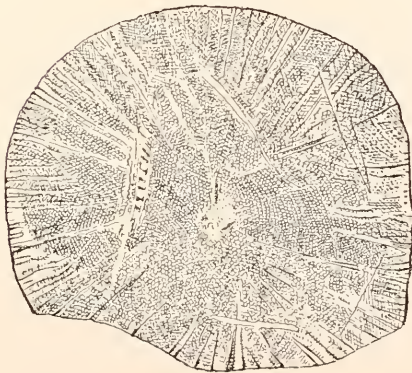


Fig. 257.—*Radiopalma dichotoma.*

Valve sub-circular, very delicate, with hexagonal striation interrupted by plaits more or less marginal, often divided dichotomously.

A single species: *Radiopalma dichotoma* Brun., found in the fossil deposit of Moron (Spain) and drawn in the text (fig. 257) after my photographs.

I have in my possession a similar form, but with larger cells, and plaits more regularly marginal, coming from Chalky Mount, Barbadoes (Weissflog). Awaiting a more minute examination I give it the name of *R. Brunii*, H.V.H. I am tempted to believe that the *Radiopalma* are only external layers of valves of some form that has not yet been identified.



TRIBE XXV.—COSCINODISCEÆ.

TABLE OF GENERA.

A.—Valves disciform, oval or elliptic.

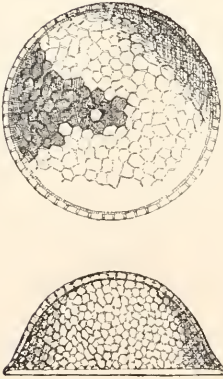
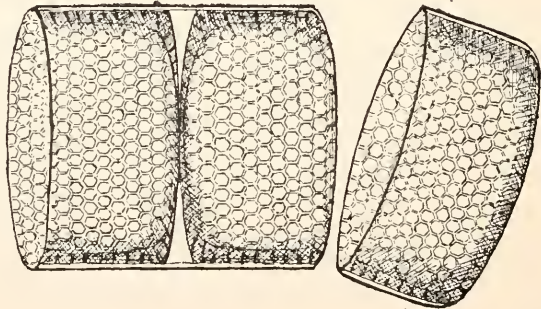
Valves very inflated into a pyxidium.	Valves not inflated into a pyxidium.	No projecting ridge.	No septa or hyaline rays.	Striation or cells not identical throughout the valve.	Valves without pseudo-openings.	Valves not as above.	Valves with a ring of large and peculiar cells.	Large marginal cells.	Large cells forming a ring, which separates the centre from the broad marginal border; centre cells arranged in curved or spiral lines.	Valve very finely punctate, showing on two sides, about a third from the margins, an arc of pseudo-cells. The two arcs united to one another by a row of spines.	Valve having a marginal or submarginal pseudo-nodule; puncta in radiating rows of unequal length, leaving usually subulate blank spaces.	Valves dissimilar, the superior with rows of puncta in distant lines, alternately long and short; inferior valve with puncta in approximate rows of equal length.	Valve disciform, punctate or cellular, without any costae, septa or processes whatsoever, except sometimes some very small teeth.	Valves furnished with long horns, more or less robust.	Valve with cellular structure . . . . . <b>Pyxidicula.</b>	Structure not cellular. <ul style="list-style-type: none"> <li>Valves punctate, with scattered puncta, and furnished with sinuous-reticulated lines . . . . . <b>Liradiscus.</b></li> <li>Valves quite hyaline, furnished with stiff erect spines . . . . . <b>Xanthiopyxis.</b></li> </ul>	Valves furnished with a projecting irregular ridge . . . . . <b>Acanthodiscus.</b>	Puncta or cells interrupted by hyaline rays. <ul style="list-style-type: none"> <li>Valves with puncta arranged in radiating rows, interrupted by hyaline spaces; centre often bulbous or with thinly scattered puncta, no marginal spines, margin hyaline . . . . . <b>Cosmioidiscus.</b></li> <li>Valve delicate, small; centre hyaline, granular, and with a circlet of marginal teeth . . . . . <b>Stephanodiscus.</b></li> </ul>	Valve having a conspicuous pseudo-opening at the centre . . . . . <b>Porodiscus.</b>	Valves cellular, with a broad margin, with structure different from that of the centre, from which it is separated by a well-defined margin, without spines . . . . . <b>Craspedodiscus.</b>	Valve having a row of large cells entirely marginal . . . . . <b>Heterodictyon.</b>	Large oblong cells arranged in festoon . . . . . <b>Brunia.</b>	Brightwellia	Janischia.	Actinoocyclus.	Anisodiscus.	Coscinodiscus.	Gossleriella.
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## B.—Valves linear, reniform, or cuneate.

{	Valves not reniform.	{	Valves arcuate or linear, cuneate.	{	Valves cellular, similar to <i>Coscinodiscus</i> , but reniform . . . . .	<i>Stoschia</i> .
					Valves elongated, linear or somewhat cuneate, with scattered puncta . . . . .	<i>Willemoësia</i> .
					Valves arcuate, at least on the dorsal side, and marked with more or less scattered, often very coarse, puncta; girdle face straight . . . . .	<i>Leudugeria</i> .
					Valves not arcuate; girdle face cuneate.	{
					Valves cellular, furnished with a small pseudo-nodule on the ventral margin . . . . .	<i>Euodia</i> .
					Valves with radiating striæ, very delicate; ventral and dorsal margins usually furnished with small teeth . . . . .	<i>Palmeria</i> .

SECT. I. PYXIDÆ.—Valves inflated, convex, in the form of a pyxidium or shaving box.

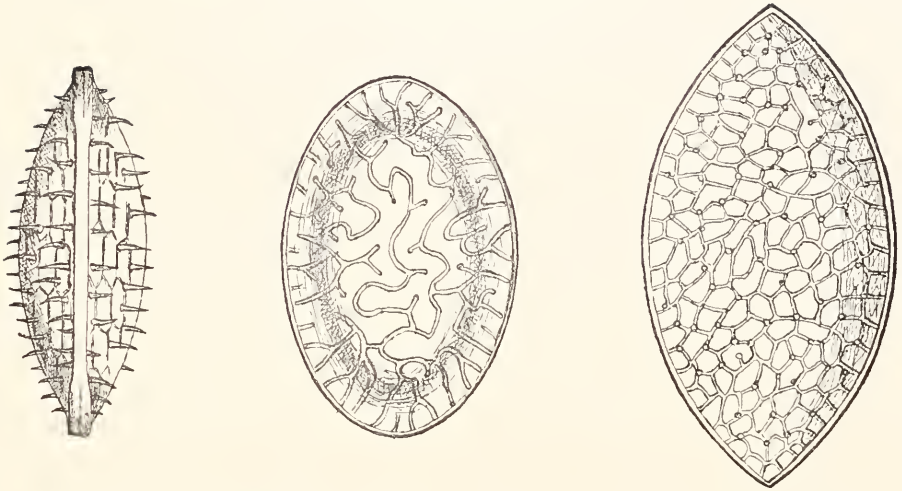
## GENUS 173.—PYXIDICULA EHR., 1833.

Fig. 258.—*Pyxidicula Mediterraneum*.Fig. 259.—*P. (Dictyopyxis) brevis*.

Frustules with connecting zone very narrow. Valves convex, disciform, or capuliform, without teeth or central spines, sometimes with small marginal teeth.

This genus, in which we include the genus *Dictyopyxis* of Ehrenberg, consists of a few species which are specially differentiated from *Stephanopyxis* (*Melosirææ*) by the absence of central teeth which unite the frustules to one another. We give in the text *P. Mediterraneum* Grun. (fig. 258), and *Dictyopyxis brevis* Grev. (fig. 259).

## GENUS 174.—LIRADISCUS GREV., 1865.



a. Fig. 260.—*Liradiscus ovalis*.  
a. Girdle view.

b.  
b. Valve view.

Fig. 261.—*Liradiscus ellipticus*.

Valves circular or elliptic, convex, sinuous-reticulate, more or less bristling with spines. Connecting zone narrow.

This genus includes seven curious species, the greater part fossil. Figure 260 representing *Liradiscus ovalis* Gr., and fig. 261. *L. ellipticus* Grev. will give an idea of the genus.

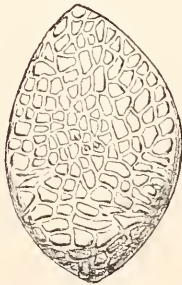
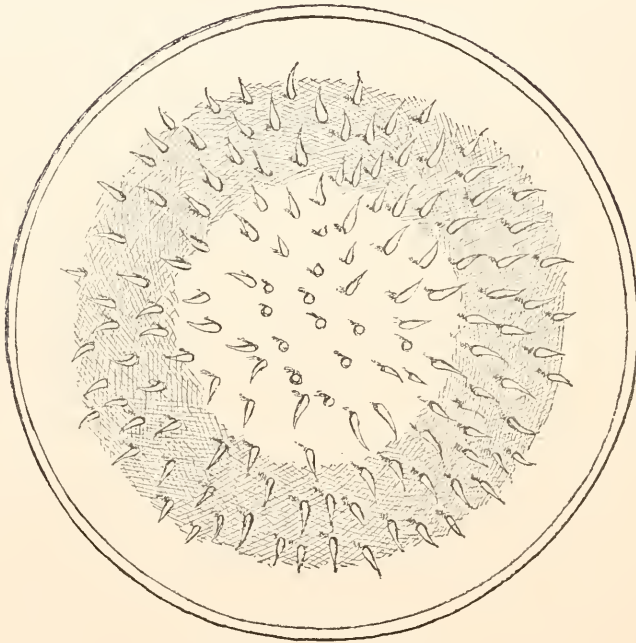


Fig. 262.—*Epithelion curvatum*.

Figure 262 represents *Epithelion curvatum* Pant., which does not appear to me to be differentiated from a *Liradiscus*.

Dr. Pantocsek, in a letter to me of the 26th February, 1894, defines his genus *Epithelion* as "Frustule oblong, oval, convex, with epithelioid or punctate-spinous structure."

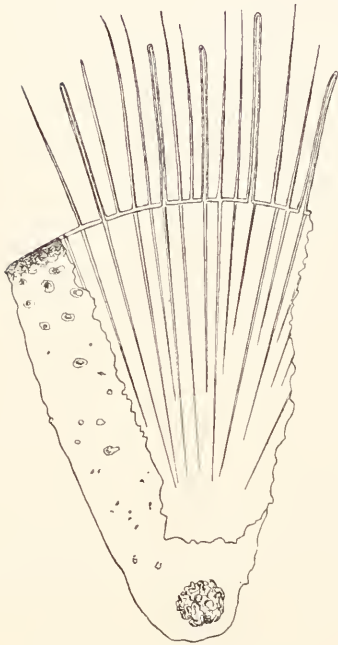
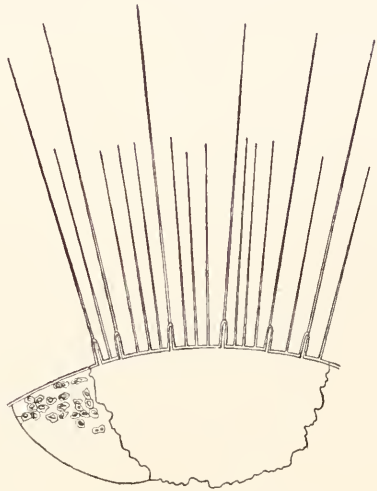
## GENUS 175.—XANTHIOPYXIS EHR., 1844.

Fig. 263.—*Xanthiopyxis umbonata*.

Valves entirely hyaline, circular, or elliptic, bristling with short spines, robust and erect.

This genus comprises a dozen curious species, all fossil. We give (fig. 263) *X. umbonata* Grev., found in the Monterey deposit.

## GENUS 176.—GOSSLERIELLA SCHÜTT, 1893

Fig. 264.—*Gossleriella tropica*.Fig. 265.—*Gossleriella radiata*.

Frustule disciform ; valve orbicular, having a marginal crown of gibbous prominences, bearing straight elongated robust spines, with smaller spines scattered between them.

This genus which belongs to the *Xanthiopyxideæ*, according to De Toni, has a vague resemblance to *Coscinodiscus* Sol. I should not like to affirm decisively that it is a diatom.

Only a single form, *G. tropica* Schütt (fig. 264), the hairs of which are of the same length but of an unequal thickness, and *G. radiata* Schütt (fig. 264), the hairs of which are of a very unequal length.

SECT. II. BRIGHTWELLIEÆ.—Valves cellular, with one or more rows of marginal or sub-marginal cells, differing (generally much larger) from the other cells of the valve; or with the sculpture of the median portion different from that of the margins.

GENUS 177.—BRIGHTWELLIA RALFS., 1861.

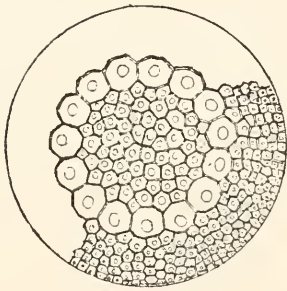


Fig. 266.—*Brightwellia hyperborea*.

Valves circular, with cellular structure; cells unequal, those of the margin smaller than those of the centre, and separated from one another by a ring of much larger cells.

This beautiful genus possesses seven species, which are all fossil, two of them (including *B. hyperborea* Grun.), (fig. 266), have also been found in marine dredgings or soundings.

GENUS 178.—HETERODICTYON GREV., 1863.

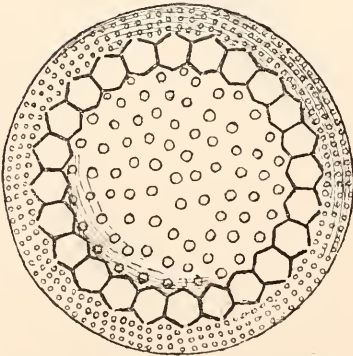
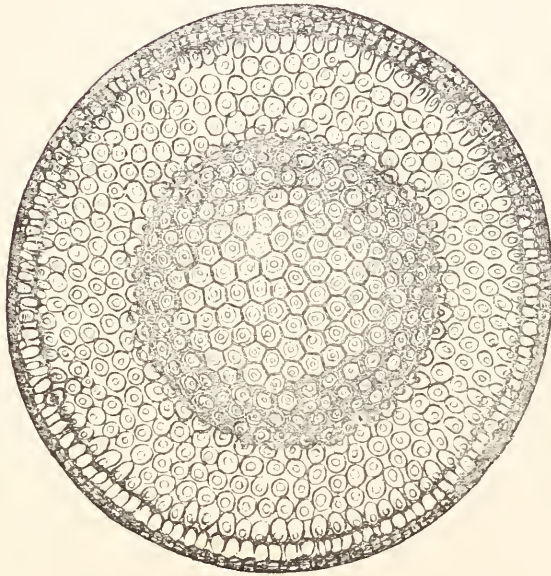


Fig. 267.—*Heterodictyon Rylandsianum*.

Valves circular, finely punctate, with a central rosette of medium sized cells, and a ring, quite marginal, of large elongated cells.

This genus consists of a single species, *H. Rylandsianum* Grev., figured in the text, found in the Cambridge Estate Deposit, Barbadoes, by C. Johnson.

## GENUS 179.—CRASPEDODISCUS EHR., 1844.

Fig. 268.—*Craspedodiscus insignis*.

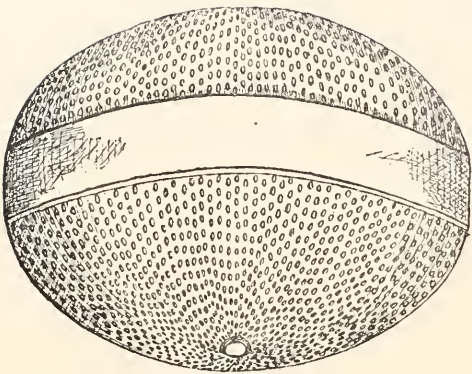
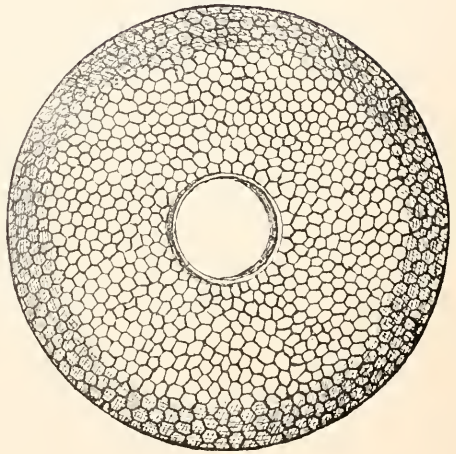
Valve usually circular, with cellular structure, having a broad border of structure different from that of the centre, from which it is separated by a well-defined margin, without spines.

I give in the text, after Dr. Ad. Schmidt, a figure of *Cr. insignis*, *A. Schm.* This form has been found at Nankoori, in the Nicobar Islands.

Authors have described about 20 species belonging to this genus. Those most frequently met with in collections are *C. Coscinodiscus Ehr.*, and *C. elegans Ehr.*, both fossil, and found in the fossil deposit of Nottingham, Maryland.

In the forms which I have been able to examine, it is a depression of the valve which produces the singular appearance which is characteristic of the genus.

## GENUS 180.—PORODISCUS GREV., 1863.

Fig. 269.—*Porodiscus elegans* (girdle view).Fig. 270.—*Porodiscus splendidus* (valve view).

Valves elliptic, circular, or rhomboidal, with cellular or coarsely punctate structure, showing at the median portion a pseudo-opening—in reality a depression—the bottom of which is either hyaline (?) or more or less finely punctate.

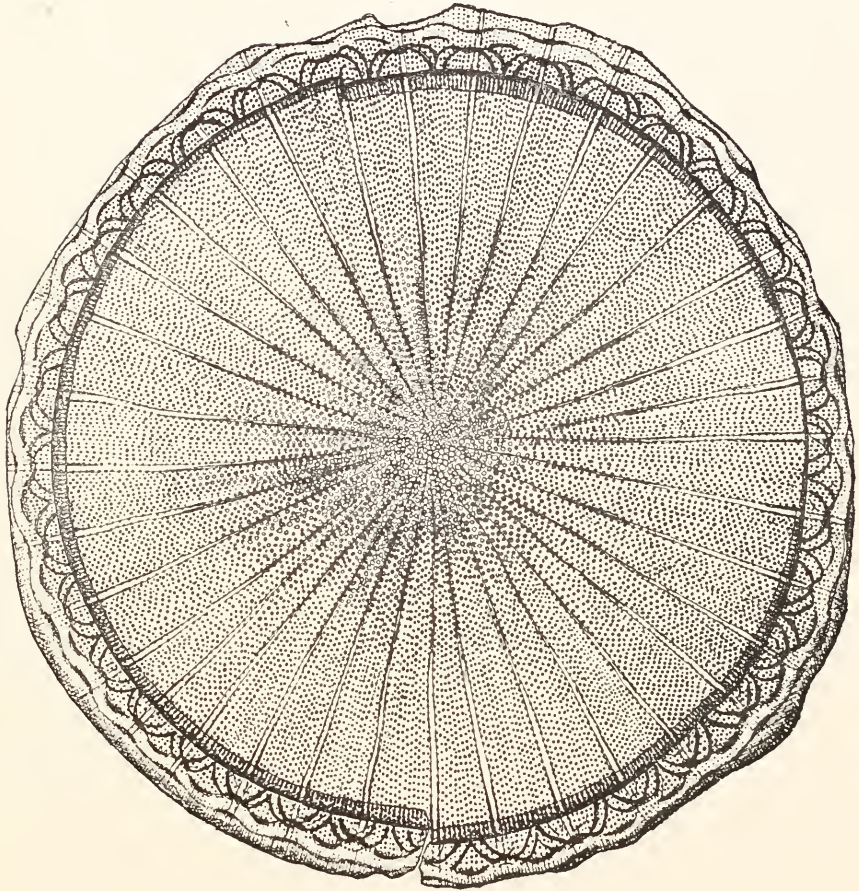
I give, after Greville, the girdle face of *Porodiscus elegans* (fig. 269), and the valve face of *P. splendidus*.

From an examination of the forms in my collections, I cannot see any difference between the *Craspedodiscus* and *Porodiscus*, except that in the latter the depression is deeper and smaller. I therefore agree with the opinion of Mr. Grunow, who ranks the *Porodiscus* with the genus *Craspedodiscus*.

About a dozen forms have been classified as *Porodiscus*, all of which are fossil, with the exception of *P. Stotterfothii* Cast.



## GENUS 181.—BRUNIA TEMPÈRE, 1890.

Fig. 271.—*Brunia Japonica*.

Valves circular, finely punctate, or with delicate cellular structure, bearing at a certain distance from the margin a row of coarse oblong or semi-circular cells forming a festooned line.

The following is Mr. Tempère's description of this remarkable genus:—  
“Diameter, .380 mm. (The diameter is very variable in size, the largest specimens being quite double the smallest). Valve face almost plain, gently

rising in order to bend back at a right angle, thus forming a rather elevated wall or prominent margin, which is reflected in the same direction as the superior portion, but inclining more or less outwards, to form a gently convex edge of variable size.

The general form of the valve is very similar to that of a plate whose rather deep side is at a right angle with the bottom.

On the margin and at its intersection with the wall is found a row of coarse oblong cells with a rounded outline placed end to end, and forming a broken but uninterrupted line, giving the appearance of a festoon surrounding the base of the wall. This corona of coarse cells is lodged in a channel formed of two silicious plates; one of these being a continuation of the valve, and the other, exterior, which is extremely thin, follows the undulations, which form the cells, and is very finely punctate.

This arrangement of the coarse cells is more evident in fragments inclined in the same direction as the margin on which they are placed. Dimensions of one arch of the corona .003 mm.

Between each cell is found a cavity or depression of the valve; this regular depression produces an undulated plait which surrounds the corona of cells.

Superior surface of the valve: Diameter .310 mm., with radiant and punctate striation, 5 to 6 striæ as a mean in .01 m., and formed of small beads increasing in size as they approach the centre. No distinct area. Rays ending between each pair of coarse cells.

The punctate lines and the rays continue the whole length of the wall as far as the cells; outside that, only the punctate lines are continued, and the puncta are more accentuated.

The silica of the cells is very robust, while that of the rest of the valve is very thin and flexible, resulting in only fragments of this species being found. Its colour is drab yellow.

Habitat—Limestone from Japan.

Mr. Tempère describes two species in this genus, *B. Japonica Temp.*, figured in the text (fig. 271), taken from a photograph which Mr. Tempère has been good enough to send me, and *Brunia mirabilis Temp.*, also coming from Japan, and which differs from the first by the absence of rays. I have in my possession a specimen of this form from Sta. Monica, where it was found in 1878, by Mr. Weissflog.

## SECT. III. ACANTHODISCEÆ.—Characters of the genus.

## GENUS 182.—ACANTHODISCUS PANT, 1892, in litt.

Valve convex, with coarse scattered puncta throughout, between the centre and the margin a rugose, dentate ridge, more or less interrupted or plicate.

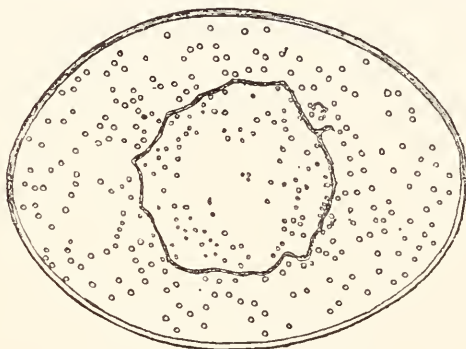


Fig. 272.—*Acanthodiscus clypeolus*

In his "Diatomeés nouvelles, 1891," Professor Brun established a genus called *Cotyledon*, based especially on the presence of a ridge. Prof. De Toni has suppressed this genus because a genus of the same name already existed. This does not appear to me to be a sufficient reason, as there can be no confusion possible between a phanerogamic genus and one of diatoms.

But the genus of Mr. Brun, as the learned diatomist himself subsequently stated, was only given as a landmark, and it includes very different forms.

I therefore think it is more convenient to adopt the genus which Dr. Pantocsek has communicated to me, and to which he gives the name of *Acanthodiscus*, and which is founded as much on the striation as the presence of the ridge.

The genus *Acanthodiscus* therefore includes two species, *A. clypeolus* (*Brun.*), a variety of which will be found figured in the text (fig. 272), drawn from one of my photographs, and *A. rugosus* *Pant.* Both have been found fossil at Kusnetz, Russia.

As to the curious form which Mr. Brun calls *Cotyledon coronalis* it requires further examination, and may constitute a new genus, *Bruniella* *H.V.H.*, in which may also perhaps be included his *C. circularis*.

SECT. IV. HYALINO-RADIEÆ.—Valve furnished with radiating hyaline spaces.

GENUS 183.—STEPHANODISCUS (Ehr., 1845), Emend. Grun.

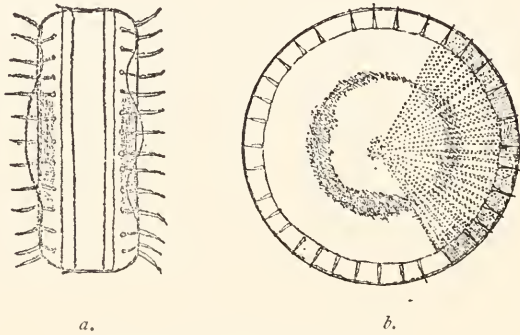


Fig. 273.—*Stephanodiscus Niagara*.

a. Girdle view.

b. Valve view.

Valve circular, somewhat convex, with margin furnished with a corona of spines, simple, acute, with fine puncta arranged in radiating rows, interrupted by smooth spaces radiating, simulating lines; centre with scattered granules.

In this genus have been arranged a rather numerous series of forms, most of which probably do not belong to it. In the text will be found the type-form of the genus *S. Niagara* Ehr., found living at Niagara, and also at Franz Josef Land. It has also been found in a fossil state at Buffalo and in Prussia.

*S. Hantzschianus* has been recorded in Belgium.

**S. Hantzschianus Grun.** (Arct. Diat., p. 115; H.V.H. Atl., pl. 95, f. 10\* ; Type No. 482), plate 23, fig. 662.

Valve small, with rather robust marginal spines, 6 to 9 in 1 c.d.m.; striae radiant, formed of two parallel rows of very fine puncta, very difficult to be seen. Diameter, 1 to 1.75 c.d.m.

Fresh water.—Brussels (Delogne). Antwerp (H.V.H.).

It is probable that it will be met with in other countries in our zone.

## GENUS 184.—COSMIODISCUS GREV., 1866.



Fig. 274.—*Cosmiodiscus tenuis*.  
 opinion to be preserved. The hyaline margin and its rays, equally hyaline and distant, easily determines the species which ought to be included in it.

The figure in the text is that of *C. tenuis* Grun., which is found fossil in the Monterey deposit.

Valve with hyaline margin, puncta arranged in radiating rows, interrupted at various points by hyaline rays; centre with scattered puncta.

This genus, which was included in the *Coscinodiscus* by Rattray, deserves in my

## GENUS 185.—ANISODISCUS GRUN., 1886.

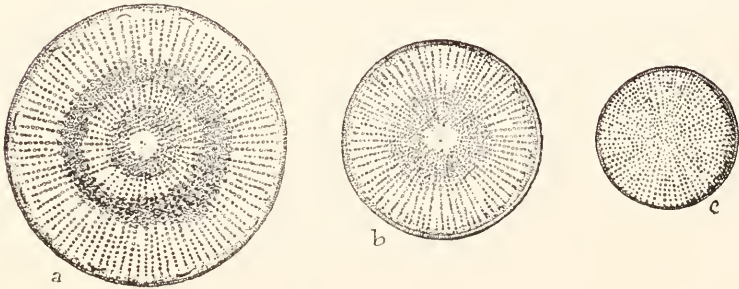


Fig. 275.—*Anisodiscus Pantocsekii*.

Valves circular, furnished with a margin of small distant spines, difficult to see. The two valves dissimilar; the superior, with rows of puncta in distant lines, alternately short and long, the inferior valve with puncta in approximate lines of equal length.

This genus only includes a single species, *A. Pantocsekii* Grun., found in a fossil state in Hungary, the figure of which is reproduced after Grunow (fig. 275).

GENUS 186.—ACTINOCYCLUS EHR., 1840.

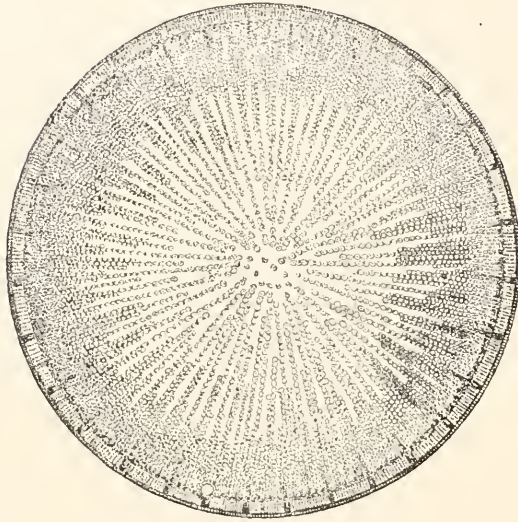


Fig. 276.—*Actinocyclus Ralfsii*.

Valve orbicular, elliptic or rhomboidal-oblong, convex, having a marginal or submarginal pseudo-nodule, frequently furnished with small marginal or submarginal spines; puncta in radiating rows of unequal length, usually leaving subulate hyaline spaces. Frustule disciform.

ANALYSIS OF SPECIES.

{	Valves circular.	{	Valve usually iridescent at a low magnification, puncta very visible.	{	Hyaline spaces of the valve clearly subulate-acute.	{	Subulate spaces very broad, producing the appearance of well-marked concentric zones; puncta very vigorous . . . . .	<i>A. Ralfsii</i> .
							Subulate spaces very narrow; puncta more delicate . . . . .	<i>A. Ehrenbergii</i> .
{	Valves elliptic	{	Valve not iridescent; puncta very feeble or absent . . . . .	{	Hyaline spaces not subulate; puncta strong, forming undulated concentric lines . . . . .	{		<i>A. crassus</i> .
								<i>A. subtilis</i> .
								<i>A. Roperii</i> .

The genus *Actinocyclus* includes about 60 species, found mostly in a living state, and inhabiting all parts of the world.

A good monograph of this genus was published in 1890 by Rattray, under the title of "A revision of the genus *Actinocyclus*," to which we refer the reader who desires to study exotic species of this genus.

Figure 278 in the text represents *A. Ralfsii*, the type-form of our regions.

**A. Ralfsii (W. Sm.) Ralfs.** (in Pritch., p. 835; *Eupodiscus Ralfsii* W. Sm., S.B.D., ii., p. 86; H.V.H. Atl., pl. 123, f. 6\*; in Type No. 518 and *var.* in Type No. 516 and *var.* in Type No. 517), plate 23, fig. 658.

Valve circular, with large submarginal pseudo-nodule. Puncta interrupted by very numerous subulate hyaline spaces, arranged in several rows and giving, at a low magnification, the appearance of concentric zones; 5 rows of puncta at the middle of the ray at the superior extremity of the innermost zone in 1 c.d.m. Margin furnished with small spines, almost marginal, distant about 1 c.d.m. from one another; puncta very fine, in quincunx, about 14 rows in 1 c.d.m. Diameter of valve, 10 to 13 c.d.m.

Marine.—Very rare: Blankenberghe, Ostend, Antwerp (Scheldt, H.V.H.), France (Bréb!), England (W. Sm.! Kitton, Stolt., Comber), Scotland (Cole! Baxter Coll., No. 2689), Cuxhaven (Bessel), Marstrand (Sweden, Thum.!), Ireland (O'Meara).

**var. sparsus (Greg.) Ralfs.**—Rows radiating, excessively distant at the central portion of the valve (about 8 in 1 c.d.m.) then augmenting regularly and progressively so as to form conspicuous concentric zones.

The opinions of authors differ greatly on this form, while Gregory, Ralfs, Kitton, and others see in it only a variety of *A. Ralfsii*. Mr. Rattray, on the other hand, thinks right to make it a distinct species, at least provisionally.

Marine.—Scotland: Glenshira Sand (Weissflog! Gregory).

**A. Ehrenbergii Ralfs.** (in Pritch. Inf., p. 834; H.V.H. Atl., pl. 123, f. 7; Type No. 518), plate 23, fig. 659.

Valve circular; pseudo-nodule very large, submarginal; connecting zone slightly or not marked; hyaline spaces very narrow and few; puncta approximate, 8 radiating rows in 1 c.d.m. Margin with small spines about 1 c.d.m. from one another; puncta in quincunx, about 16 rows in 1 c.d.m. Diameter of valve, 6 in 11 c.d.m.

Marine.—Blackenberghe, Scheldt at Antwerp (H.V.H.), Cherbourg (Bréb.), England, various localities, Cuxhaven (Möller, etc.). Found on all our coasts.

**A. crassus H. Van Heurck.** (H.V.H. Atl., pl. 124, f. 6 and 8\*), plate 23, fig. 660.

Valve orbicular, with pseudo-nodule submarginal, and furnished with very small submarginal spines, indistinct in small specimens. Puncta strong

at the centre of the valve, becoming finer and finer towards the margins, arranged in radiating rows, forming undulated concentric circles; about 8 puncta in 1 c.d.m. at the middle of the ray and 18 at the margin, where they are arranged in quincunx. Diameter, 4 to 8 c.d.m.

Marine.—Blackenberghe, 2nd Basin, Scheldt at Antwerp (H.V.H.), England (W. Sm. ! Hodgson, Kitton, Stolt., Norman), Ireland (O'Meara).

In the text of the "Synopsis" I have given the form under the following descriptions:—

**A. crassus (W. Sm. !)** Ralfs (*Eupodiscus crassus* W. Sm., S.B.D., i., p. 24, pl. 4, f. 41\*), plate 34, fig. 897.

Mr. Rattray, in his Monograph, p. 154, says: "The present species is separated from the *Eupodiscus crassus* of Smith, owing to the inconspicuousness of the fasciculi and the sharpness of the submarginal zone." A further examination has shown me that my form is quite identical with the authentic gatherings, labelled by Wm. Smith himself, in my possession, but that Smith's figure is faulty and shews fasciculi which do not exist in nature. Only in one of the gatherings of W. Sm. at most can there be recognized, under low magnification, a vague arrangement of puncta in radiating lines. I have consequently modified the name of this in accordance with Rattray and De Toni.

**A. subtilis (Greg.)** Ralfs. (in Pritch., p. 835; *Eupodiscus subtilis* Greg.; Diat. of Clyde, p. 29, pl. 3, f. 50; H.V.H. Atl., pl. 124, f. 7\*, Type No. 519, and *var.* Type No. 520), plate 23, fig. 661.

Valve yellowish, almost hyaline, not iridescent; pseudo-nodule submarginal, less visible than the preceding species. Striæ radiating, about 13 or 14 in the middle of the ray, finely punctate, leaving hardly any subulate hyaline spaces. Margins with small spines distant about 75  $\mu$ , with striæ somewhat more compact. Diameter of valve, 5 to 9 c.d.m.

Marine.—Not yet observed in Belgium. England, various localities (Weissflog, W. Arnott, Kitton, Norman), Scotland (Greg.).

**A. Roperii (Bréb.)** Kitt. (Bull. Soc. Belge. Micr., 1878, p. 30; *Eupodiscus Roperii* Bréb.; *Coscinodiscus (?) ovalis* Roper; H.V.H. Atl., pl. 125, f. 5, 6\*), plate 34, fig. 898.

Valve greyish, rounded-elliptic, with margin furnished with a crown of processes enlarged at the summit, striæ delicately punctate, arranged in



conspicuous fascicles, pseudo-nodule indistinct. Centre with puncta in irregular concentric rows. Striæ about 16 in 1 c.d.m. near the middle of the ray; length of minor axis of valve, 3 to 4 c.d.m.; major axis 4 to 6.5 c.d.m.

Marine.—France (Normandy, Bréb!), England (Deby, Norman), Scotland (W. Arn! Rattray).

SECT. V. EUCOSCINODISCEÆ.—Valves with similar structure throughout the surface.

GENUS 187.—COSCINODISCUS EHR., 1838.

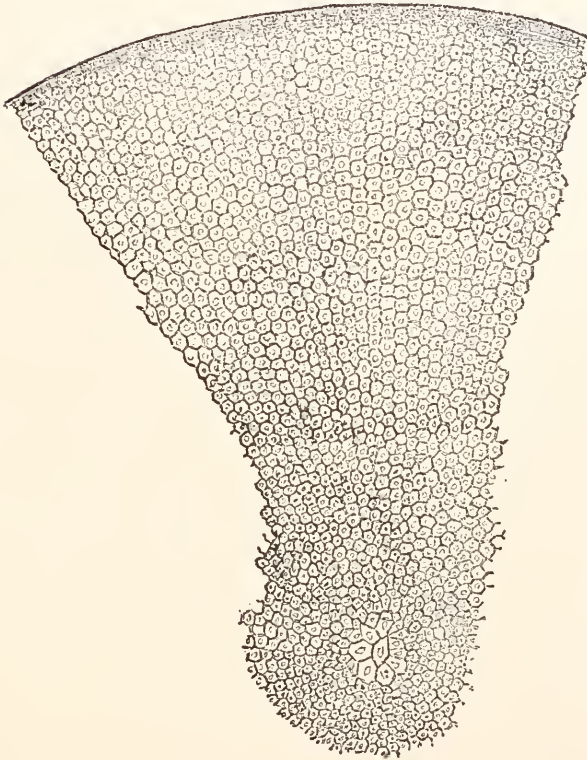


Fig. 277.—*Coscinodiscus Asteromphalus* var. *consticua*.

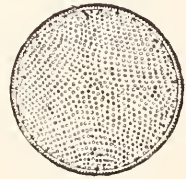


Fig. 278.—*Coscinodiscus excentricus*.

Valves circular or elliptic without any process (sometimes with small submarginal teeth), costæ or septa. Structure alveolate or punctate. Frustule disciform.

The genus *Coscinodiscus* is in a more confused state than any other. It comprises not less than 300 species, on the value of which authors are far from being agreed. The genus has been the subject of three important

works by Mr. Grunow, Mr. Rattray, and Mr. J. D. Cox. It will be convenient to make a few remarks about each. The work of Mr. Grunow will be found in his important publication *Die Diatomeen von Franz Josef's Land*. Mr. Grunow there arranges the *Coscinodiscus* into two principal groups, the *Radiati* and the *Fasciculati*, to which is added a third small group the *Pseudo stephanodisci*. He admits into each group a limited number of principal forms or species, to which he attaches a considerable number of varieties or sub-varieties. Mr. Grunow states that the difference, the delimitation of species, is extremely difficult in consequence of the innumerable transitional forms which knit together the large groups. In this way is the *Radiati*, which are characterised by the cellular structure; in many species the cells pass into puncta. Mr. Grunow's work is one of considerable importance, in which the stamp of a master is clearly recognizable, and I advise anyone who desires to devote himself to the *Coscinodiscus*, to study it thoroughly.

Mr. Rattray has published "A revision of the genus *Coscinodiscus* and some allied Genera," a volume of 240 pages, and a work of great importance. Mr. Rattray introduces into the genus *Coscinodiscus* several allied genera, which are easily distinguished, and which consequently deserve to be preserved, if only to facilitate their determination. In any case, Mr. Rattray's work gives in a condensed form all that is known of the *Coscinodiscus*, and it would be impossible to devote oneself to this genus without recognizing the work of this skilful monographer.

The third work, which is not the least original, has been published by Dr. J. D. Cox, under the title of "The *Coscinodiscæ*; Notes on some unreliable criteria of genera and species." The Hon. J. D. Cox, starting from the same point of view as many well-known diatomists, deplors the immense number of forms which have been created in the genus *Coscinodiscus*, and he proposes to refer all the *Coscinodiscus* to seven forms, which are as follows:—

1. **Actinocyclus Ehrenbergii Ralfs.**—The disc is divided into compartments or segments by radial lines of alveoli, at the marginal end of which is a small spine. Each compartment is filled by a fascicle of lines of alveoli, of which the middle line is radial and the other lines parallel to the middle one. The outer rim is bevelled or curved sharply beyond the spines, and upon this are more numerous lines of finer alveoli, making decussating as well as radial striæ. A "pseudo-nodule" is near the margin.

2. **Coscinodiscus subtilis Ehr.**—Marking of the disc like the last, except that the radial lines between the fascicles are omitted, and the parallel

lines of the wedge-shaped fascicles are lengthened till those of adjacent fascicles touch. The small spine is at the marginal end of the middle line of the fascicle. Bevelled rim beyond the spines similar to last. No pseudo-nodule.

3. *Coscinodiscus radiolatus* Ehr.—Marking of the disc similar to the last, except that the fascicles are each formed by a radial line, with parallel lines on one side of it only, the fascicles being all similar to each other and symmetrical. The small spine is at the end of the radial line forming the side of the fascicle.

4. *Coscinodiscus lineatus* Ehr.—The disc covered with alveoli in straight lines parallel to a diameter and arranged in quincunx, so that where the round alveolus becomes hexagonal the surface of the disc resembles a true honey-comb, the most prominent lines in appearance being parallel to the given diameter; a loose circle of small spines marginal or intra-marginal.

5. *Coscinodiscus radiatus* Ehr.—Marking of the disc made up of hexagonal alveoli in radial lines, which, starting from a central rosette, bifurcate as they go outward, so that there are rarely continuous straight radial lines of alveoli. In robust specimens the upper surface of each alveolus has a dotted appearance, caused by finer secondary pits or marks.

6. *Coscinodiscus centralis* Ehr.—Marking of the disc of hexagonal, round or subquadrate alveoli, which, starting near the centre, go outward in continuous radial lines, new radial lines being intercalated as room is made by the outward divergence. Secondary marking in robust specimens: in large examples the central zone is thin, and the outer zone relatively robust and thick.

7. *Coscinodiscus marginatus* Ehr.—Marking of the disc sub-hexagonal, alveoli without traceable scheme of radiation, but in largest specimens approaching *Cos. radiatus*. Margin strongly recurved and produced, so as to make a more and more deeply cup-shaped valve in each new frustule formed by fission, the small valves being thus most deeply cupped in a given brood, and the large valves most flat.

I have already several times indicated my way of looking at the matter, and I believe that whenever an easily recognised division can be formed—whether called genus or subgenus or section—it is useful to form it in order to restrict the field of research, and to render easier determinations. Thus

although the reasons given by Mr. Cox are very plausible, I prefer continuing to separate the *Actinocyclus* from *Coscinodiscus*. In addition, I consider that a seventh form should be admitted (the *Actinocyclus* having been suppressed), namely, *C. excentricus Ehr.*, which is clearly characterised by its rows of eccentric lines.

As to the other propositions of Mr. Cox, I frankly admit that they agree somewhat with my own views. Sooner or later it is inevitable that a serious effort must be made to reduce enormously the number of species which are permitted to day. Each further form that is described more or less covers up the differences existing hitherto between certain given species. A time will come, therefore, when it will be necessary to recognize that the number of real species is excessively limited, and the culture method, if that becomes general, will certainly produce material of the greatest value—probably even the only such admissible for the definite solution of the difficulty.

But a single cultivation will not suffice for a given form. These must be prolonged and directed—even for a single form—in different directions, and it will be necessary to appreciate the influence of different conditions of existence. My cultivation of phanerograms enables me to advocate this cause, and better, perhaps, than some others. In fact, in my youth, I closely pursued (and that under the direction of Maitre) the cultivations at the Ecole Jordanienne ; I studied with Jordan those innumerable species created at the expense of *Draba verna*, and many other Linnean forms, and the lessons which I then received have not a little contributed to destroy any illusions, and to give me, with regard to diatoms, ideas similar to those of Messrs. J. D. Cox, Ham, L. Smith, etc.

But meanwhile, and until sufficient study has enabled us to decide these knotty questions, let us return to the *Coscinodiscus* of our coasts. I shall give the forms now admissible within reasonable limits. The following table will show that these forms are not very numerous in the limited region adopted for this work :—

ANALYSIS OF SPECIES.

Valves having a smooth hyaline rounded space in the centre.		Valve with coarse granules, smooth space small . . . . . <b>C. perforatus.</b>		
		Valve with very fine puncta, smooth space large . . . . . <b>C. nobilis.</b>		
Valves without central smooth space.	Valves with alveolate structure: (at least the central).	Alveoles in radiating rows.	Valves with central alveoles of almost the same size as the median alveoles of the valve . . . . . <b>C. radiatus (Type).</b>	
			Valves with central alveoles stellately grouped, much larger than the median alveoles.	Cells of the rosette plane. { Valves without asymmetrical apiculi . . . . . <b>var. Oculus Iridis.</b>
		Cells of the rosette punctate. { Valve with two asymmetrical apiculi seen with difficulty . . . . . <b>var. centralis.</b>		
		Alveoles in eccentric rows.	Valves with margins furnished with apiculi, alveoles in simple eccentric lines.	Valve with large robust alveoles . . . . . <b>var. asteromphalus.</b>
				Valve with small and very delicate cells . . . . . <b>var. concinnus.</b>
			Valves very small, apiculi very robust, alveoles in irregular eccentric lines, the central much larger than the others . . . . . <b>C. decipiens Gr.</b>	
		Alveoles arranged in rectilinear rows	Valve rather large, apiculi delicate, alveoles in regular lines . . . . . <b>C. excentricus.</b>	
			Valves having margin without apiculi, alveoles arranged in eccentric lines forming fasciculi . . . . . <b>C. Kutzingii.</b>	
			Alveoles arranged in rectilinear rows . . . . . <b>C. lineatus.</b>	
		Valves punctate.	Puncta very fine.	Puncta large, forming distant and more or less radiating rows . . . . . <b>C. nitidus.</b>
Puncta in linear rows forming fasciculi . . . . . <b>C. subtilis.</b>				
Puncta forming lines divided dichotomously . . . . . <b>C. lacustris.</b>				
		Valve with puncta in radiating lines and showing in addition, here and there, coarse granules . . . . . <b>C. punctulatus.</b>		

*Group I. PERFORATI.*—Valves with a smooth hyaline rounded space at the centre.

**C. perforatus Ehr.** (Mon. Ber. An., 1844, p. 78; Ad. Schm. Atl., pl. 64, f. 12\*), plate 34, fig. 899.

Valves with coarse radiant puncta, granular or polygonal, arranged in rows of unequal length, the shorter terminating in an apiculus on the interior margin of the valve; centre of the valve smooth, hyaline; diameter 9 to 12 c.d.m. 3.5 to 4 rows of puncta in 1 c.d.m.

Marine and fossil.—Found in Thames mud by Roper. Antwerp: Mud of the Scheldt (H.V.H.) Maarstrand, Sweden. Ireland (O'Meara).

**C. nobilis Grun.** (J.R.M.S., 1879, p. 687, pl. 21, f. 1\*) plate 34, fig. 900.

Valve very large, with fine puncta arranged in radiating rows, interrupted here and there by hyaline lines, leaving at the centre of the valve a considerable rounded hyaline space. Diameter of the valve, 37 to 54 c.d.m.; about 7 puncta in 1 c.d.m.

Marine.—Found in Noctilucae and Ascidiae at different points on the English Coast, and probably will be found in Belgium.

This form has often been confounded with *C. Concinnus*, from which it is distinguished by its smooth central space.

*Group II. ALVEOLI.*—Valve with distinctly cellular structure.

**C. radiatus Ehr.** (Kreideth, pl. 3, f. 1, *a.b.c.*; Ad. Schm. Atl., pl. 60, f. 9, etc.; H.V.H. Atl., pl. 129, f. 5\*; Type No. 529), plate 23, fig. 663.

Valves with alveoles arranged in radiating rows, about 2 to 2.5 in 1 c.d.m., of the same size throughout, except near the margin, where there is a zone of smaller alveoles (about 5 to 6 in 1 c.d.m.). Alveoles punctate, distributed throughout the valve, and not leaving a hyaline space at the central portion. Size excessively variable; mean size of Belgian specimens, 5 to 7 c.d.m.

Marine.—Blankenberghe, and on all the coasts of the North Sea. Forms of all dimensions found. England (Kitton, Stolt., Norman, Comber). Ireland (O'Meara).

The above description corresponds with the form which Mr. Grunow considers as the type-form, but there are all possible varieties both in size and in the size of the alveoles.

**var. Oculus-Iridis Ehr.** (Type No. 528).

Central alveoles grouped stellately, much larger than the others, and very slightly or not punctate; medium sized alveoles, about 3 to 4 in 1 c.d.m. in the typical variety; alveoles of margin twice as small.

The largest specimens of this form observed by Mr. Grunow attain as much as 30 c.d.m.

Marine.—Rare. Blankenberghe, 2nd Basin. Scheldt at Antwerp, and on all the coasts of the North Sea. Ireland (O'Meara).

**var. Asteromphalus Ehr.** (H.V.H. Atl., pl. 130, f. 1, 2 and 5\*; in Type No. 508), plate 23, fig. 664.

Similar to the last variety, from which it only differs by the strong punctuation of the central alveoles; this punctuation is sometimes excessively obvious (*forma conspicua Grun.*).

Blankenberghe.—Very rare. Cuxhaven. England (Stolt).

**var. centralis (Ehr.) Rattr.**

Differs from the preceding by the presence of two asymmetrical apiculi difficult to be seen in balsam.

Marine.—North Sea, numerous localities. England (Norman). Ireland (O'Meara).

**var. concinnus W. Sm.**

Valves with central alveoles grouped stellately, distinctly punctate; median alveoles very small, forming 7 to 10 radiant rows in 1 c.d.m. Margin furnished with a circlet of small submarginal spines, rather approximate and unequally distant. Diameter of Belgian specimens, about 20 c.d.m.

Blankenberghe 2nd Basin, rather common, and on all the coasts of the North Sea. England (Kitton, Stolt., Norman, Comber). Ireland (O'Meara). This species is very fragile and is generally only met with in fragments. It is found in great abundance in a pelagic state both in the Scheldt and in the North Sea (H.V.H.).

**var. Jonesianus H.V.H.** (*Eupodiscus Jonesianus* Grev.; *E.?* *commutatus* Grun.; *Coscinodiscus* Grun. in Franz Jos. Ld., p. 79; H.V.H. in Type No. 490).

This is only an appendiculate form of the preceding variety. The marking of the valve and the central rosette differentiates at first view the form from a true *Eupodiscus*. I have therefore given it the name of *subvarietas Jonesiana*. It is clearly characterised by the two asymmetrical processes and by the row of dots or small spines which form a complete sub-marginal circle.

This form is not very rare in the North Sea (H.V.H.). It is sometimes met with in a triangular form. I have also a specimen in my possession from Java. The processes are not coincident with the angles, but are placed in the middle of the margins.

*Note.*—In his work on the diatoms of Franz Josef's Land, Mr. Grunow states that all these forms are connected with one another by all possible variations, and that it is best to unite them under the name of *C. radiatus*, the first species of the group which has just been described.

**C. excentricus Ehr.** (Kütz. Bac., p. 131, pl. 1, f. 9; H.V.H. Atl., pl. 130, f. 4, 7 and 8\*; Type No. 530), **plate 23, fig. 666.**

Valve circular, margin furnished with numerous small spines; alveoles diminishing gently and gradually up to the margin, where is found a very narrow zone of much smaller alveoles. The rows of alveoles form eccentric lines; about 5 rows in 1 c.d.m. at the centre of the valve. Diameter, 5 to 6 c.d.m.

Marine.—Very frequent; Blankenberghe, Antwerp, England (Kitton, Stolt., Norman, Comber).

**C. decipiens Grun.** (H.V.H. Atl., pl. 91, f. 10\*; Type No. 471, *C. minor* of English authors (non Ehr.), plate 34, fig. 905.

Valve small, with polygonal puncta decreasing regularly from the centre to the circumference, and arranged in eccentric rows. Margin of valve furnished with robust apiculi placed at unequal intervals. Diameter, 2·5 to 3 c.d.m.

Marine.—Lamlash (Greg.). Woolwich (W. Arnott!). England (Norman, Kitton). Ireland (O'Meara).

**C. Kützingii Ad. Schm.** (Ad. Schm. Atl., pl. 57, f. 17-18\*), plate 34, fig. 903.

Puncta polygonal, about 6 in 1 c.d.m., arranged in eccentric fasciculate rows. Margin without apiculi. Diameter, about 6·5 c.d.m.

Marine.—Firth of Tay. Cuxhaven.

**C. lineatus Ehr. (Kutz.)**, (Bac., p. 131, pl. 1, f. 10; H.V.H. Atl., pl. 131, f. 3, 5 and 6\*), plate 23, fig. 665.

Valve circular, with margins furnished with small spines, and sometimes a small process (*var. leptopus Grun.*); alveoles arranged in series forming straight lines in all directions, and in the rather extensive marginal zone much smaller than in the middle of the valve. About 7 to 7·5 series of alveoles in 1 c.d.m. Diameter, about 3 to 10 c.d.m.

Marine.—Blankenberghe, 2nd basin (H.V.H.). Devonshire, England (Baxter Coll., No. 2841). Ireland (O'Meara).

### *Group III. PUNCTATI.*—Valves with puncta only.

**C. nitidus Greg.** (Diat. of Clyde, p. 27, pl. 10, f. 25; H.V.H. Atl. Supp., f. 41\*), plate 23, fig. 667.

Valve circular, with very large and very distant puncta, forming more or less radiant lines. Puncta on margin small, arranged in two concentric rows, about 6 to 7 in 1 c.d.m. Diameter, 4 to 5 c.d.m. in the specimens observed.

Marine.—Rare. Blankenberghe, 2nd Basin (H.V.H.), England (Kitton). Cumbrae, Scotland (W. Arnott). Lamlash (Grev., Greg.). Ireland (O'Meara). Hvidingsoe (A. Schm.).

**C. subtilis (Ehr. ?) Grun.** (Kaspisch. Meer, p. 27; Diat. Franz. J. Land, p. 29, pl. C, f. 26\*), plate 34, fig. 901.



Valve circular, margin not spinous, alveoles small, easily seen to be punctiform, arranged in fasciculate rows.

Marine.

This type-form is represented in our region by the following varieties:—

**var. Normanii Greg.** (*Coscinodiscus fasciculatus*, *A. Schm.*; *Coscinodiscus subtilis*, Eul., No. 115; H.V.H., pl. 131, f. 1\*), plate 23, fig. 668.

Valve without spines, alveoles small, very small at the margin; rows of alveoles bifurcating so as to form, near the margin, fascicules, consisting of 6 rows; near the margin, 9 rows of alveoles in 1 c.d.m. Diameter of valve, 3.5 to 7 c.d.m.

Marine.—Frequent. Blankenberghe, Antwerp (Scheldt, H.V.H.). Hull, England (Norman). Ireland (O'Meara). Holstein (Möller)

**var. Rothii Grun!** (*Cosc. Rothii Grun.*, Kasp. Meer, p. 28; H.V.H., Types Nos. 532 and 533).

Valve small, with margin furnished with small spines placed just at the middle of the fasciculi; about 12 striæ in 1 c.d.m. at the margin of the valve. Diameter, 2.5 to 3.5 c.d.m.

Marine.—Antwerp, very frequent in the Scheldt

**C. lacustris Grun!** (Diat. Fr. J. Land, p. 33, pl. D, f. 300; *Cyclotella punctata* W. Sm.; H.V.H. Atl. Suppl., f. 42\*; in Type No. 535), plate 23, fig. 669.

Valve orbicular, undulated at the side, with margin furnished with small spines, approximate (6 in 1 c.d.m.), and very distinct. Puncta fine, arranged in radiating rows, divided dichotomously. About 10 to 11 rows in 1 c.d.m. at the margin of the valve. Diameter, 1.5 to 6 c.d.m.

Fresh water.—Deurne, near Antwerp (P. Gautier). England: Market Weighton (Norman, Grunow), Yorkshire, Wisbeach (W. Sm.), Breydon (Kitton).

**C. punctulatus Greg.** (Diat. of Clyde, p. 28, pl. 2, f. 46\*), plate 34, fig. 904.

Valve with radiating striæ, very fine (about 20 to 22 in 1 c.d.m.), scarcely visible towards the centre of the valve, intermixed with coarse scattered puncta. Margin striate and clearly defined. Diameter, 4.5 to 8.5 c.d.m.

Marine.—Lamlash Bay and Loch Fine, Scotland (Greg.), Ireland (O'Meara).

*Note.*—Gregory has referred this form to the *Coscinodiscus* with doubt, and believes that it may be a valve of *Meiosira*. Walker Arnott in his manuscript

and notes, as well as Eulenstein, considered it a *Podosira*. I am equally of opinion that it not a true *Coscinodiscus*.

**Planktoniella Schütt, 1893.**—A genus created for *Coscinodiscus Sol*, which is distinguished by the membranous ala surrounding the valve, and by the baculiform appearance of the girdle face. This diatom, besides being very rare, deserves to be raised, in my opinion, to the rank of a genus.

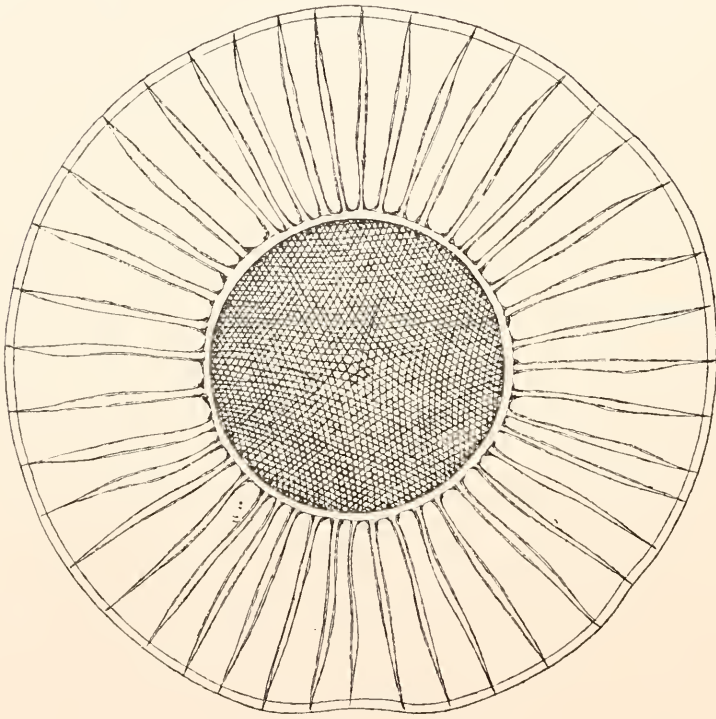


Fig. 279.—*Planktoniella Sol*.

**Antelminellia Schütt, 1893.**—A genus created for *Coscinodiscus Gazelle* of Janisch (plate 34, fig. 902 of this work). This form, which has the structure of *C. concinnus*, is distinguished by its large size, which reaches almost to 2 mm., and by the small spines found on the central portion.

The following genera are very approximate to the *Coscinodiscus* and should probably be combined with this genus :—

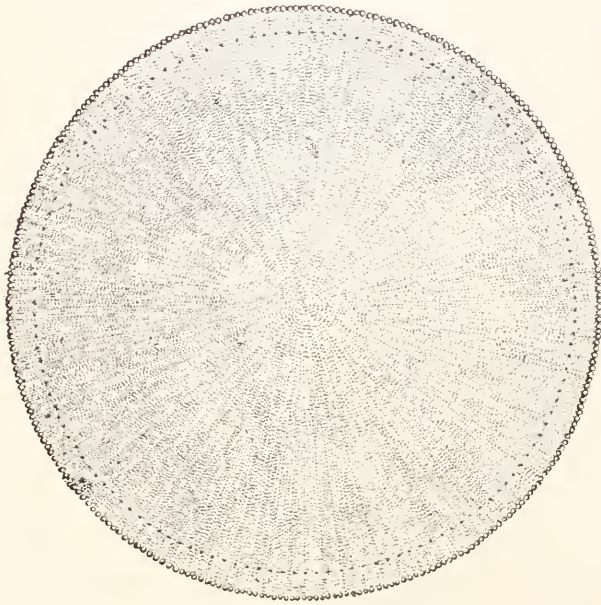


Fig. 280.—*Ethmodiscus punctiger*.

**Ethmodiscus** **Castr., 1886**—This genus includes the *Coscinodiscus* with very fine puncta. Figure 280 in the text shows a form of this genus *Ethmodiscus punctiger* *Castr.*, which has been found in Yeddo Bay.

**Haynaldiella** **Pant., 1892** (*Haynaldia* *Pant. olim*).

Valve circular, convex, with small plane central area, margin striate, very distinct. Structure striolate, flame-like, with striæ forming radiating lines.

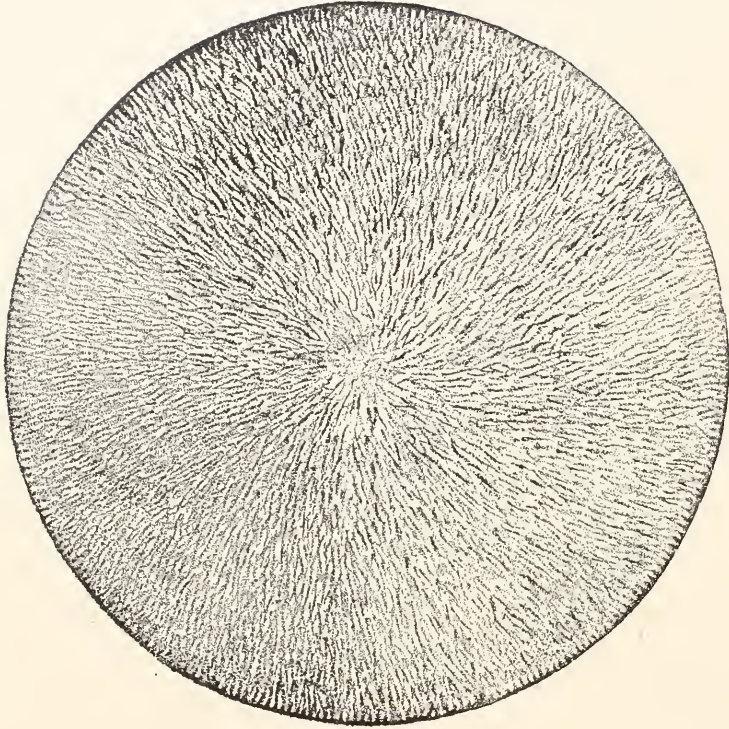


Fig. 281.—*Haynaldiella antiqua*.

A single species, *Haynaldiella antiqua* Pant. (*Coscinodiscus strigillatus* Witt.), represented in fig. 281, which has been found in a fossil state in Russia and in Hungary.

**GENUS 188.—JANISCHIA GRUN., 1882.**

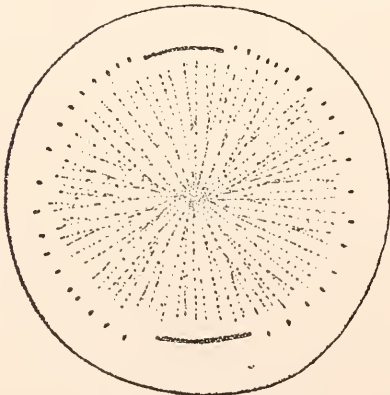


Fig. 282.—*Janischia antiqua*.

Valve circular, finely punctate ; puncta arranged in quincunx, and interrupted near the margin by a row of coarse elongated puncta (processes), surrounded by a small hyaline area. On two opposite parts of the valve the processes are interrupted and replaced by a long semi-hyaline line, formed of coarse puncta, surrounded by smooth spaces.

The genus *Fanischia* only comprises one species, *F. antiqua* Grun. (*Coscinodiscus Ludovicianus* Ratt.), fig. 282, (H.V.H. Atl., pl. 95 bis, f. 10, 11). This is in reality a very peculiar *Coscinodiscus*, the structure of which closely resembles *Brunia*, but with this difference, that in the *Fanischia* the peculiar band does not make a complete circuit of the valve, and has only a very slight development in breadth.

**Stoschia Janisch** (in litteris) is a reniform *Coscinodiscus*, which Mr. Rattray has described under the name of *C. reniformis*. It is represented in the text (fig. 283). Is it a constant form or only a deformed valve? I am

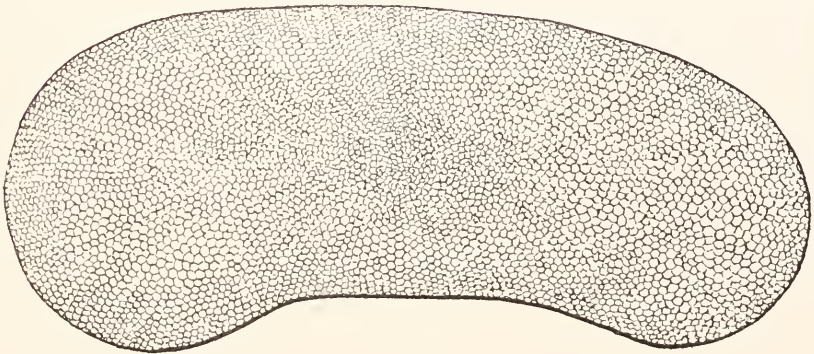


Fig. 283.—*Stoschia*.



Fig. 284.—*Willemoesia humilis*.

unable to answer this question. Mr. Janisch certainly examined this curious diatom in his work on the Expedition of the Gazelle. Numerous examples of this interesting form have been found on the West Coast of Africa.

**Willemoesia Castr., 1886**, is also described by Mr. Rattray as a *Coscinodiscus*. I give in the text (fig. 284) after Castracane a figure of *Willemoesia humilis* Castr. (*Coscinodiscus humilis* Rattr.), which has been found in one of the gatherings of the Challenger Expedition. Its habitat is unknown.



SECTION VI.—HEMIDISCE.E.  
 GENUS 189.—EUODIA BAILEY, 1860.

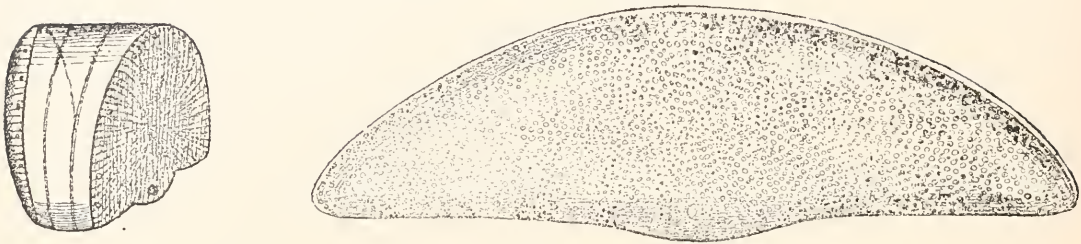


Fig. 285.—*Euodia gibba*.

Valve arcuate, with areolate or punctate structure; cells often radiant, sometimes more or less fasciculate. Margin often furnished with small pseudo-nodule, more or less developed, sometimes reduced to a sub-hyaline spot. Girdle face cuneate.

This genus is closely connected with both *Eupodiscus* and *Coscinodiscus*; the cuneate form which is common to this, and the following genus distinguish them from all other approximate genera. It can be further subdivided into two sub-genera: the *Hemidiscus* of Wallich, which possesses the pseudo-nodule and a rather fine cellular structure, plainly radiating, and the true *Euodia*, which are without a pseudo-nodule and have very coarse, more or less scattered puncta.

In the text is given (fig. 285) *Euodia gibba* Bail. (*Hemidiscus Cuneiformis* Walls), which is found in the West Indies, at Ceylon, Zanzibar, &c.

This genus includes about a dozen species, many of which require further examination.

GENUS 190.—PALMERIA GREV., 1865.

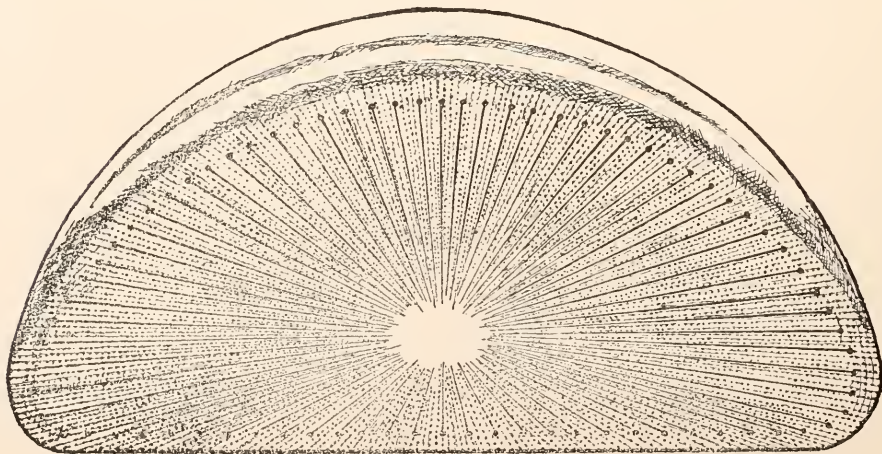


Fig. 286.—*Palmeria Hardmaniana*.

Valve semi-lunate, finely striate, with margins furnished with small spines, from which arise somewhat more robust striæ. Striæ radiating, finely punctate, only extending to the centre of the valve, which is smooth. Girdle face cuneate.

In the text will be found (fig. 286) from one of my photographs, *P. Hardmaniana* Grev., with the observation that the robust striæ have been exaggerated in the drawing. This species is found in China.

### GENUS 191.—LEUDUGERIA TEMPÈRE, 1893.

Valve arcuate, with very coarse puncta more or less scattered. Girdle face straight, showing on one of its faces an inflexion at the apices of the valve. Connecting membrane plicate, rather finely punctate.

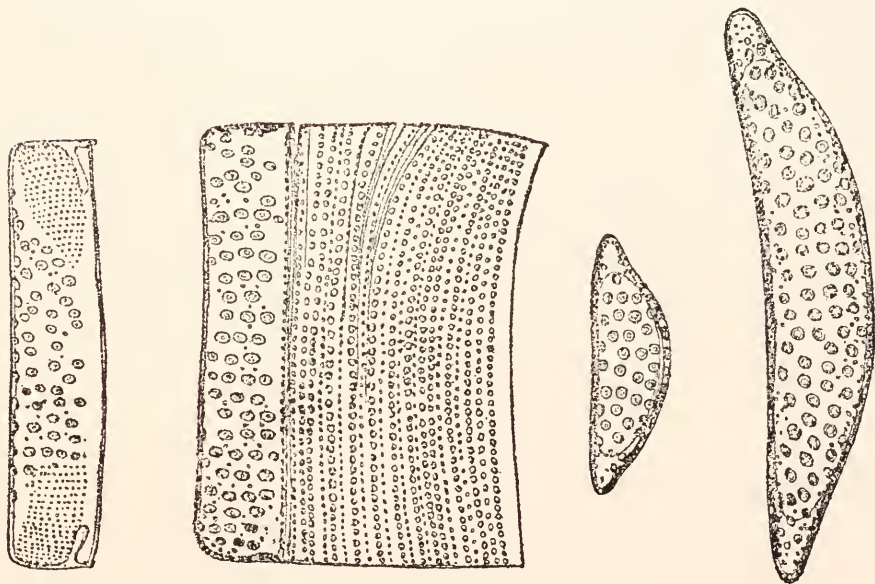
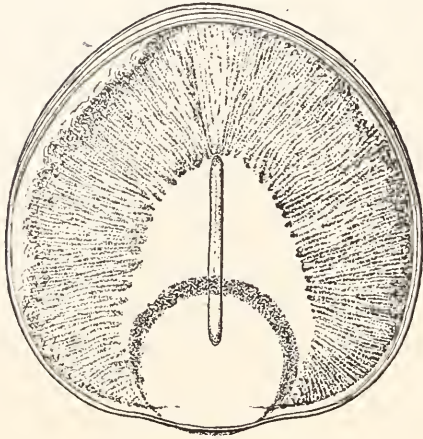


Fig. 287.—*Leudugeria Janischii*.

This genus only includes one species (fig. 287), *Leudugeria Janischii* (Grun.) Temp. (*Euodia* and *Eunotiopsis Janischii* Grun.), which inhabits Japan, China, Seychelles Islands, Ceylon, Australia, Gallapagos Islands, and is found fossil in Sta. Monica, etc.

## Genera dubia v. Incertæ sedis.

VAN HEURCKIELLA PANT., 1892.

Fig. 288.—*Van Heurckiella admirabilis*.

Frustule with girdle face panduriform or subcircular, furnished with a large marginal ocellus and with a plumose flamiform structure.

This genus was created for the very curious form, represented in the text, which Dr. Pantocsek named *Van Heurckiella admirabilis*. It has been found in Jackson's Paddock, Oamaru. Fig. 218 is an exact reproduction

of my photograph made from the original specimen belonging to the author. Dr. Pantocsek in a letter dated 26th February, 1893, writes:—"Observ.—Hic pertinet *Amphiprora cornuta*, H. Chase. Grunow eam in Bot. Centr., 1877, No. 43, p. 97, pro spongiolithum libet, sed hoc incorrectum nam habitus et præsertim structura qua illius *Aulisco Hardmanniano* similis—semper nos dicat ut forma cita ad Bacillarias numeranda." The question is very difficult to settle.

On an examination of only Dr. Pantocsek's specimen I am quite disposed to agree with him entirely, but since then I have discovered in Weissflog's collection a diatom found by that equally learned and modest diatomist, in the Oamaru deposit. This latter form only differs from that of Dr. Pantocsek by the absence of granular striæ. The preparation includes a demi (so called) frustule similar to that represented in the text, one (frustule) arranged on its face, and another arranged on its side. The latter shows at once that it is not a true diatom, and that Grunow's opinion is well founded. In the work of Prof. Johnson Sollas on sponges, inserted at page 39 of "Zoological Articles," by Ray Lankaster, London, 1891, there will be found a long paragraph on sponge spicules and numerous outlined figures representing various forms. One of these (*Microselæræ*, fig. 17 K.) has a very great analogy to *Van Heurckiella*, and I think that it really represents the Oamaru form drawn from an approximate focus.



## SPERMATOGONIA LEUD. FORTM., 1892.



Fig. 289.

*Spermatogonia antiqua.*

“ In the form of a spermatozoa with triangular head, a linear body which tapers to a point with inflation at the lower third. Capitate striæ on the margins.” (Leud. Fortm.).

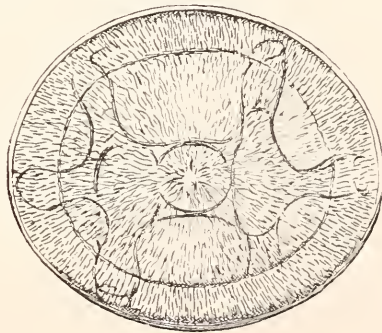
A single form: *Spermatogonia antiqua* represented in the text (fig. 289) after Dr. Leuduger-Fortmorel.

Mergui Archipelago. Java.

Is it a diatom ?

## CHELONIODISCUS PANT., 1869.

Frustules with subcircular valves, convex, mucronate at the poles. Superior valve vaguely striolate, flamiform, furnished with coarse confluent elevations, reaching to the margins, one of which is longitudinal and inserted in one of the apices, and two are transversal; inferior valve indistinctly striolate flamiform.

Fig. 290.—*Chelonioidiscus Ananiensis.*

A single species, *Chelonioidiscus Ananiensis*, Pant., found in Ananino, represented in the text after one of my photographs (fig. 290). This form, which I can only class as a diatom with great doubt, is arranged by Dr. Pantocsek among the *Biddulphiææ*.

## HERIBAUDIA, M. PERAG., 1893.

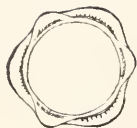


Fig. 291.  
*Heribaudia ternaria.*

Valve disciform, circular, hyaline or finely punctate, bearing on its edge three small expansions or conical alæ, between which extends three other larger alæ, rounded or plicate.

This genus comprises a single form only, *H. ternaria* M. Perag., which has been found in a fossil state in the deposits of Puy de Dôme, France. The genus is imperfectly known, and only the valve face has been figured.

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# Index of Genera and Species.

\* denotes that a figure of the species will be found in the Text at that page.

"pl. —, f. —" after the page refers to the plates and figures at the end of the volume.

The number in brackets after a Tribe or Genus refers to its position both in the Analytical Contents and the Text.

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## ADDENDA ET CORRIGENDA.

p. 5, l. 11, for "it," read "its"; p. 10, l. 30, insert "a" before "string"; p. 124, for "Cocconideæ," read "Cocconeideæ"; p. 152, Gomphopleura=Reicheltia; p. 156, l. 31, for "stigmophora," read "Stigmophora"; p. 166 (5 lines from bottom), for "England," read "Scotland"; p. 169, l. 14, for "Pinnulariæ," read "Pinnularie"; ll. 15, 16, for "Radioseæ," read "Radiosæ"; p. 175, l. 28, for "anceolate," read "lanceolate"; p. 193, l. 15, for "plate 25," read "plate 26"; p. 198, l. 2, for "Major," read "major"; p. 254, l. 2, omit "915"; p. 270 (l. 3 from bottom), the bracket should be after "etc.," and not after "16\*"; p. 288, the description of *C. Pediculus* is incorrect. It should be as follows:—

Valve broad, subrhomboidal, strongly flexed; hyaline zone of the superior valve constricted at the median portion; striae interrupted by hyaline flexuous lines; inferior valve showing some short, very robust costae; transverse striae radiant, rather robust, punctate, about 16 to 17 in 1 c.d.m. Length, 15 to 3 c.d.m.

p. 299, l. 4, for "narrow," read "narrow"; p. 306, l. 8, for "1865," read "1863"; p. 317, l. 1, for "IV," read "III"; p. 322, l. 3, for "Nitzschioides," read "nitzschioides"; p. 367, l. 18, insert bracket between "Solca" and "Breb.,"; p. 369, l. 15, for "subsala" read "subsalsa"; p. 402, l. 1, for "debitis" read "debilis"; p. 411 (last line), for "Cocconidiscus," read "Cocconidiscæ"; p. 416, l. 11, for "Schült," read "Schutt"; p. 419, in name of figure for "Meridiana," read "meridiana"; p. 429, Mastogonia=Stephanogonia; p. 430, l. 11, for "Ketrodiscus," read "Kentrodiscus"; p. 430, l. 14, for "1891," read "1889"; p. 451, in name of figure, for "Enervis," read "enervis"; p. 454, l. 24, for "Ennotogramma," read "Eunotogramma"; p. 456, in name of second figure, for "Regnia," read "Regina"; p. 459, l. 17, for "Monile," read "monile"; p. 466, l. 29, for "circinnus," read "Circinus"; p. 457, in name of Fig. 200, for "concinnus," read "Circinus"; p. 546, col. 1, l. 44, for "Pinnularia" read "Stauroneis."







PLATE I

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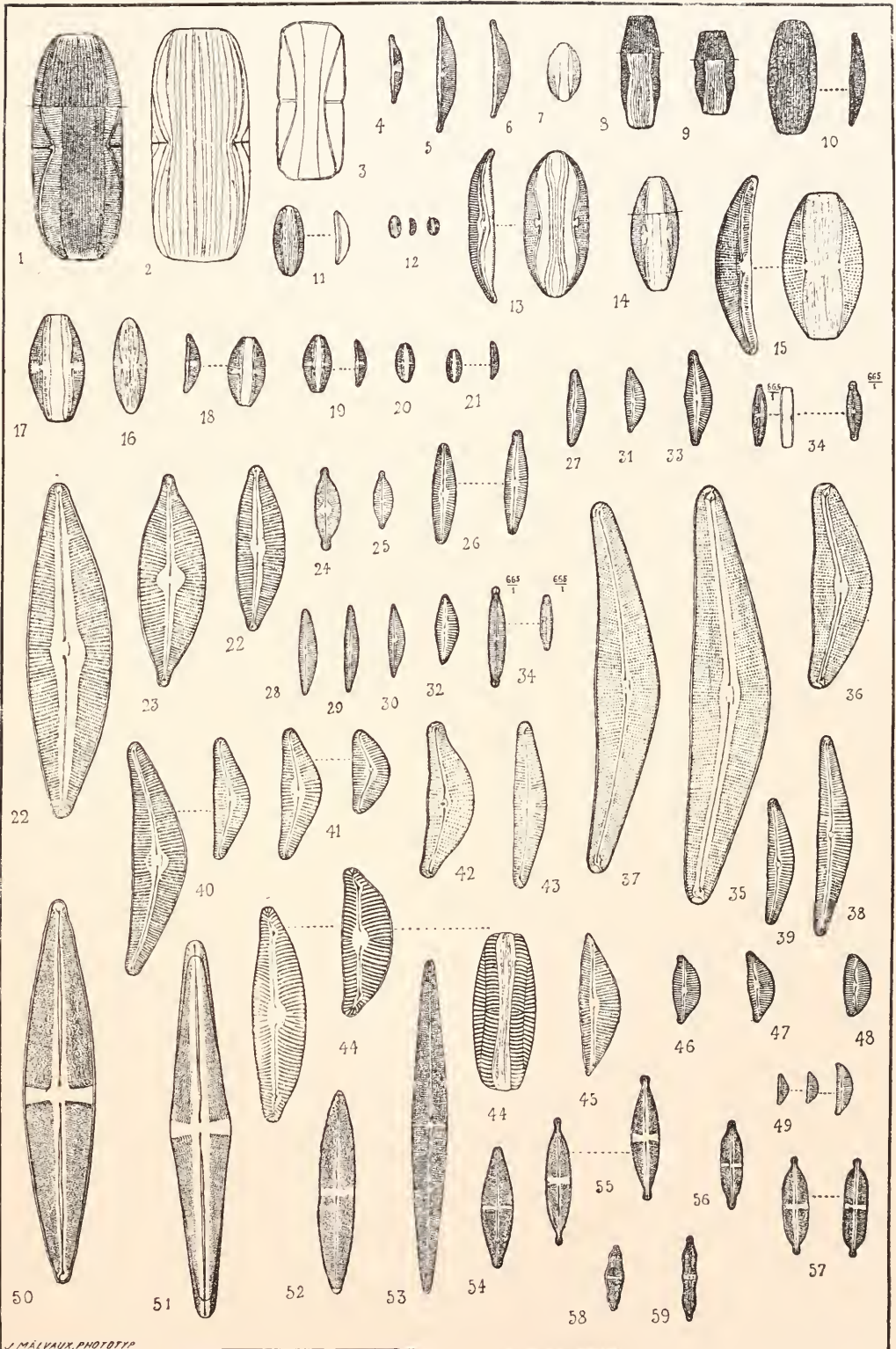






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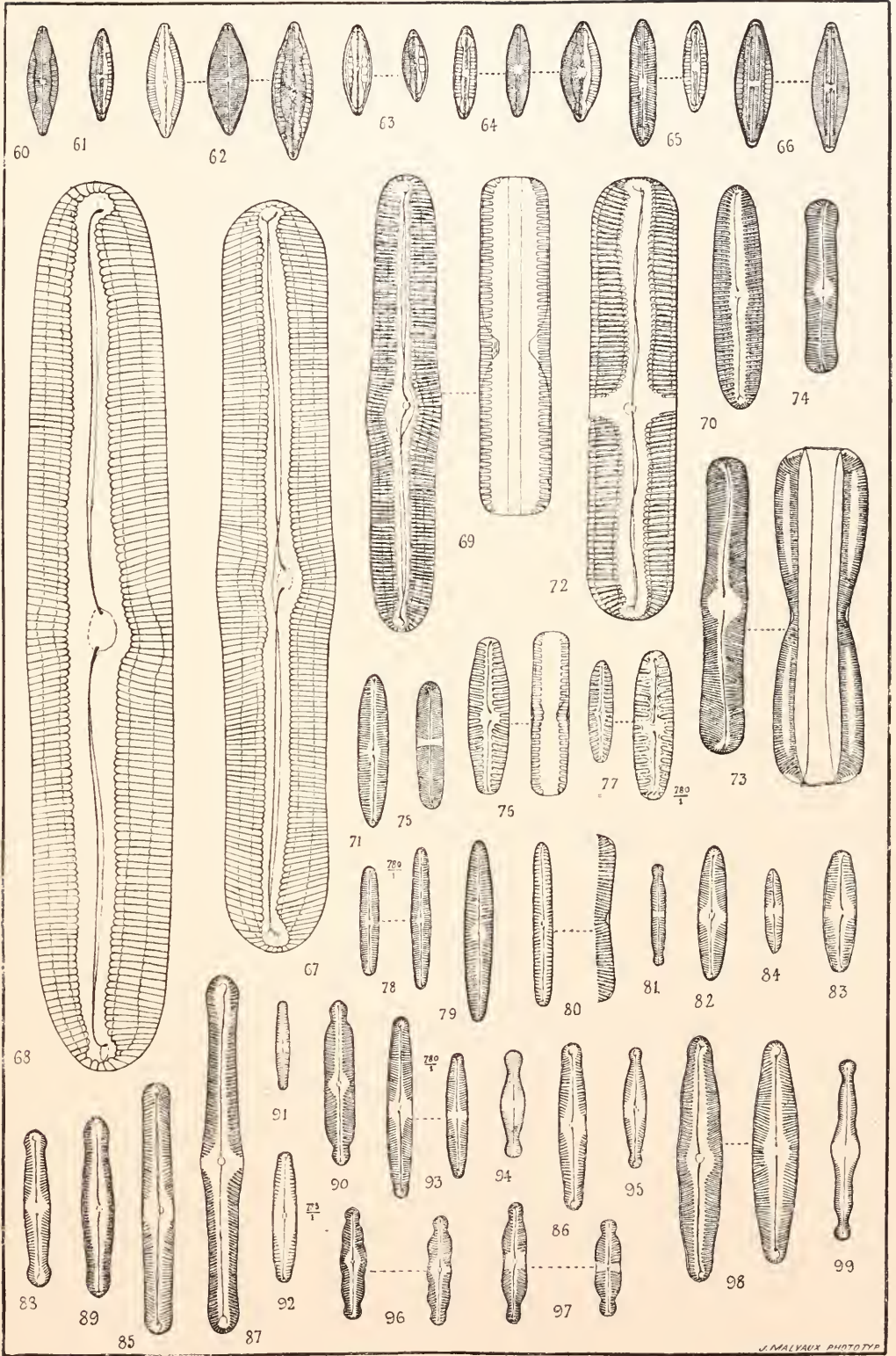




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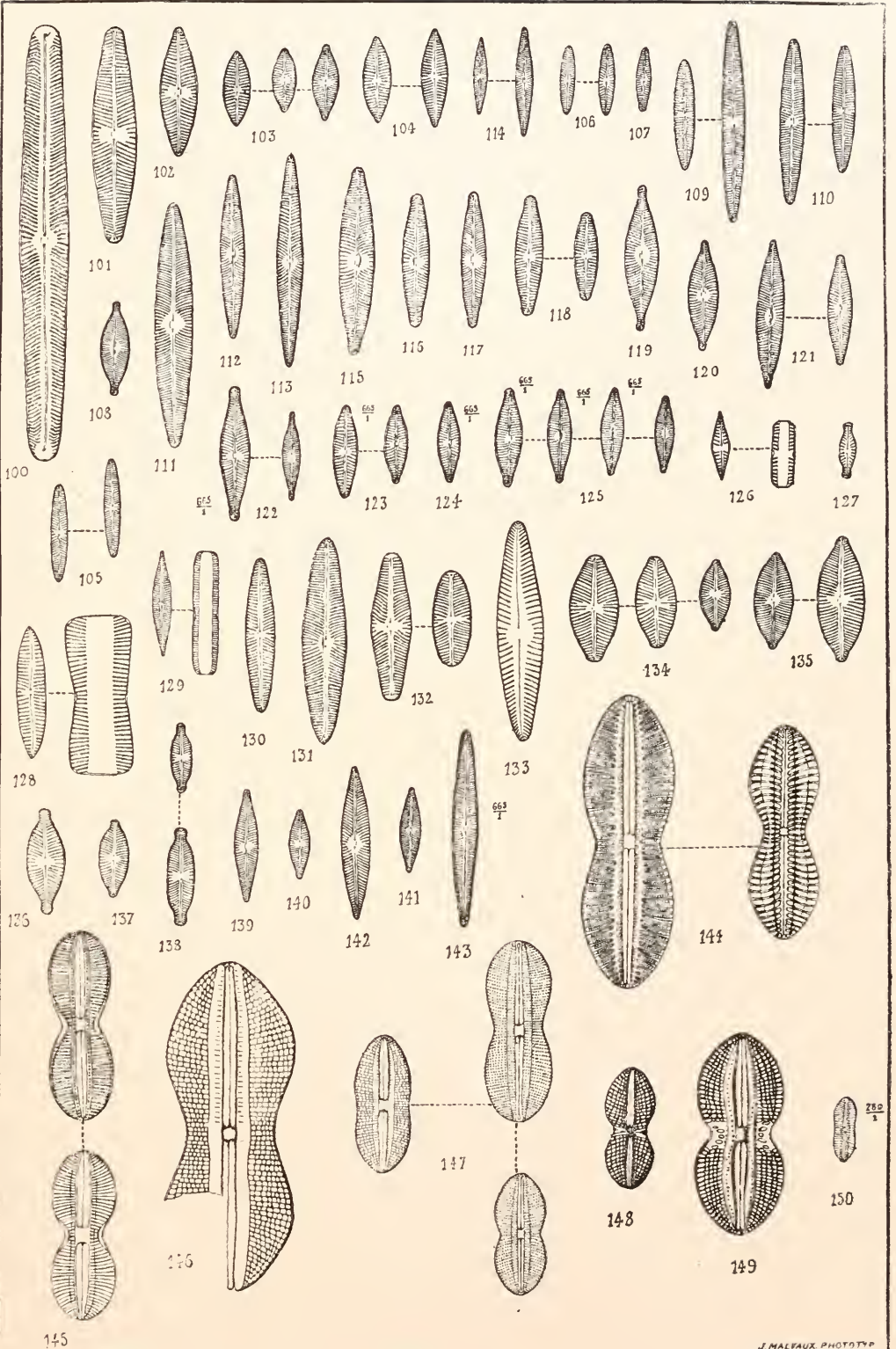






PLATE IV.

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Fig. 193. *Navicula ambigua*, forma *craticula*, p. 214.  
Fig. 194. *Navicula sculpta*, Ehr., p. 216.  
Fig. 195. *Navicula sphærophora*, Kütz, p. 216.  
Fig. 196. *Navicula serians*, Bréb., p. 217.  
Fig. 197. *Navicula serians*, var. *brachysira*, p. 217.  
Fig. 198. *Navicula exilis*, Grun., p. 217.



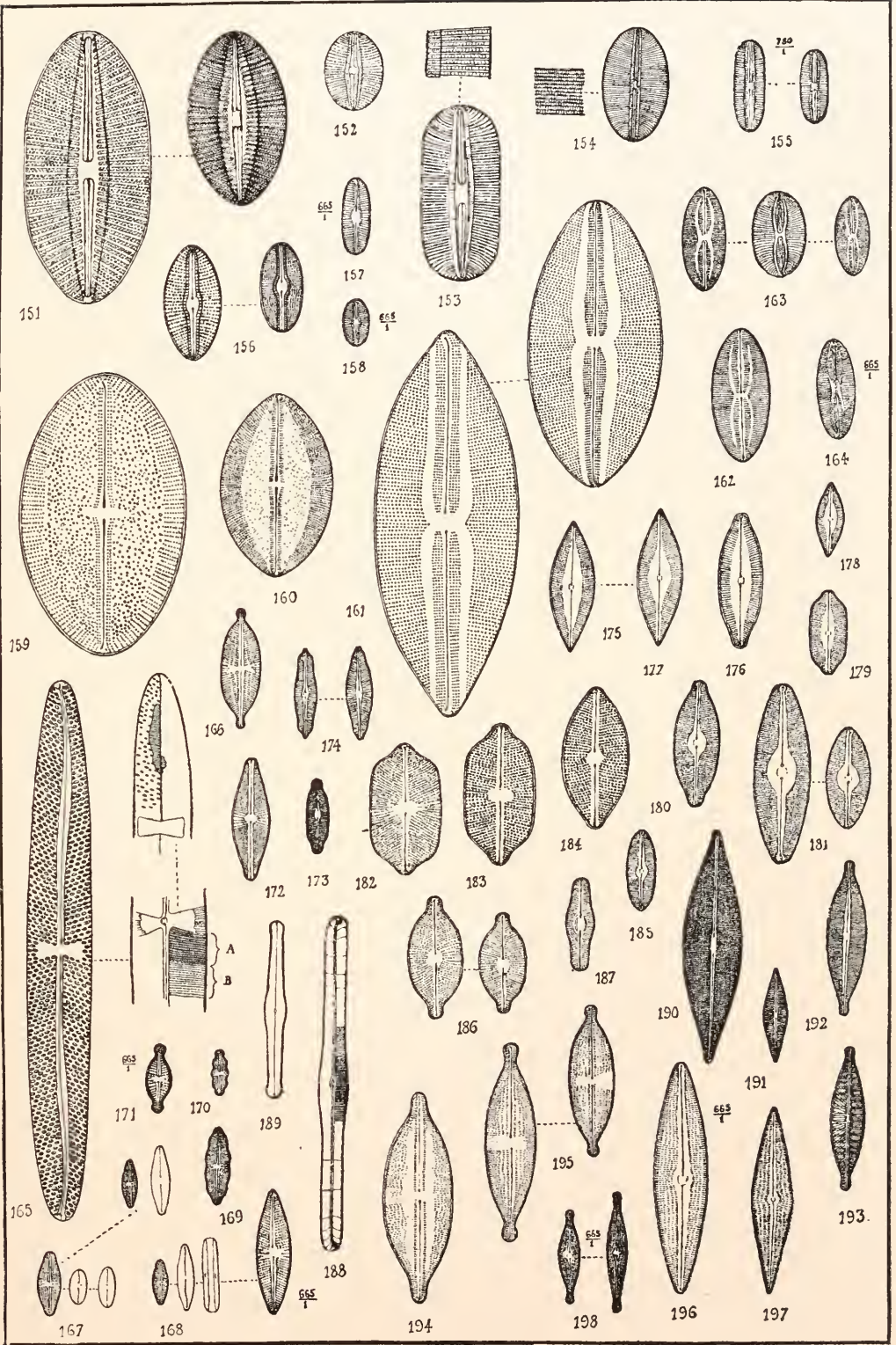




PLATE V.

- Fig. 199. *Navicula formosa*, Greg., p. 218.  
 Fig. 200. *Navicula latiuscula*, Kütz., p. 218.  
 Fig. 201. *Navicula Liburnica*, Grun., p. 218.  
 Fig. 202. *Navicula permagna*, Bailey, p. 218.  
 Fig. 203. *Navicula amphibæna*, Bory, p. 219.  
 Fig. 204. *Navicula amphibæna*, var. *subsalina*, p. 219.  
 Fig. 205. *Navicula amphibæna*, forma *major*, p. 219.  
 Fig. 206. *Navicula amphibæna*, var. *Fenzlii*, p. 219.  
 Fig. 207. *Navicula limosa*, Kütz., p. 219.  
 Fig. 208. *Navicula limosa*, var. *gibberula*, p. 220.  
 Fig. 209. *Navicula ventricosa* (Ehr.?), Donk., p. 220.  
 Fig. 210. *Navicula ventricosa*, var. *minuta*, p. 220.  
 Fig. 211. *Navicula fontinalis*, Grun., p. 220.  
 Fig. 212. *Navicula Iridis*, Ehr., p. 220.  
 Fig. 213. *Navicula Iridis*, var. *amphigomphus*, p. 221.  
 Fig. 214. *Navicula Iridis*, var. *amphirhynchus*, p. 221.  
 Fig. 215. *Navicula Iridis*, var. *dubia*, p. 221.  
 Fig. 216. *Navicula Iridis*, var. *undulata*, p. 221.  
 Fig. 217. *Navicula Iridis*, var. *affinis*, p. 221.  
 Fig. 218. *Navicula Iridis*, var. *producta*, p. 221.  
 Fig. 219. *Navicula Liber*, Wm. Sm., p. 222.  
 Fig. 220. *Navicula Liber*, var. *linearis*, p. 222.  
 Fig. 221. *Navicula Americana*, Ehr., p. 223.  
 Fig. 222. *Navicula Bacillum*, Ehr., p. 224.  
 Fig. 223. *Navicula Bacillum*, forma *minor*, p. 224.  
 Fig. 224. *Navicula pseudo-Bacillum*, Grun., p. 224.  
 Fig. 225. *Navicula subhamulata*, Grun., p. 224.  
 Fig. 226. *Navicula Pupula*, Kütz., p. 225.  
 Fig. 227. *Navicula incerta*, Grun., p. 226.  
 Fig. 228. *Navicula Seminulum*, Grun., p. 227.  
 Fig. 229. *Navicula minima*, Grun., p. 227.  
 Fig. 230. *Navicula atomoides*, Grun., p. 227.  
 Fig. 231. *Navicula Atomus*, Nag., p. 227.  
 Fig. 232. *Navicula Falaisensis*, Grun., p. 228.  
 Fig. 233. *Navicula Bulnheimii*, Grun., p. 228.  
 Fig. 234. *Navicula exilissima*, Grun., p. 229.  
 Fig. 235. *Navicula binodis* (Ehr.), Wm. Sm., p. 229.  
 Fig. 236. *Navicula lepidula*, Grun., p. 229.  
 Fig. 237. *Navicula Gallica* (Wm. Sm.), H.V.H., p. 229.  
 Fig. 238. *Navicula Flotowii*, Grun., p. 230.  
 Fig. 239. *Navicula contenta*, Grun., p. 230.  
 Fig. 240. *Navicula contenta*, var. *biceps*, p. 230.  
 Fig. 241. *Schizonema Smøthii*, Ag., p. 231.  
 Fig. 242. *Schizonema cruciferum*, Wm. Sm., p. 232.  
 Fig. 243. *Schizonema Grevillei*, Ag., p. 232.  
 Fig. 244. *Schizonema ramosissimum*, Ag., p. 232.  
 Fig. 245. *Schizonema ramosissimum*, var. *setaceum*, p. 233.  
 Fig. 246. *Colletonema lacustre* (Ag.), H.V.H., p. 239.  
 Fig. 247. *Scoliopleura latestriata* (Bréb.), Grun., p. 246.  
 Fig. 248. *Scoliopleura tumida* (Bréb.), Rab., p. 246.  
 Fig. 249. *Van Heurckia*, rhomboides, Bréb., p. 240.  
 Fig. 250. *Van Heurckia*, rhomboides, var. *crassinervis*, p. 240.  
 Fig. 251. *Van Heurckia*, viridula, Bréb., p. 240.  
 Fig. 252. *Van Heurckia*, vulgaris (Thw.), H.V.H., p. 240.  
 Fig. 253. *Amphipleura pellucida*, Kütz., p. 242.  
 Fig. 254. *Berkeleya micans* (Lyng.), H.V.H., p. 245.  
 Fig. 255. *Berkeleya Dillwynii* (Ag.), H.V.H., p. 245.  
 Fig. 256. *Toxonidea insignis*, Donk., p. 247.  
 Fig. 286. *Denkinia recta* (Donk.), Grun., p. 248.  
 Fig. 287. *Amphiprora* (Orthotropis), lepidoptera (Greg.), Cl., p. 263.  
 Fig. 288. *Amphiprora* (Orthotropis), maxima, Greg., p. 264.  
 Fig. 289. *Amphiprora alata*, Kütz., p. 262.  
 Fig. 290. *Amphiprora paludosa*, Wm. Sm., p. 262.  
 Fig. 291. *Amphiprora hyalina* (A. paludosa, var.?).  
 Fig. 292. *Amphiprora paludosa*, var. *duplex*, p. 262.  
 Fig. 293. *Amphiprora ornata*, Bail, p. 262.



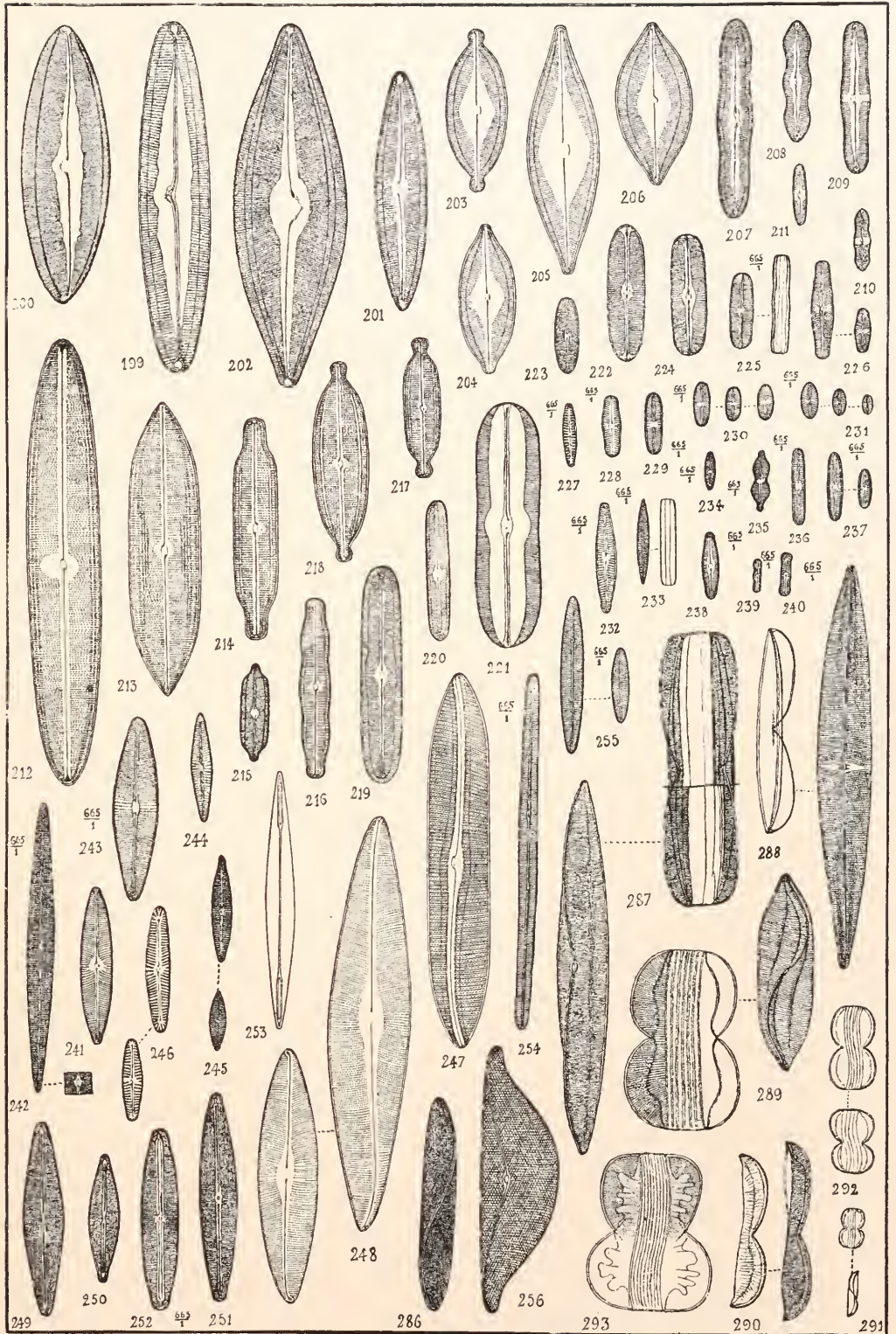






PLATE VI.

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- Fig. 257. *Pleurosigma angulatum*, Wm. Sm., p. 251.  
Fig. 258. *Pleurosigma angulatum*, var. *Æstuarii*, p. 251.  
Fig. 259. *Pleurosigma angulatum*, var. *quadratum*, p. 251.  
Fig. 260. *Pleurosigma angulatum*, var. *major*, p. 251.  
Fig. 261. *Pleurosigma angulatum*, var. *strigosum*, p. 251.  
Fig. 262. *Pleurosigma elongatum*, Wm. Sm., p. 253.  
Fig. 263. *Pleurosigma affine*, Grun., p. 252.  
Fig. 264. *Pleurosigma affine*, var. *Nicobarica*, p. 252.  
Fig. 265. *Pleurosigma rigidum*, Wm. Sm., p. 251.  
Fig. 266. *Pleurosigma naviculaceum*, Bréb., p. 252.  
Fig. 267. *Pleurosigma intermedium*, Wm. Sm., p. 253.  
Fig. 268. *Pleurosigma formosum*, Wm. Sm., p. 254.  
Fig. 269. *Pleurosigma decorum*, Wm. Sm., p. 254.  
Fig. 294. *Plagiotropis elegans* (Wm. Sm.), Grun., p. 265.  
Fig. 295. *Plagiotropis Van Heurckii*, Grun., p. 265.



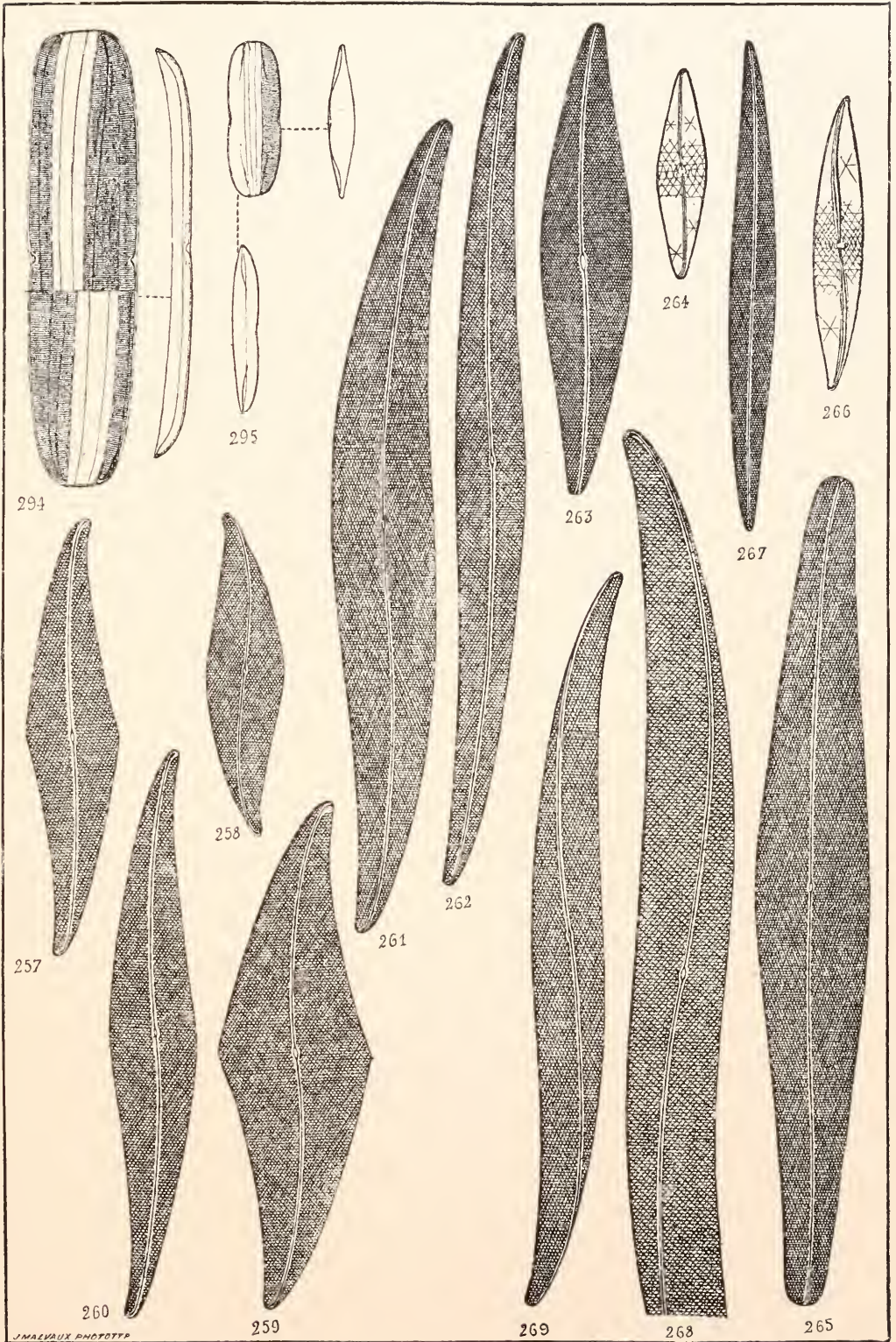




PLATE VII.

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- Fig. 270. *Pleurosigma Hippocampus*, Wm. Sm., p. 255.  
Fig. 271. *Pleurosigma attenuatum*, Wm. Sm., p. 255.  
Fig. 272. *Pleurosigma Balticum*, Wm. Sm., p. 255.  
Fig. 273. *Pleurosigma Balticum*, var. *Breissonii*, p. 256.  
Fig. 274. *Pleurosigma acuminatum* (Kütz), Grun., p. 256.  
Fig. 275. *Pleurosigma strigilis*, Wm. Sm., p. 256.  
Fig. 276. *Pleurosigma Spencerii*, Wm. Sm., var. *Smithii*, p. 257.  
Fig. 277. *Pleurosigma Spencerii*, var. *Kützingii*, p. 257.  
Fig. 278. *Pleurosigma Spencerii*, var. *nodifera*, p. 257.  
Fig. 279. *Pleurosigma Spencerii*, var. *curvula*, p. 258.  
Fig. 280. *Pleurosigma Parkeri*, Harrison, p. 258.  
Fig. 281. *Pleurosigma Fasciola*, Wm. Sm., p. 258.  
Fig. 282. *Pleurosigma maerum*, Wm. Sm., p. 259.  
Fig. 283. *Pleurosigma eximium* (Thw.), H.V.H., p. 259.  
Fig. 284. *Pleurosigma scalproides*, Rab., p. 259.  
Fig. 285. *Pleurosigma attenuatum*, var. *scalprum*, p. 255.  
Fig. 296. *Gomphonema constrictum*, Ehr., p. 270.  
Fig. 297. *Gomphonema constrictum*, var. *capitatum*, p. 270.  
Fig. 298. *Gomphonema constrictum*, var. *curta*, p. 270.  
Fig. 299. *Gomphonema acuminatum*, Ehr., p. 270.  
Fig. 300. *Gomphonema acuminatum*, var. *coronatum*, p. 271.  
Fig. 301. *Gomphonema Augur*, Ehr., p. 271.  
Fig. 302. *Gomphonema Augur*, var. *Gautieri*, H.V.H., p. 271.  
Fig. 303. *Gomphonema montanum*, Schumann, p. 271.  
Fig. 304. *Gomphonema montanum*, var. *subclavatum*, p. 272.  
Fig. 305. *Gomphonema montanum*, var. *commutatum*, p. 272.  
Fig. 306. *Gomphonema parvulum*, Kütz, p. 272.  
Fig. 307. *Gomphonema parvulum*, var. *lanceolata*, p. 272.  
Fig. 308. *Gomphonema parvulum*, var. *subcapitata*, p. 272.  
Fig. 309. *Gomphonema gracile*, Ehr., p. 272.  
Fig. 310. *Gomphonema gracile*, var. *dichotomum*, p. 273.  
Fig. 311. *Gomphonema gracile*, var. *auritum*, p. 273.  
Fig. 312. *Gomphonema micropus*, Kütz, p. 273.  
Fig. 313. *Gomphonema intricatum*, Kütz, p. 273.  
Fig. 314. *Gomphonema angustatum*, Kütz, p. 273.  
Fig. 315. *Gomphonema olivaceum*, Kütz, p. 274.  
Fig. 316. *Gomphonema olivaceum*, var. *vulgaris*, p. 275.  
Fig. 317. *Gomphonema exiguum*, Kütz, p. 275.  
Fig. 318. *Gomphonema exiguum*, var. *minutissima*, p. 275.  
Fig. 319. *Rhoicosphenia curvata* (Kütz), Grun., p. 275.  
Fig. 320. *Rhoicosphenia curvata*, var. *marinum*, p. 276.  
Fig. 321. *Rhoicosphenia Van Heurckii*, Grun., p. 276.



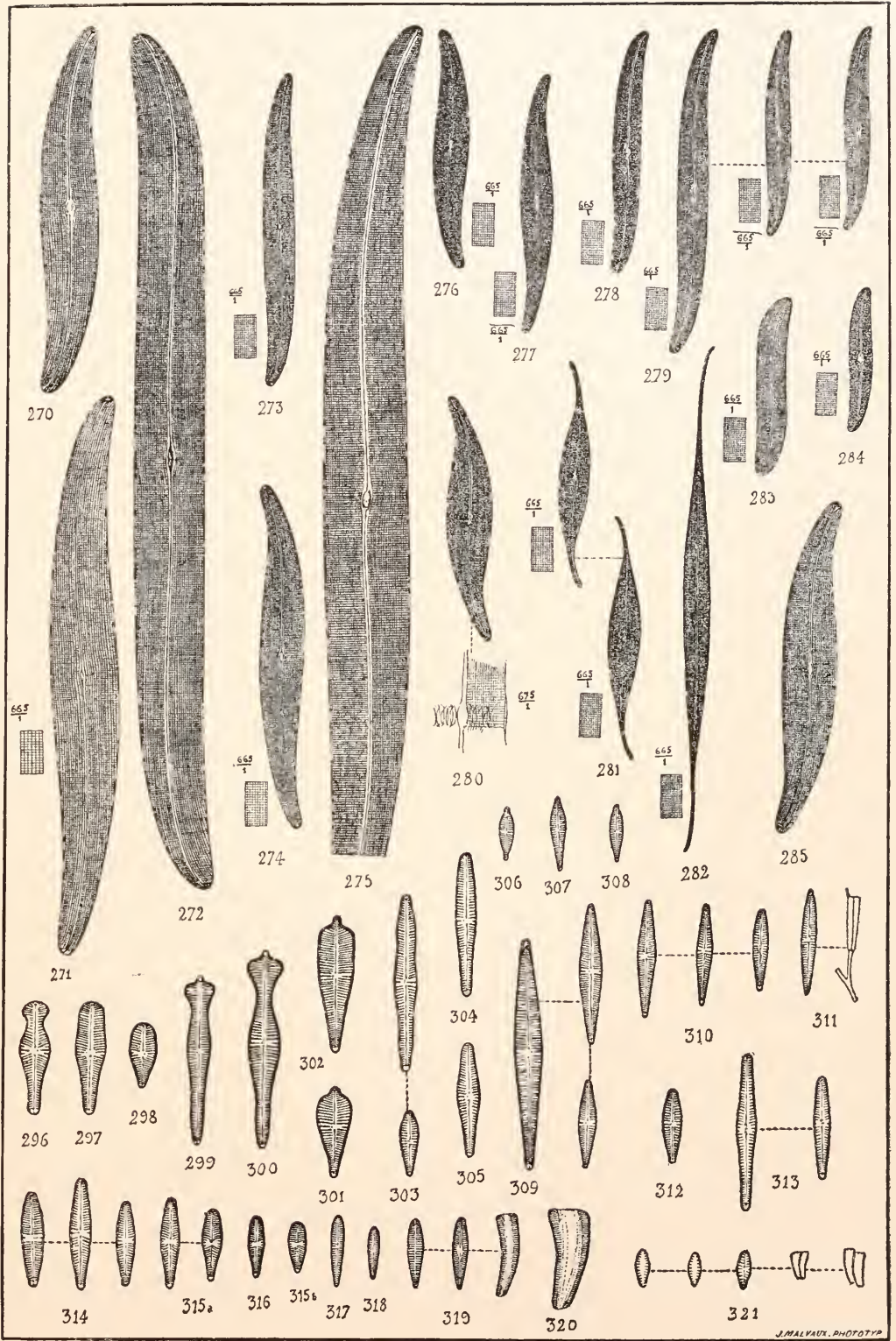






PLATE VIII.

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- Fig. 322. *Aclanthidium flexellum*, Bréb., p. 277.  
Fig. 323. *Achnanthes longipes*, Ag., p. 279.  
Fig. 324. *Achnanthes brevipes*, Ag., p. 279.  
Fig. 325. *Achnanthes subsessilis*, Ehr., p. 279.  
Fig. 326. *Achnanthes parvula*, Kütz., p. 280.  
Fig. 327. *Achnanthes coarctata*, Bréb., p. 280.  
Fig. 328. *Achnanthes Hungarica*, Grun., p. 280.  
Fig. 329. *Achnanthes affinis*, Grun., p. 280.  
Fig. 330. *Achnanthes delicatula*, Kütz., p. 281.  
Fig. 331. *Achnanthes Biasoletiana*, Grun., p. 281.  
Fig. 332. *Achnanthes microcephala*, Kütz., p. 281.  
Fig. 333. *Achnanthes exilis*, Kütz., p. 281.  
Fig. 334. *Achnanthes minutissima*, Kütz., p. 282.  
Fig. 335. *Achnanthes linearis*, Wm. Sm., p. 282.  
Fig. 336. *Achnanthes lanceolata*, Bréb., p. 282.  
Fig. 337. *Achnanthes lanceolata*, var. *dubia*, p. 283.  
Fig. 338. *Cocconeis Scutellum*, Ehr., p. 287.  
Fig. 339. *Cocconeis Scutellum*, forma *parva*, p. 287.  
Fig. 340. *Cocconeis Pediculus*, Ehr., p. 288.  
Fig. 341. *Cocconeis Placentula*, Ehr., p. 288.  
Fig. 342. *Cocconeis Placentula*, var. *lineata*, p. 288.  
Fig. 343. *Cocconeis dirupta*, Greg., p. 290.  
Fig. 344. *Camploneis Grevillei* (Wm. Sm.), Grun., p. 285.  
Fig. 345. *Campyloneis Grevillei*, var. *Argus*, p. 285.



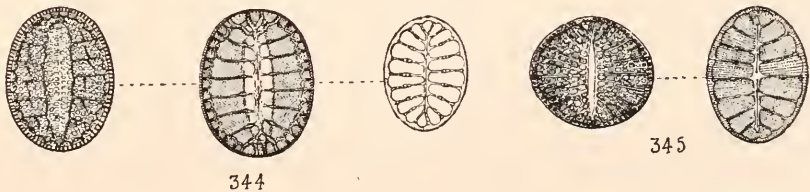
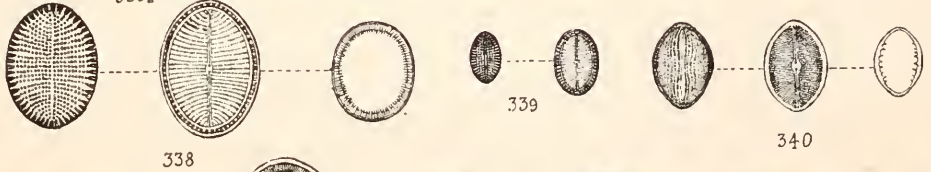
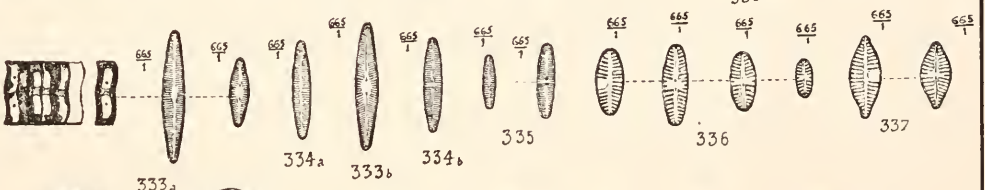
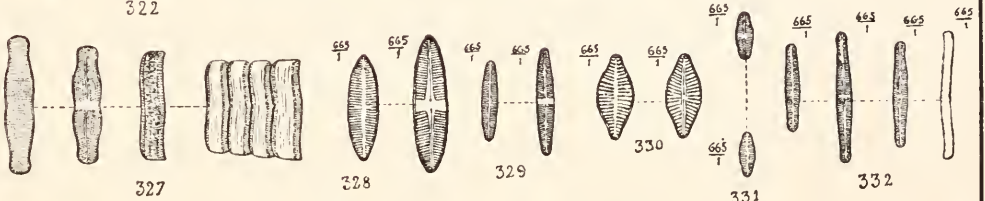
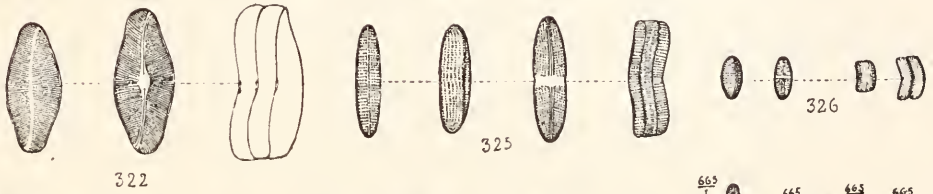
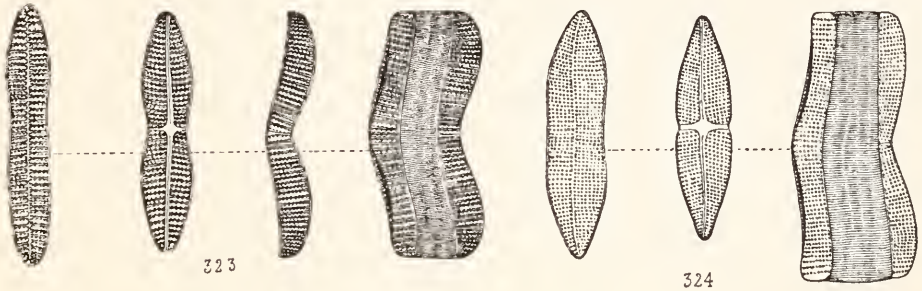




PLATE IX.

- Fig. 346. *Epithemia turgida* (Ehr.), Kütz. p. 294.  
 Fig. 347. *Epithemia turgida*, var. *Westermanni*, p. 295.  
 Fig. 348. *Epithemia turgida*, var. *granulata*, p. 295.  
 Fig. 349. *Epithemia turgida*, var. *Vertagus*, p. 295.  
 Fig. 350. *Epithemia Hyndmanni*, Wm. Sm., p. 295.  
 Fig. 351. *Epithemia Sorex*, Kütz. p. 295.  
 Fig. 352. *Epithemia gibba*, Kütz. p. 296.  
 Fig. 353. *Epithemia gibba*, var. *parallela*, p. 296.  
 Fig. 354. *Epithemia gibba*, var. *ventricosa*, p. 296.  
 Fig. 355. *Epithemia Argus*, Kütz. p. 296.  
 Fig. 356. *Epithemia Argus*, var. *amphicephala*, p. 296.  
 Fig. 357. *Epithemia Zebra* (Ehr.), Kütz. p. 296.  
 Fig. 358. *Epithemia Zebra*, var. *proboscidea*, p. 297.  
 Fig. 359. *Epithemia Musculus*, Kütz. p. 297.  
 Fig. 360. *Epithemia Musculus*, var. *constricta*, p. 297.  
 Fig. 361. *Epithemia gibberula*, var. *producta*, p. 297.  
 Fig. 362. *Eunotia Arcus*, Ehr., p. 299.  
 Fig. 363. *Eunotia Arcus*, var. *minor*, p. 299.  
 Fig. 364. *Eunotia Arcus*, var. *uncinata*, p. 299.  
 Fig. 365. *Eunotia Arcus*, var. *bidens*, p. 299.  
 Fig. 366. *Eunotia major* (Wm. Sm.), Rab., p. 300.  
 Fig. 367. *Eunotia major*, var. *bidens*, p. 300.  
 Fig. 368. *Eunotia gracilis* (Ehr.), Rab., p. 300.  
 Fig. 369. *Eunotia exigua*, Bréb., p. 300.  
 Fig. 370. *Eunotia pectinalis* (Kütz.), Rab., forma *curta*, p. 301.  
 Fig. 371. *Eunotia pectinalis*, forma *elongata*, p. 301.  
 Fig. 372. *Eunotia pectinalis*, var. *ventricosa*, p. 301.  
 Fig. 373. *Eunotia pectinalis*, var. *undulata*, p. 301.  
 Fig. 374. *Eunotia Faba* (Ehr.), Grun., p. 301.  
 Fig. 375. *Eunotia tridentula*, Ehr., p. 301.  
 Fig. 376. *Eunotia prærupta*, Ehr., p. 302.  
 Fig. 377. *Eunotia prærupta*, forma *curta*, p. 302.  
 Fig. 378. *Eunotia prærupta*, var. *inflata*, p. 302.  
 Fig. 379. *Eunotia prærupta*, var. *bidens*, p. 302.  
 Fig. 380. *Eunotia prærupta*, var. *bigibba*, p. 302.  
 Fig. 381. *Eunotia robusta*, Ralfs., p. 303.  
 Fig. 382. *Eunotia robusta*, var. *tetraodon*, p. 303.  
 Fig. 383. *Eunotia tridodon*, Ehr., p. 303.  
 Fig. 384. *Eunotia lunaris* (Ehr.), Grun., p. 303.  
 Fig. 385. *Eunotia lunaris*, var. *subarcuata*, p. 304.  
 Fig. 386. *Eunotia lunaris*, var. *bilunaris*, p. 304.  
 Fig. 387. *Eunotia flexuosa*, Kütz. p. 304.  
 Fig. 388. *Eunotia flexuosa*, var. *bicapitata*, p. 304.



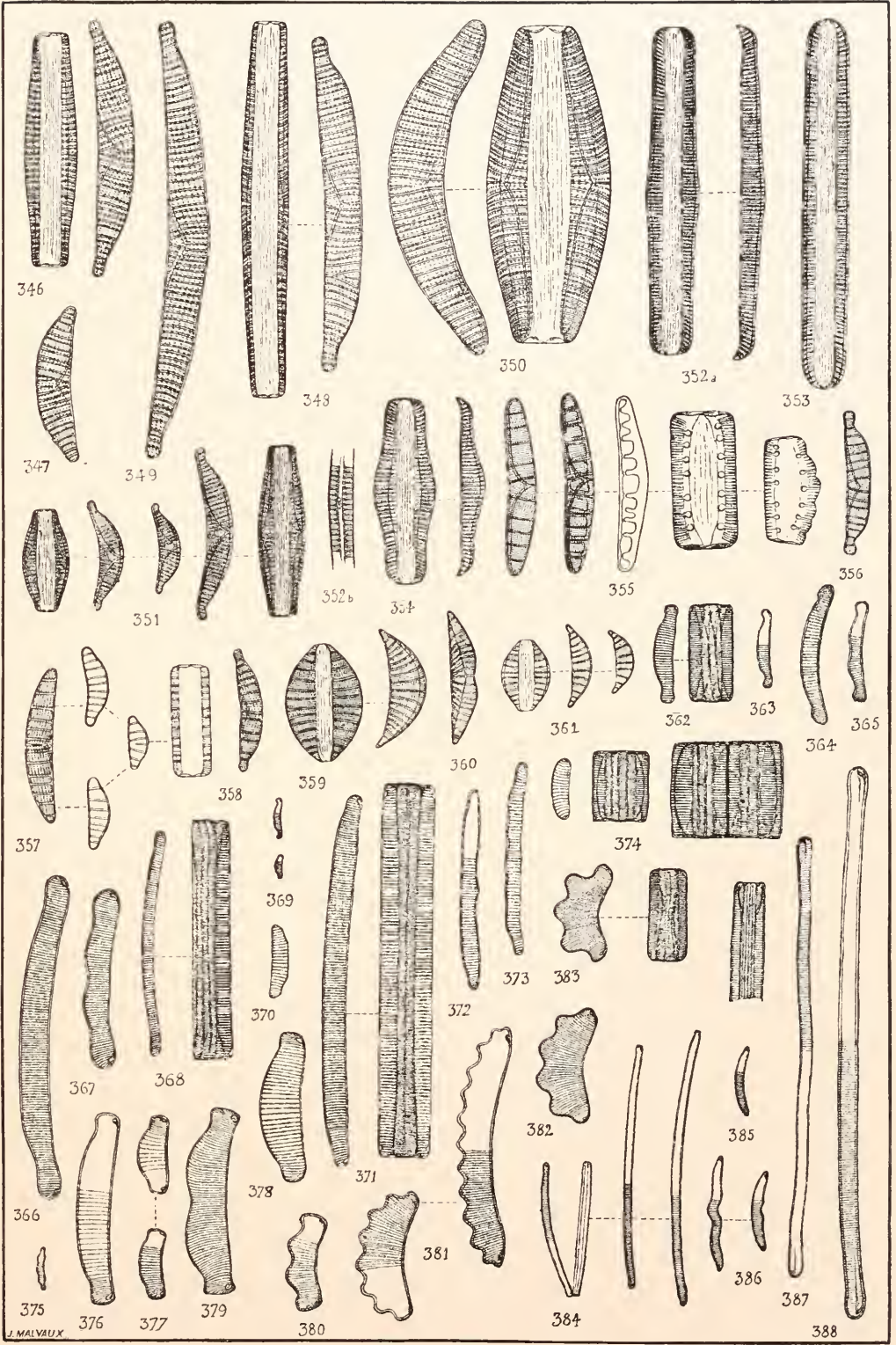






PLATE X.

- Fig. 389. *Peronia erinacea*, Bréb. and Arn., p. 333.  
 Fig. 390. *Plagiogramma Gregorianum*, Grev., p. 336.  
 Fig. 391. *Plagiogramma Van Heurckii*, Grun., p. 338.  
 Fig. 392. *Dimnogramma minor* (Greg.), Ralfs., p. 336.  
 Fig. 393. *Dimnogramma minor*, var. *nana*, p. 336.  
 Fig. 394. *Raphoneis amphicerus*, Ehr., p. 330.  
 Fig. 395. *Raphoneis amphicerus*, var. *rhombica*, p. 330.  
 Fig. 396. *Raphoneis Belgica*, Grun., p. 330.  
 Fig. 397. *Raphoneis Surirella* (Ehr.?), Grun., p. 330.  
 Fig. 398. *Raphoneis Surirella*, var. *Australis*, p. 330.  
 Fig. 399. *Sceptroneis Caduceus*, Ehr., p. 332.  
 Fig. 400. *Raphoneis Liburnica*, Grun., p. 331.  
 Fig. 401. *Ceratoneis Arcus*, Kütz., p. 306.  
 Fig. 402. *Synedra pulchella*, Kütz., p. 309.  
 Fig. 403. *Synedra pulchella*, forma *major*, p. 309.  
 Fig. 404. *Synedra pulchella*, var. *Smithii*, p. 309.  
 Fig. 405. *Synedra pulchella*, var. *lanceolata*, p. 309.  
 Fig. 406. *Synedra Vaucheriae*, Kütz., p. 310.  
 Fig. 407. *Synedra Vaucheriae*, var. *parvula*, p. 310.  
 Fig. 408. *Synedra Vaucheriae*, var. *perminuta*, p. 310.  
 Fig. 409. *Synedra Ulna* (Nitzsch), Ehr., p. 310.  
 Fig. 410. *Synedra Ulna*, var. *splendens*, p. 310.  
 Fig. 411. *Synedra Ulna*, var. *subaequalis*, p. 310.  
 Fig. 412. *Synedra Ulna*, var. *longissima*, p. 310.  
 Fig. 413. *Synedra Ulna*, var. *spatulifera*, p. 311.  
 Fig. 414. *Synedra Ulna*, var. *amphirhynchus*, p. 311.  
 Fig. 415. *Synedra Ulna*, var. *Danica*, p. 311.  
 Fig. 416. *Synedra Ulna*, var. *lanceolata*, p. 311.  
 Fig. 417. *Synedra Ulna*, var. *obtusa*, p. 311.  
 Fig. 418. *Synedra Ulna*, var. *oxyrhynchus*, p. 311.  
 Fig. 419. *Synedra Ulna* var. *vitrea*, p. 311.  
 Fig. 420. *Synedra Acus* (Kütz), Grun., p. 311.  
 Fig. 421. *Synedra Acus*, var. *delicatissima*, p. 312.  
 Fig. 422. *Synedra Acus*, var. *angustissima*, p. 312.  
 Fig. 423. *Synedra radians* (Kütz), Grun., p. 311.  
 Fig. 424. *Synedra Gallionii*, Ehr., p. 312.  
 Fig. 425. *Synedra investiens*, Wm. Sm., p. 313.  
 Fig. 426. *Synedra barbatula*, Kütz., p. 313.  
 Fig. 427. *Synedra capitata*, Ehr., p. 313.  
 Fig. 428. *Synedra famelica*, Kütz., p. 313.  
 Fig. 429. *Synedra amphicephala*, Kütz., p. 313.  
 Fig. 430. *Synedra affinis*, Kütz., p. 314.  
 Fig. 431. *Synedra affinis*, var. *tabulata*, p. 314.  
 Fig. 432. *Synedra affinis*, var. *parva*, p. 314.  
 Fig. 433. *Synedra affinis*, var. *fasciculata*, p. 314.  
 Fig. 434. *Synedra nitzschoides*, Grun., p. 314.  
 Fig. 435. *Synedra crystallina* (Lyng.), Kütz., p. 315.  
 Fig. 436. *Synedra fulgens* (Kütz), Wm. Sm., p. 316.  
 Fig. 437. *Synedra undulata* (Bailey), Greg., p. 317.  
 Fig. 438. *Synedra Henedyana*, Greg., p. 317.



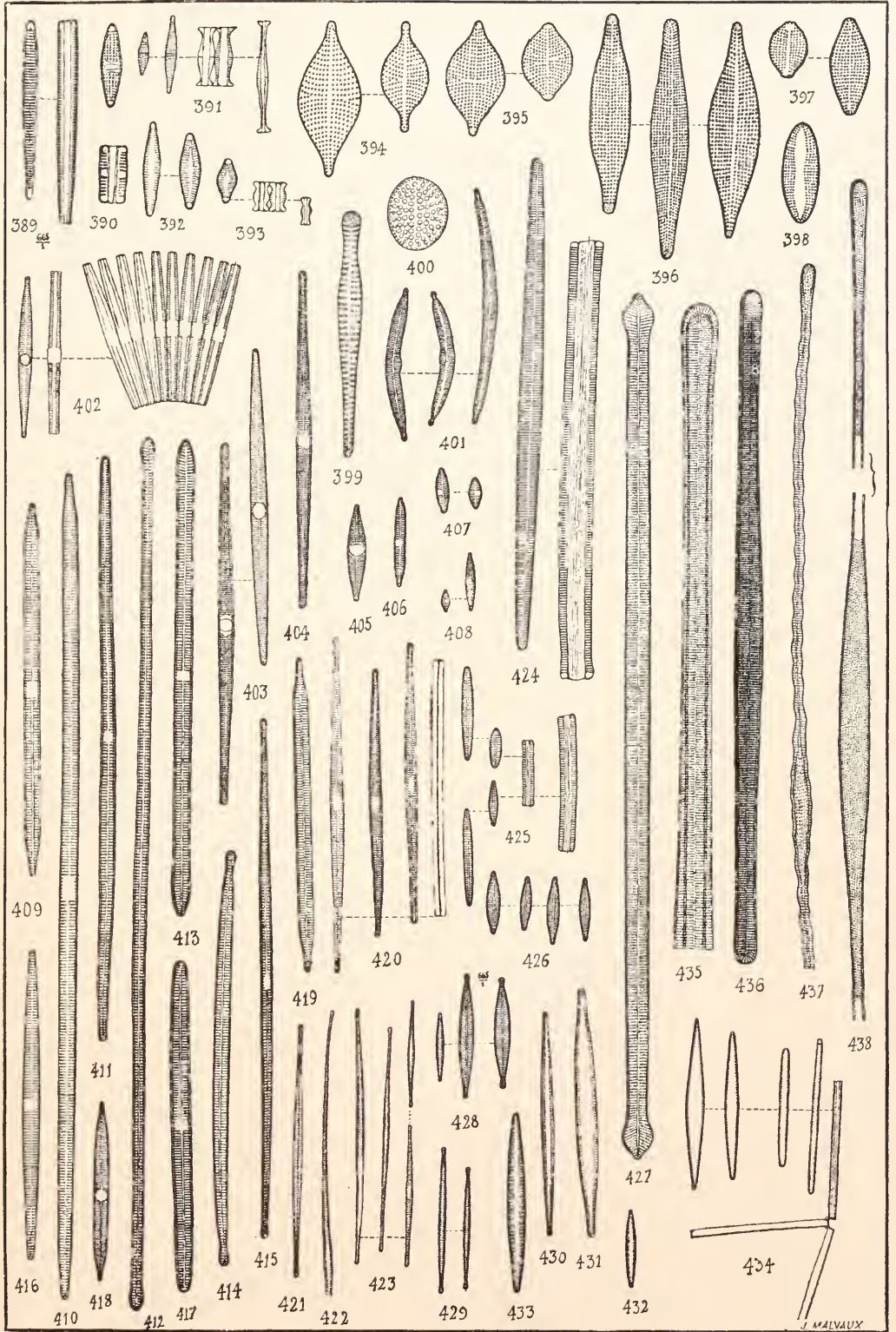




PLATE XI.

- Fig. 439. *Asterionella formosa*, Hassall, p. 321.  
 Fig. 440. *Asterionella formosa*, var. *gracillima*, p. 321.  
 Fig. 441. *Asterionella formosa*, var. *inflata*, p. 321.  
 Fig. 442. *Fragilaria virescens*, Ralfs., p. 323.  
 Fig. 443. *Fragilaria hyalina* (Kütz.), Grun., p. 324.  
 Fig. 444. *Fragilaria Crotonensis* (A. M. Edwards), Kitton, p. 324.  
 Fig. 445. *Fragilaria Crotonensis*, var. *prolongata*, p. 325.  
 Fig. 446. *Fragilaria capucina*, Desmazières, p. 325.  
 Fig. 447. *Fragilaria capucina*, var. *mesolepta*, p. 325.  
 Fig. 448. *Fragilaria capucina*, var. *acuta*, p. 325.  
 Fig. 449. *Fragilaria capucina*, var. *acuminata*, p. 325.  
 Fig. 450. *Fragilaria construens* (Ehr.), Grun., p. 325.  
 Fig. 451. *Fragilaria construens*, var. *Venter*, p. 325.  
 Fig. 452. *Fragilaria construens*, var. *binodis*, p. 326.  
 Fig. 453. *Fragilaria Harrisonii* (Wm. Sm.), Grun., p. 326.  
 Fig. 454. *Fragilaria mutabilis* (Wm. Sm.), Grun., p. 326.  
 Fig. 455. *Fragilaria brevistriata*, Grun., p. 326.  
 Fig. 456. *Cymatosira Belgica*, Grun., p. 327.  
 Fig. 457. *Campylosira cymbelliformis* (A.S.), Grun., p. 357.  
 Fig. 458. *Licmophora Anglica* (Kütz.), Grun., p. 343.  
 Fig. 459. *Licmophora Dalmatica* (Kütz.), Grun., p. 343.  
 Fig. 460. *Licmophora Lyngbyei* (Kütz.), Grun., p. 344.  
 Fig. 461. *Denticula tenuis*, Kütz., p. 352.  
 Fig. 462. *Denticula tenuis*, var. *inflata*, p. 352.  
 Fig. 463. *Denticula tenuis*, var. *frigida*, p. 352.  
 Fig. 464. *Denticula subtilis*, Grun., p. 352.  
 Fig. 465. *Diatoma vulgare*, Bory, p. 348.  
 Fig. 466. *Diatoma vulgare*, var. *linearis*, p. 349.  
 Fig. 467. *Diatoma elongatum*, Ag., p. 349.  
 Fig. 468. *Diatoma elongatum*, var. *tenue*, p. 349.  
 Fig. 469. *Diatoma elongatum*, var. *hybrida*, p. 350.  
 Fig. 470. *Diatoma hiemale* (Lyngb.), Heib., p. 350.  
 Fig. 471. *Diatoma hiemale*, var. *mesodon*, p. 350.  
 Fig. 472. *Diatoma anceps* (Ehr.), Grun., p. 350.  
 Fig. 473. *Diatoma anceps*, var. *anomalum*, p. 350.  
 Fig. 474. *Meridion circulare*, Ag., p. 347.  
 Fig. 475. *Meridion circulare*, var. *constrictum*, p. 348.  
 Fig. 476. *Meridion circulare*, var. *Zinkenii*, p. 348.  
 Fig. 477. *Tabellaria fenestrata* (Lyngb.), Kütz., p. 356.  
 Fig. 478. *Tabellaria flocculosa* (Roth.), Kütz., p. 357.  
 Fig. 479. *Grammatophora marina* (Lyngb.), Kütz., p. 354.  
 Fig. 480a. *Grammatophora marina*, var. *macilentia*, p. 354.  
 Fig. 481a. *Grammatophora angulosa*, Ehr., p. 355.  
 Fig. 482a. *Grammatophora serpentina* (Ralfs.), Ehr., p. 355.  
 Fig. 489a. *Tetraocyclus rupestris* (A. Braun), Grun., p. 357.



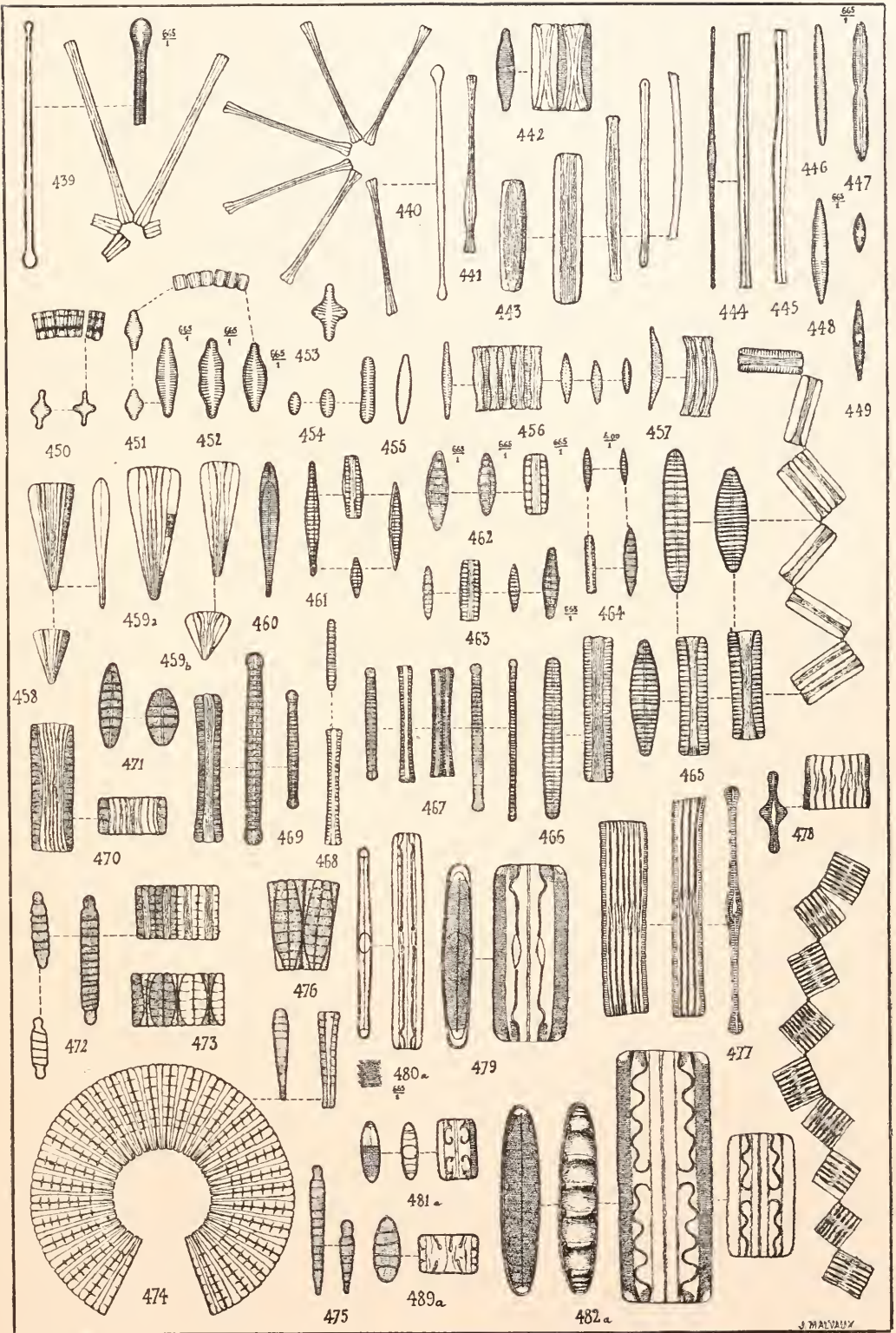






PLATE XII.

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- Fig. 483a. *Striatella delicatula* (Kütz), Grun., p. 363.  
Fig. 484a. *Striatella interrupta* (Ehr.), Heiberg., p. 363.  
Fig. 485a. *Striatella unipunctata*, Ag., p. 363.  
Fig. 486a. *Rhabdonema Adriaticum*, Kütz., p. 360.  
Fig. 487a. *Rhabdonema arcuatum* (Ag.), Kütz., p. 360.  
Fig. 488a. *Rhabdonema minutum*, Kütz., p. 361.  
Fig. 480b. *Cymatopleura elliptica* (Bréb.), Wm. Sm., p. 367.  
Fig. 481b. *Cymatopleura elliptica*, var. *constricta*, p. 367.  
Fig. 482b. *Cymatopleura Solea* (Bréb.), Wm. Sm., p. 367.  
Fig. 575. *Surirella biseriata*, Bréb., p. 369.  
Fig. 576. *Surirella elegans*, Ehr., p. 370.  
Fig. 577. *Surirella robusta*, Ehr., p. 371.  
Fig. 578. *Surirella robusta*, var. *splendida*, p. 371.  
Fig. 579. *Surirella robusta*, var. *tenera*, p. 371.



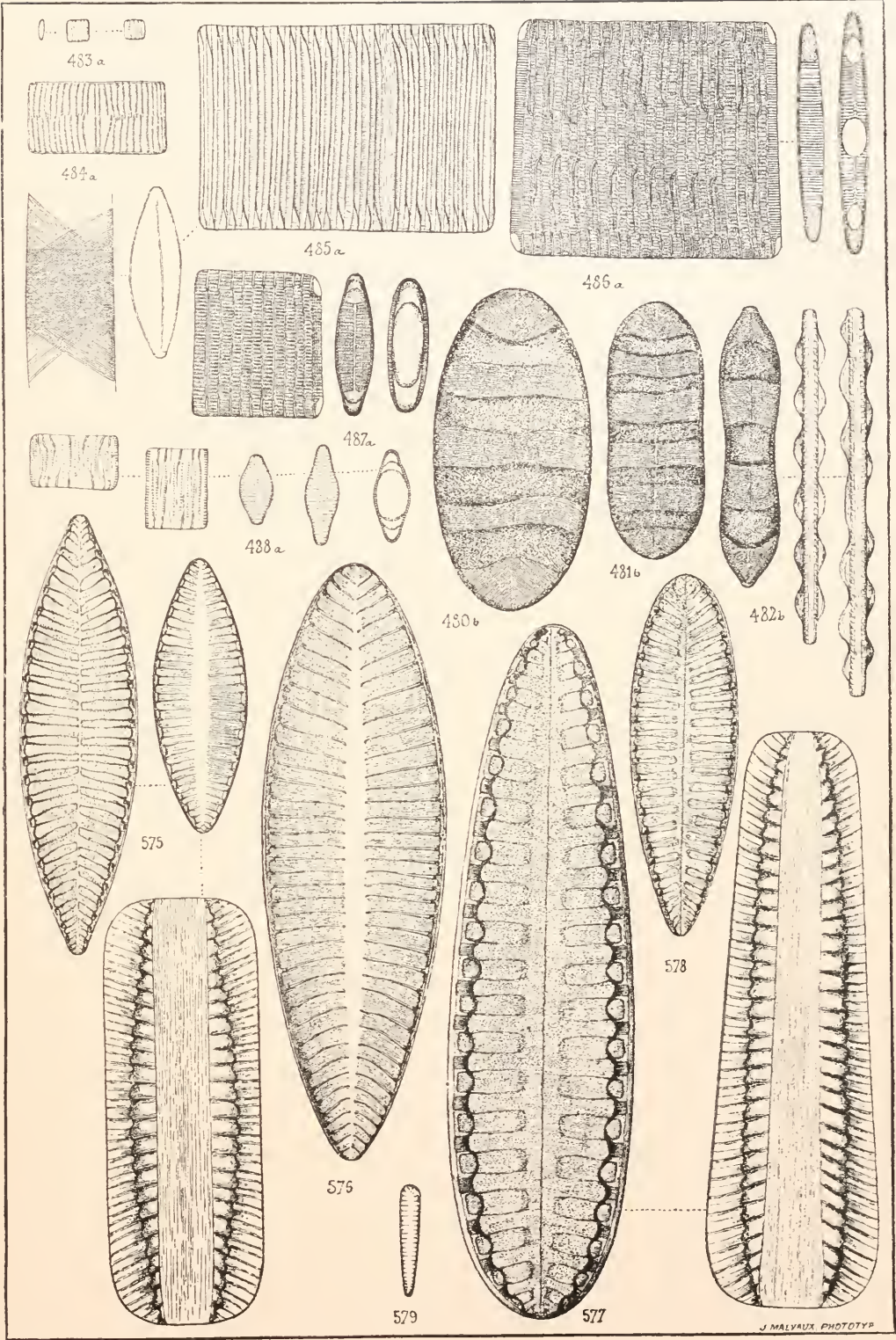


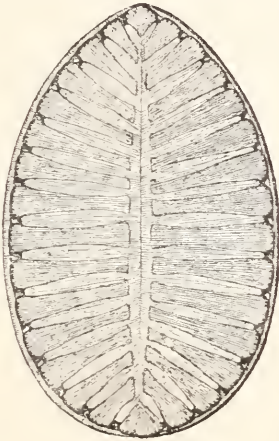


PLATE XIII.

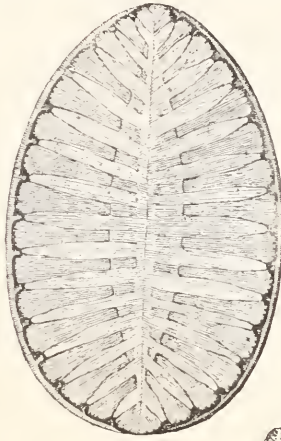
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- Fig. 580. *Surirella striatula*, Turpin, p. 371.  
Fig. 581. *Surirella striatula*, var. *biplicata*, p. 371.  
Fig. 582. *Surirella Gemma*, Ehr., p. 372.  
Fig. 583. *Surirella fastuosa*, Ehr., p. 372.  
Fig. 584. *Surirella fastuosa*, var. *lata*, p. 372.  
Fig. 585. *Surirella ovalis*, Bréb., p. 373.  
Fig. 586. *Surirella ovalis*, var. *Crumena*, p. 373.  
Fig. 587. *Surirella ovalis*, var. *ovata*, p. 373.  
Fig. 588. *Surirella ovalis*, var. *minuta*, p. 373.  
Fig. 589. *Surirella ovalis*, var. *salina*, p. 373.  
Fig. 590. *Surirella ovalis*, var. *angusta*, p. 373.  
Fig. 591. *Surirella ovalis*, var. *pinnata*, p. 373.  
Fig. 592. *Surirella spiralis*, Kütz, p. 374.





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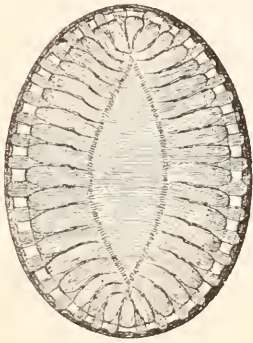
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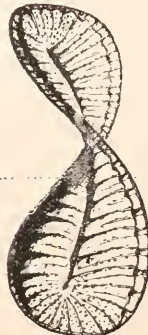




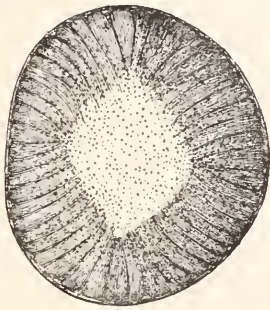


PLATE XIV.

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- Fig. 593. *Campylodiscus Hibernicus*, Ehr., p. 379.  
Fig. 594. *Campylodiscus Hibernicus*, var. *Noricus*, p. 379.  
Fig. 595. *Campylodiscus Thuretii*, Bréb., p. 378.  
Fig. 596. *Campylodiscus decorus*, Bréb., p. 376.  
Fig. 597. *Campylodiscus decorus*, forma *minima*, p. 376.  
Fig. 598. *Campylodiscus Clypeus*, Ehr., p. 377.  
Fig. 599. *Campylodiscus bicostatus*, Wm. Sm., p. 379.  
Fig. 600. *Campylodiscus Echeneis*, Ehr., p. 377.





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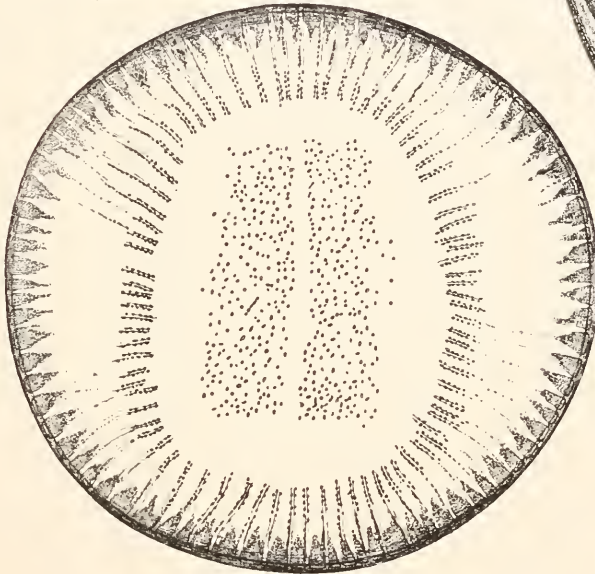
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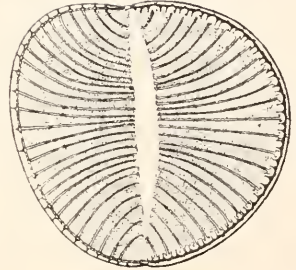
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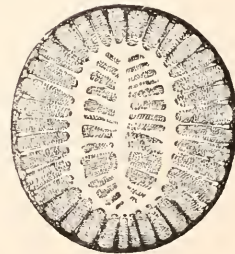
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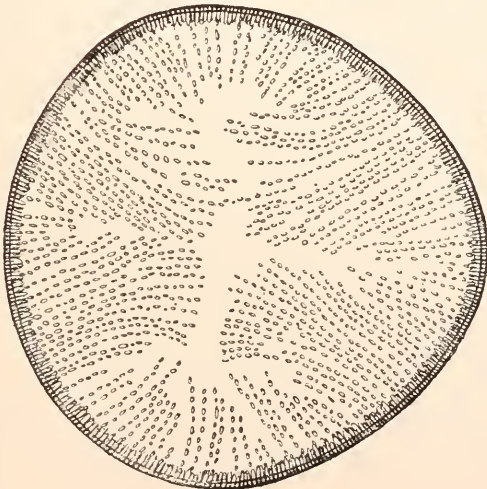
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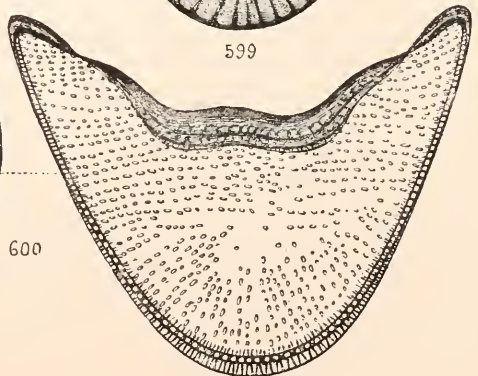




PLATE XV.

- Fig. 438b. *Hantzschia amphioxys* (Ehr.), Grun., p. 381.  
 Fig. 484b. *Hantzschia amphioxys*, var. *major*, p. 381.  
 Fig. 485b. *Hantzschia amphioxys*, var. *intermedia*, p. 381.  
 Fig. 486b. *Hantzschia amphioxys*, var. *vivax*, p. 381.  
 Fig. 487b. *Hantzschia amphioxys*, var. *elongata*, p. 381.  
 Fig. 488b. *Hantzschia virgata* (Roper), Grun., p. 381.  
 Fig. 489b. *Hantzschia marina* (Donkin), Grun., p. 382.  
 Fig. 490. *Nitzschia navicularis* (Bréb.), Grun., p. 384.  
 Fig. 491. *Nitzschia punctata* (Wm. Sm.), Grun., p. 384.  
 Fig. 492. *Nitzschia punctata*, var. *elongata*, p. 385.  
 Fig. 493. *Nitzschia Tryblionella*, *Hantzsch.*, p. 385.  
 Fig. 494. *Nitzschia Tryblionella*, var. *Levidensis*, p. 385.  
 Fig. 495. *Nitzschia Tryblionella*, var. *calida*, p. 385.  
 Fig. 496. *Nitzschia Tryblionella*, var. *littoralis*, p. 385.  
 Fig. 497. *Nitzschia debilis* (Arnott), Grun., p. 385.  
 Fig. 498. *Nitzschia angustata* (Wm. Sm.), Grun., p. 385.  
 Fig. 499. *Nitzschia angustata*, var. *curta*, p. 386.  
 Fig. 500. *Nitzschia panduriformis* Grun., p. 386.  
 Fig. 501. *Nitzschia constricta* (Greg.), Grun., p. 386.  
 Fig. 502. *Nitzschia constricta*, forma *parva*, p. 386.  
 Fig. 503. *Nitzschia plana*, Wm. Sm., p. 387.  
 Fig. 504. *Nitzschia Hungarica*, Grun., p. 387.  
 Fig. 505. *Nitzschia apiculata* (Greg.), Grun., p. 387.  
 Fig. 506. *Nitzschia acuminata* (Wm. Sm.), Grun., p. 388.  
 Fig. 507. *Nitzschia circumscuta* (Bail.), Grun., p. 388.  
 Fig. 508. *Nitzschia dubia*, Wm. Sm., p. 389.  
 Fig. 509. *Nitzschia thermalis* (Kütz.), Grun., p. 389.  
 Fig. 510. *Nitzschia thermalis*, var. *intermedia*, p. 389.  
 Fig. 511. *Nitzschia commutata*, Grun., p. 389.  
 Fig. 512. *Nitzschia bilobata*, Wm. Sm., p. 389.  
 Fig. 513. *Nitzschia bilobata*, var. *minor*, p. 390.  
 Fig. 514. *Nitzschia Denticula*, Grun., p. 390.  
 Fig. 515. *Nitzschia Denticula*, var. *Delognei*, p. 390.  
 Fig. 516. *Nitzschia sinuata* (Wm. Sm.), Grun., p. 390.  
 Fig. 517. *Nitzschia sinuata*, var. *Tabellaria*, p. 391.



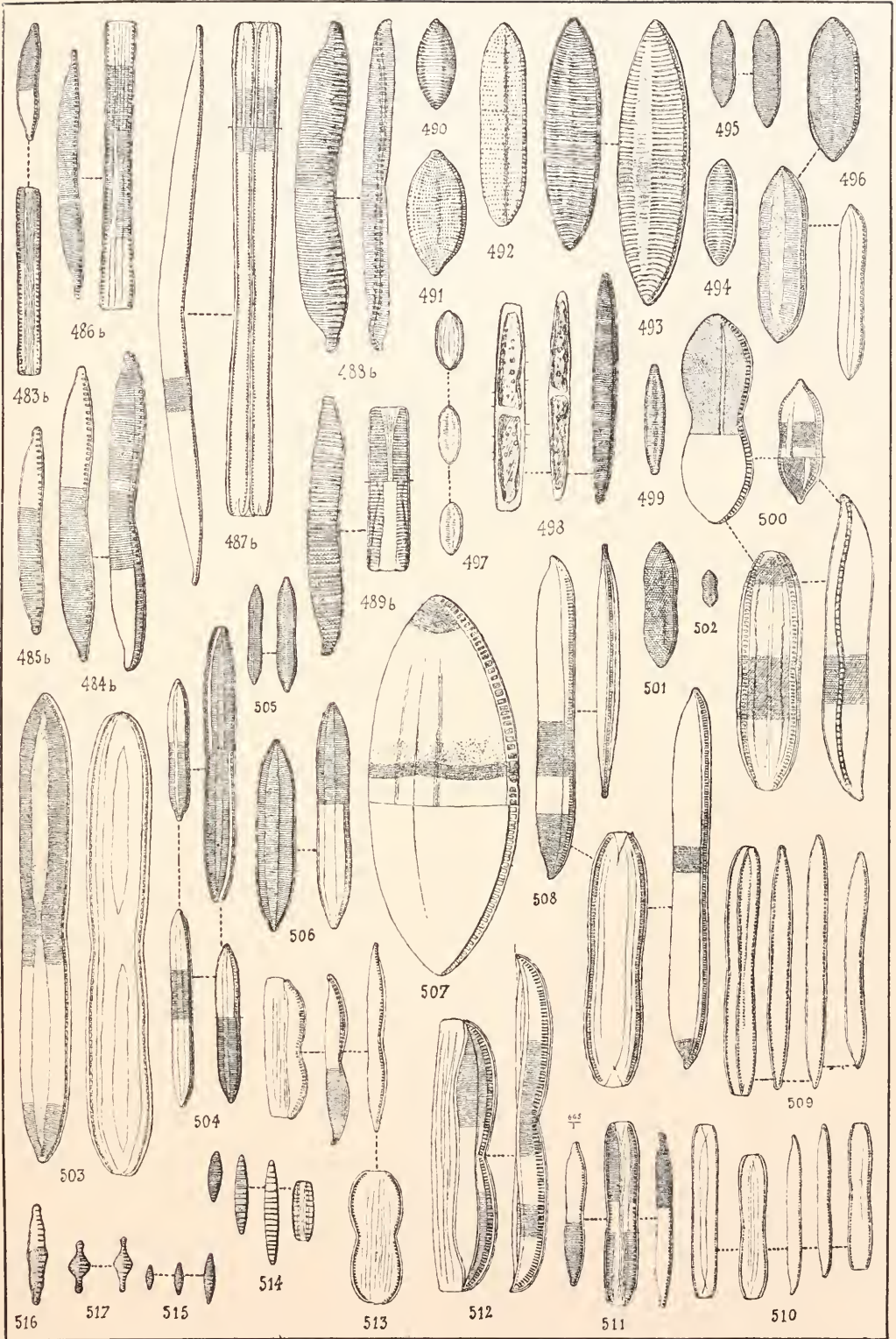






PLATE XVI.

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- Fig. 518. *Nitzschia paradoxa* (Gmel.), Grun., p. 392.  
Fig. 519. *Nitzschia paradoxa*, var. *major*, p. 392.  
Fig. 520. *Nitzschia Petitiana*, Grun., p. 393.  
Fig. 521. *Nitzschia angularis*, Wm. Sm., p. 393.  
Fig. 522. *Nitzschia angularis*, var. *affinis*, p. 393.  
Fig. 523. *Nitzschia spatulata*, Bréb., p. 393.  
Fig. 524. *Nitzschia spathulata*, var. *hyalina*, p. 394.  
Fig. 525. *Nitzschia dissipata* (Kütz), Grun., p. 394.  
Fig. 526. *Nitzschia dissipata*, var. *media*, p. 395.  
Fig. 527. *Nitzschia dissipata*, var. *acuta*, p. 395.  
Fig. 528. *Nitzschia sigmoidea* (Ehr.), Wm. Sm., p. 395.  
Fig. 529. *Nitzschia vermicularis* (Kütz), Grun., p. 395.  
Fig. 530. *Nitzschia Brebissonii*, Wm. Sm., p. 396.  
Fig. 531. *Nitzschia sigma*, Wm. Sm., p. 396.  
Fig. 532. *Nitzschia sigma*, var. *intercedens*, p. 396.  
Fig. 533. *Nitzschia sigma*, var. *rigida*, p. 396.  
Fig. 534. *Nitzschia sigma*, var. *rigidula*, p. 396.  
Fig. 535. *Nitzschia sigma*, var. *Sigmatella*, p. 397.  
Fig. 536. *Nitzschia fasciculata*, Grun., p. 397.  
Fig. 537. *Nitzschia obtusa*, Wm. Sm., p. 397.  
Fig. 538. *Nitzschia obtusa*, var. *scalpelliformis*, p. 397.  
Fig. 539. *Nitzschia obtusa*, var. *nana*, p. 398.  
Fig. 540. *Nitzschia obtusa*, var. *brevissima*, p. 398.  
Fig. 541. *Nitzschia spectabilis* (Ehr.), Ralfs., p. 398.  
Fig. 542. *Nitzschia linearis* (Ag.), Wm. Sm., p. 399.  
Fig. 543. *Nitzschia linearis*, var. *tenuis*, p. 399.  
Fig. 544. *Nitzschia vitrea*, Norman., p. 399.  
Fig. 545. *Nitzschia vitrea*, forma *major*, p. 399.  
Fig. 546. *Nitzschia vitrea*, var. *salinarum*, p. 399.  
Fig. 547. *Nitzschia vitrea*, var. *recta*, p. 400.



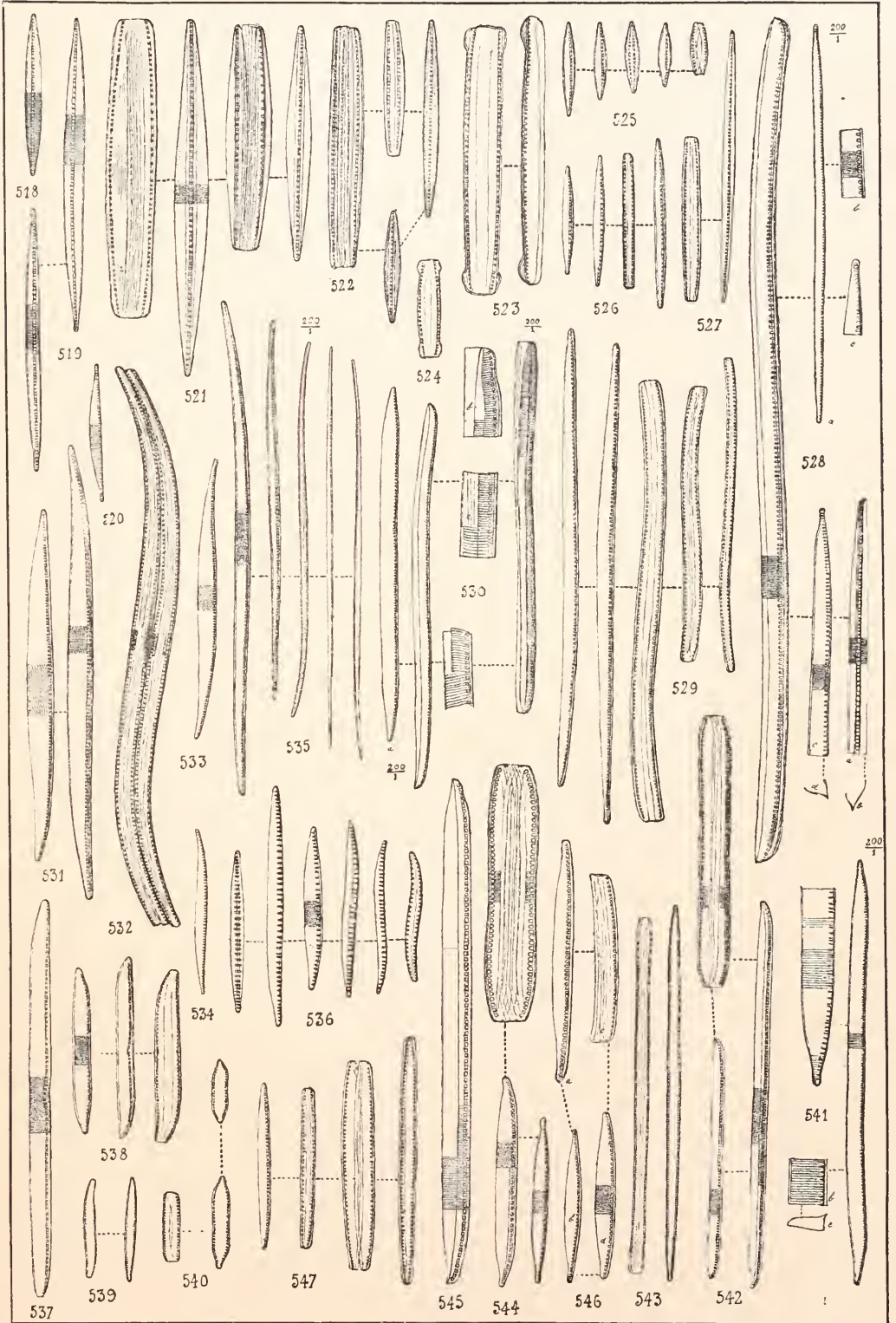


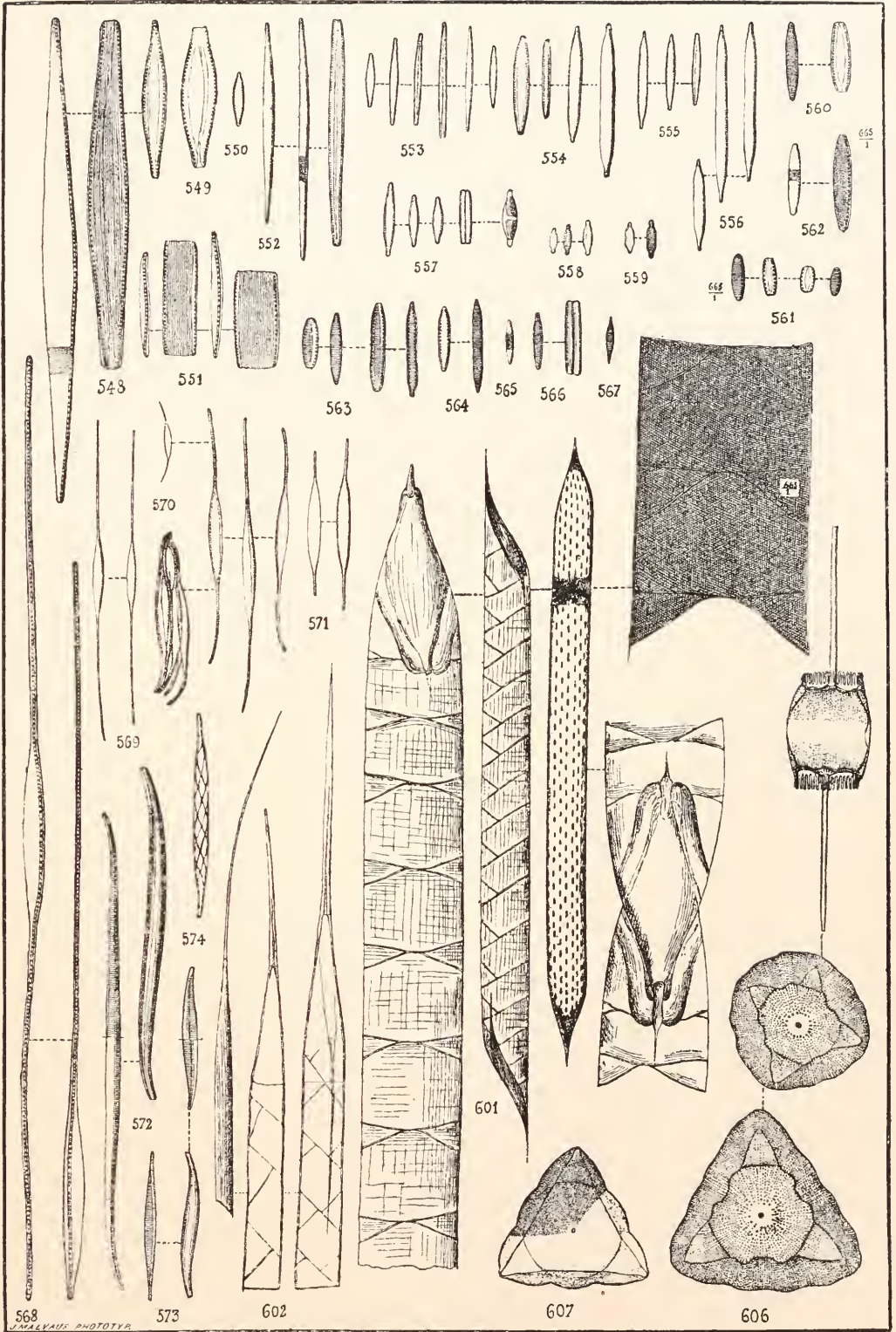


PLATE XVII.

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- Fig. 548. *Nitzschia lanceolata*, Wm. Sm., p. 400.  
Fig. 549. *Nitzschia lanceolata*, forma minor, p. 401.  
Fig. 550. *Nitzschia lanceolata*, forma minima, p. 401.  
Fig. 551. *Nitzschia lanceolata*, var. *incrustans*, p. 401.  
Fig. 552. *Nitzschia subtilis*, Grun., p. 401.  
Fig. 553. *Nitzschia subtilis*, var. *paleacea*, p. 401.  
Fig. 554. *Nitzschia Palea* (Kütz), Wm. Sm., p. 401.  
Fig. 555. *Nitzschia Palea*, var. *debilis*, p. 402.  
Fig. 556. *Nitzschia Palea*, var. *tenuirostris*, p. 402.  
Fig. 557. *Nitzschia Palea*, var. *fonticola*, p. 402.  
Fig. 558. *Nitzschia microcephala*, Grun., p. 402.  
Fig. 559. *Nitzschia microcephala*, var. *elegantula*, p. 402.  
Fig. 560. *Nitzschia communis*, Rab., p. 402.  
Fig. 561. *Nitzschia communis*, var. *abbreviata*, p. 402.  
Fig. 562. *Nitzschia communis*, var. *obtusa*, p. 402.  
Fig. 563. *Nitzschia amphibia*, Grun., p. 403.  
Fig. 564. *Nitzschia Frustulum* (Kütz), Grun., p. 403.  
Fig. 565. *Nitzschia Frustulum*, var. *minutula*, p. 403.  
Fig. 566. *Nitzschia Frustulum*, var. *perpusilla*, p. 403.  
Fig. 567. *Nitzschia Delognei*, Grun., p. 403.  
Fig. 568. *Nitzschia longissima* (Bréb.), Ralfs., p. 404.  
Fig. 569. *Nitzschia longissima*, forma parva, p. 404.  
Fig. 570. *Nitzschia longissima*, var. *Closterium*, p. 405.  
Fig. 571. *Nitzschia acicularis*, Wm. Sm., p. 405.  
Fig. 572. *Nitzschia Lorenziana*, Grun., p. 405.  
Fig. 573. *Nitzschia Lorenziana*, var. *incurva*, p. 406.  
Fig. 574. *Cylindrotheca gracilis* (Bréb.), Grun., p. 409.  
Fig. 601. *Rhizosolenia styliformis*, Brightw., p. 415.  
Fig. 602. *Rhizosolenia setigera*, Brightw., p. 414.  
Fig. 606. *Ditylum Brightwellii* (West), Grun., p. 424.  
Fig. 607. *Ditylum intricatum* (West), Grun., p. 424.





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PLATE XVIII.

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- Fig. 603. *Chaetoceros armatum*, West, p. 421.  
Fig. 604. *Chaetoceros Wighamii*, Brightw., p. 422.  
Fig. 605. *Chaetoceros (Bacteriastrum) varians*, Lauder, p. 422.  
Fig. 608. *Melosira nummuloides* (Bory), Ag., p. 440.  
Fig. 609. *Melosira Westii*, Wm. Sm., p. 441.  
Fig. 610. *Melosira Borreii*, Grev., p. 441.  
Fig. 611. *Melosira varians*, Ag., p. 441.  
Fig. 612. *Melosira Jurgensii*, Ag., p. 442.  
Fig. 613. *Melosira Jurgensii*, var. *octogona*, Grun., p. 442.



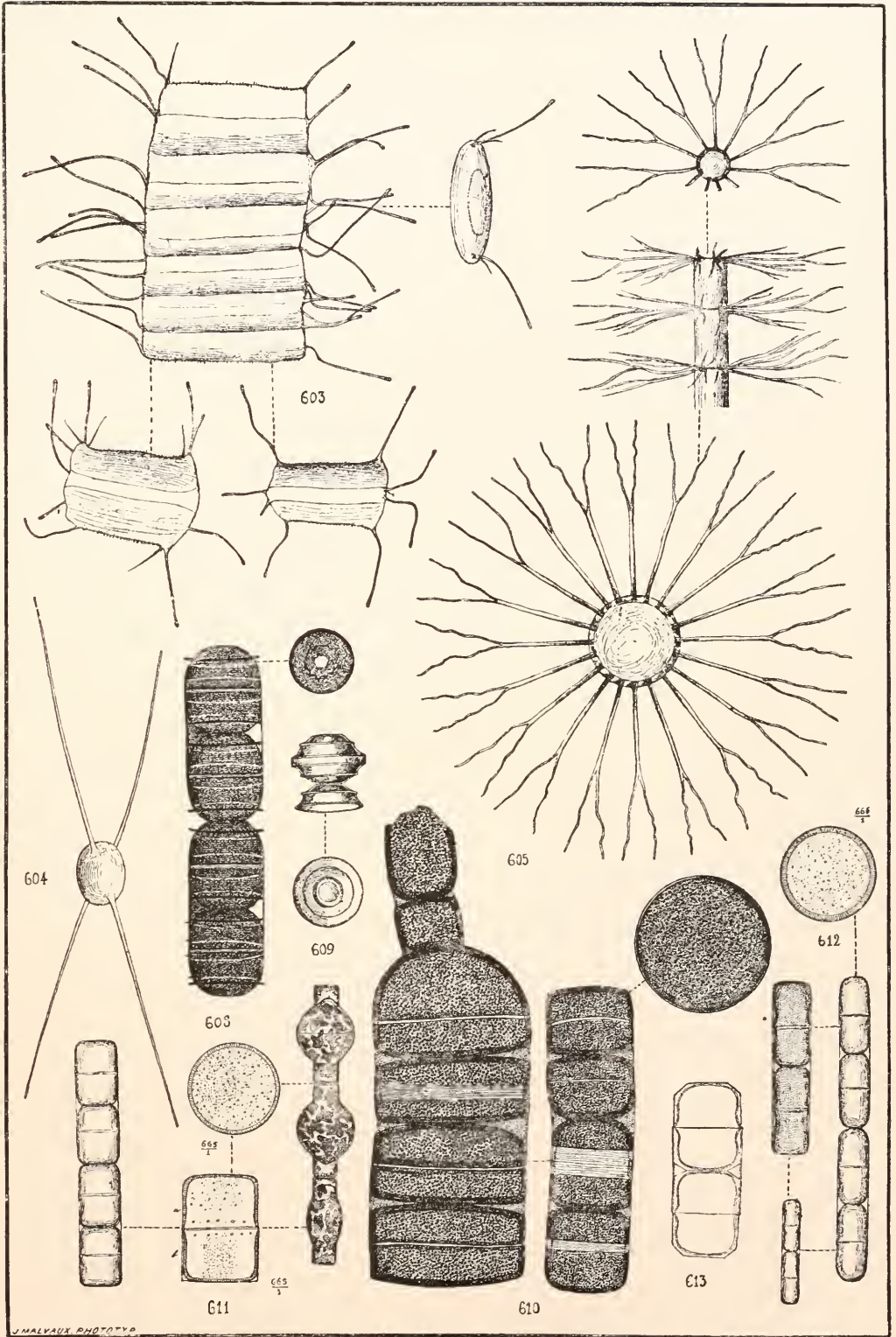




PLATE XIX.

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- Fig. 614. *Melosira Roesseana*, Rab., p. 442.  
Fig. 615. *Melosira Roesseana*, var. *spiralis*, p. 442.  
Fig. 616. *Melosira distans*, Kütz, p. 442.  
Fig. 617. *Melosira distans*, var. *nivalis*, p. 443.  
Fig. 618. *Melosira crenulata*, Kütz, p. 443.  
Fig. 619. *Melosira crenulata*, forma *tenuis*, p. 443.  
Fig. 620. *Melosira crenulata*, forma *Binderiana*, p. 443.  
Fig. 621. *Melosira areolaria*, Moore, p. 443.  
Fig. 621. *Melosira granulata* (Ehr.), Ralfs., p. 444.  
Fig. 622. *Melosira granulata*, var. *curvata*, p. 444.  
Fig. 623. *Melosira Dickiei* (Thwaites), Kütz, p. 444.  
Fig. 624. *Melosira sulcata*, Kütz, p. 444.  
Fig. 625. *Isthmia enervis*, Ehr., p. 451.  
Fig. 626. *Anaulus debilis* (Grun.), H.V.H., p. 454.  
Fig. 627. *Lithodesmium undulatum*, Ehr., p. 465.  
Fig. 628. *Eucampia Zodiacus*, Ehr., p. 461.  
Fig. 629. *Bellerophon Malleus* (Brightw.), H.V.H., j. 464.



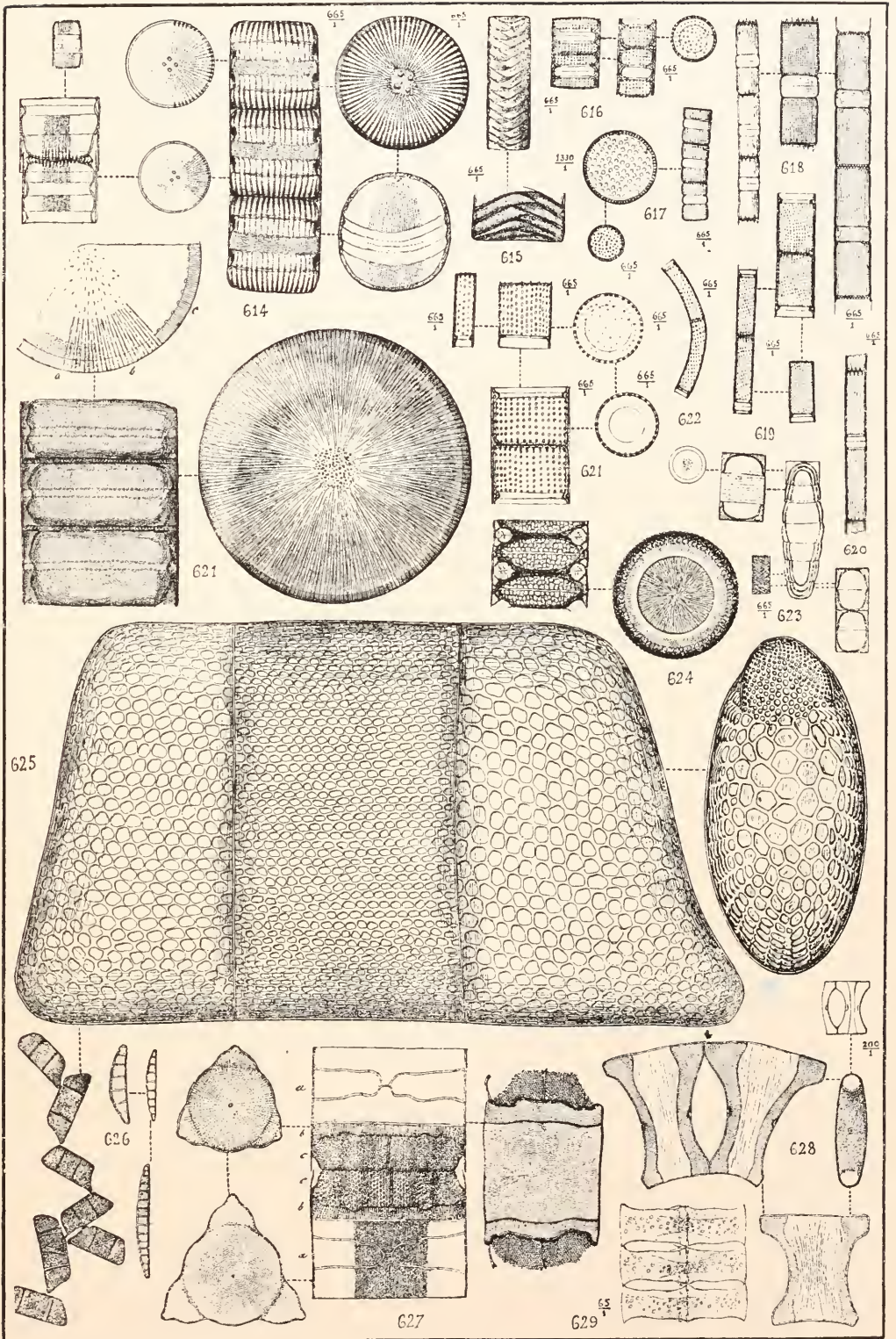






PLATE XX.

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- Fig. 630. *Biddulphia pulchella*, Gray., p. 470.  
Fig. 631. *Biddulphia aurita* (Lyngb.), Bréb., p. 471.  
Fig. 632. *Biddulphia aurita*, var. *minima*, p. 472.  
Fig. 633. *Biddulphia aurita*, var. *minuseula*, p. 472.  
Fig. 634. *Biddulphia Rhombus* (Ehr.), Wm. Sm., p. 472.  
Fig. 635. *Biddulphia Rhombus*, var. *trigona*, p. 472.  
Fig. 636. *Biddulphia Baileyii*, Wm. Sm., p. 473.  
Fig. 637. *Biddulphia granulata*, Roper, p. 473.  
Fig. 639. *Biddulphia lævis*, Ehr., p. 474.  
Fig. 640. *Biddulphia lævis*, forma *minor*, p. 474.



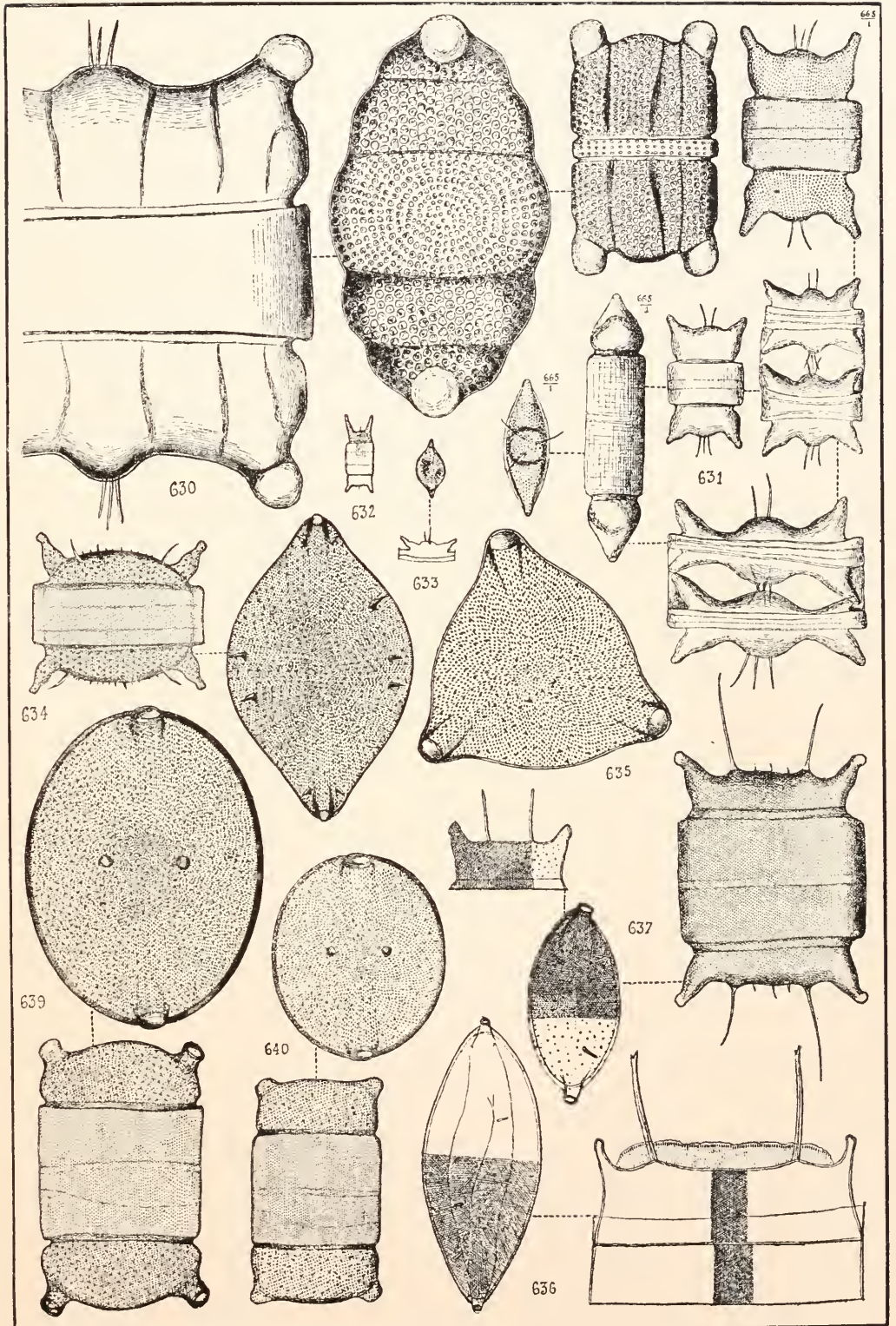


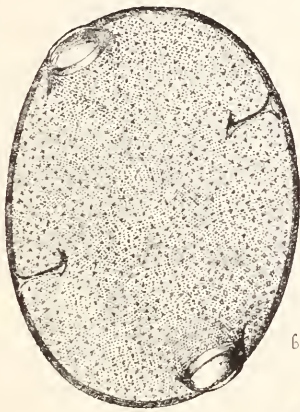


PLATE XXI.

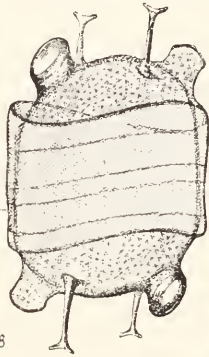
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- Fig. 638. *Biddulphia turgida*, Wm. Sm., p. 473.  
Fig. 641. *Biddulphia Smithii* (Ralfs.), H.V.H., p. 474.  
Fig. 642. *Biddulphia antediluviana* (Ehr.), H.V.H., p. 475.  
Fig. 643. *Biddulphia Favus* (Ehr.), H.V.H., p. 475.  
Fig. 644. *Biddulphia alternans* (Bail.), H.V.H., p. 475.  
Fig. 645. *Biddulphia sculpta* (Shadb.), H.V.H., p. 476.  
Fig. 646. *Auliscus sculptus* (Wm. Sm.), Ralfs., p. 482.  
Fig. 647. *Eupodiscus Argus*, Ehr., p. 487.

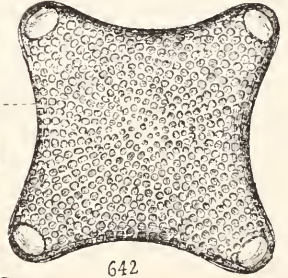
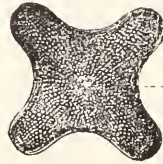
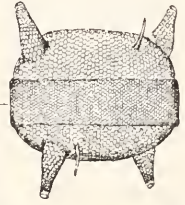




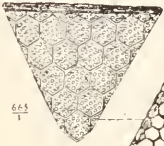
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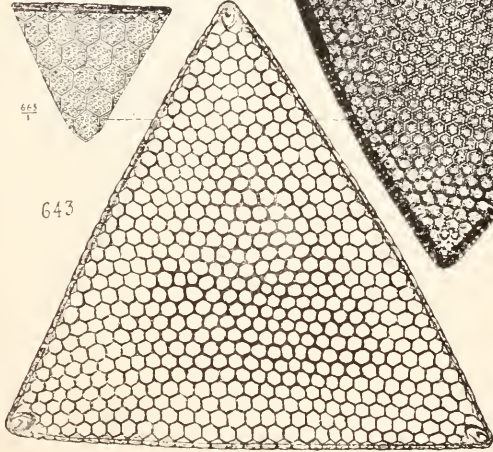
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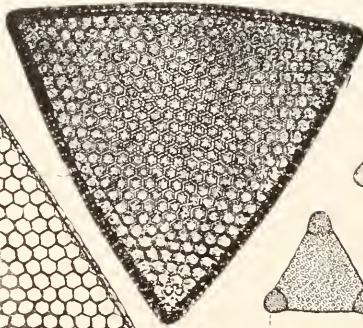
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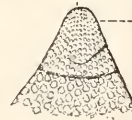
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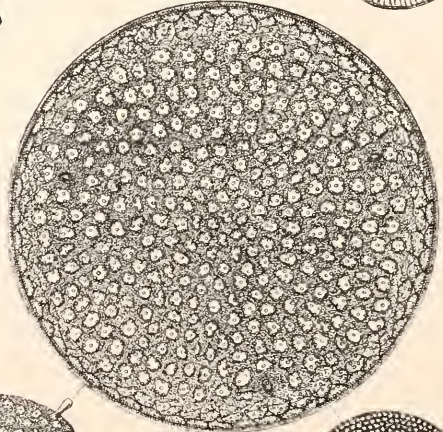
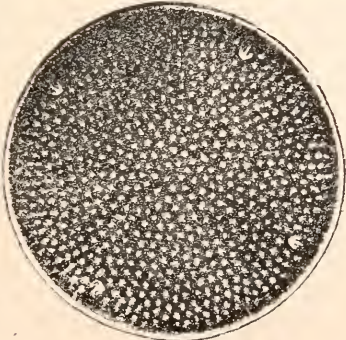
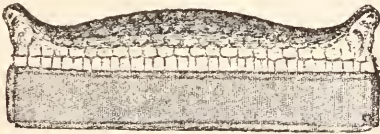
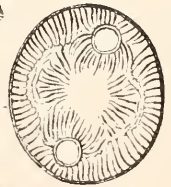
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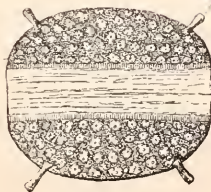






PLATE XXII.

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- Fig. 648. *Actinoptychus undulatus* (Ehr.), p. 496.  
Fig. 649. *Actinoptychus splendens* (Shadb.), Ralfs., p. 497.  
Fig. 650. *Hyalodiscus stelliger*, Bail., p. 449.  
Fig. 651. *Cyclotella striata* (Kütz), Grun., p. 446.  
Fig. 652. *Cyclotella antiqua*, Wm. Sm., p. 446.  
Fig. 653. *Cyclotella comta* (Ehr.), Kütz, p. 446.  
Fig. 654. *Cyclotella comta*, var. *radiosa*, p. 447.  
Fig. 655. *Cyclotella operculata*, Kütz, p. 447.  
Fig. 656. *Cyclotella Meneghiniana*, Kütz, p. 447.  
Fig. 657. *Cyclotella Kützingiana*, Chauvin, p. 447.



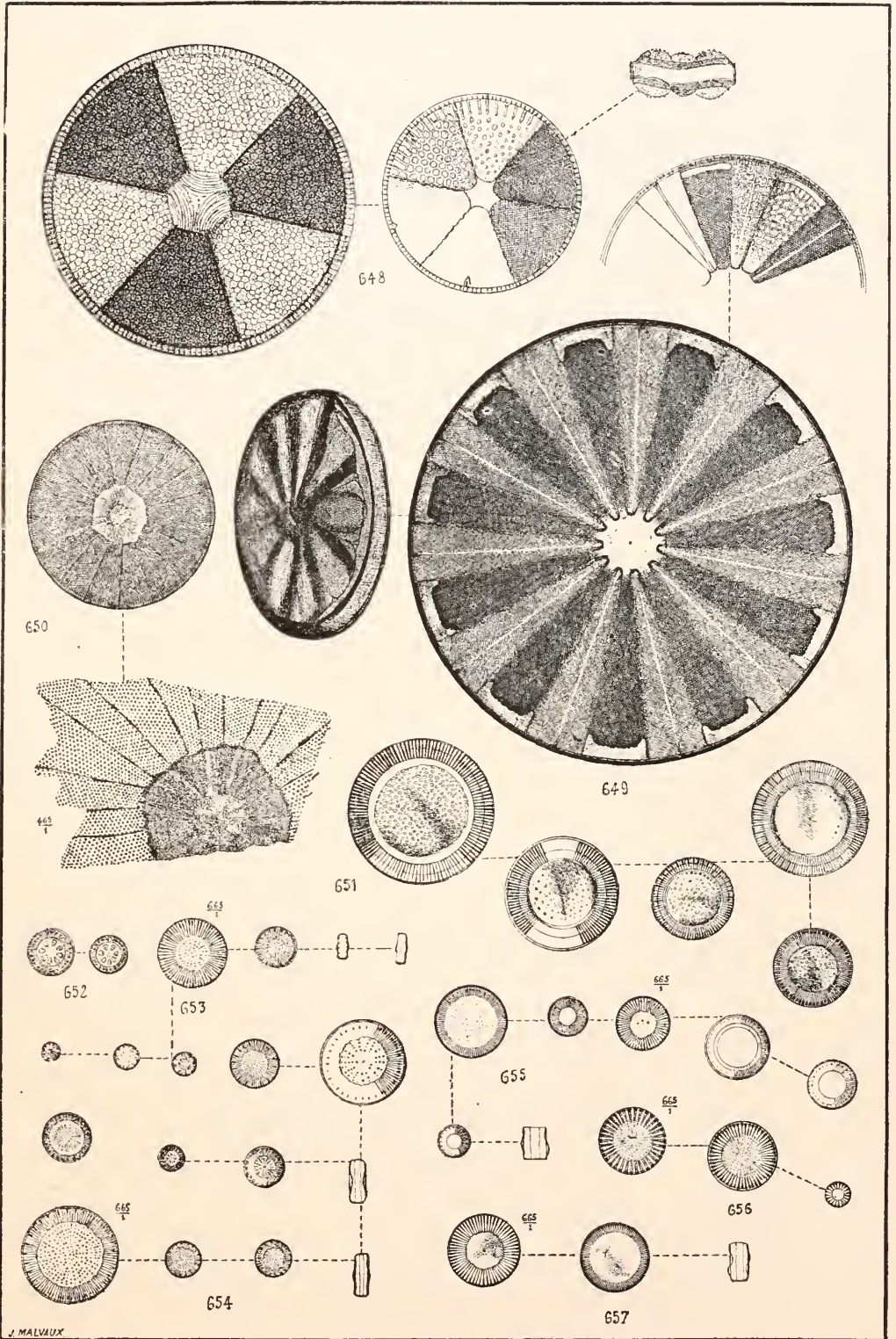


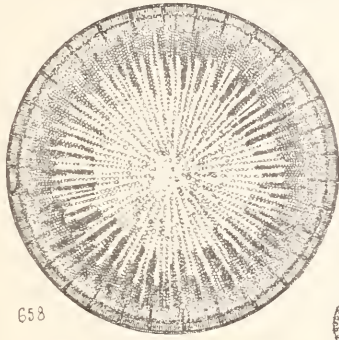


PLATE XXIII.

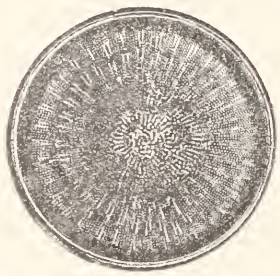
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- Fig. 658. *Actinocyclus Ralfsii* (Wm. Sm.), Ralfs., p. 523.  
Fig. 659. *Actinocyclus Ehrenbergii*, Ralfs., p. 523.  
Fig. 660. *Actinocyclus crassus*, H.V.H., p. 523.  
Fig. 661. *Actinocyclus subtilis* (Greg.), Ralfs., p. 524.  
Fig. 662. *Stephanodiscus Hantzschianus*, Grun., p. 520.  
Fig. 663. *Coscinodiscus radiatus*, Ehr., p. 530.  
Fig. 664. *Coscinodiscus radiatus*, var. *Asteromphalus*, p. 530.  
Fig. 665. *Coscinodiscus lineatus*, Ehr. (Kütz), p. 532.  
Fig. 666. *Coscinodiscus excentricus*, Ehr., p. 531.  
Fig. 667. *Coscinodiscus nitidus*, Greg., p. 532.  
Fig. 668. *Coscinodiscus subtilis*, var. *Normanii*, p. 533.  
Fig. 669. *Coscinodiscus lacustris*, Grun., p. 533.





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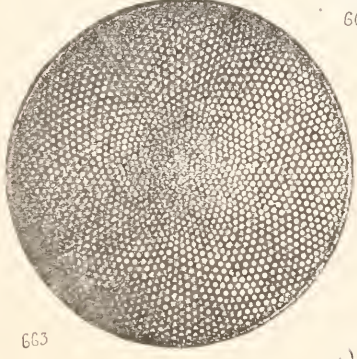
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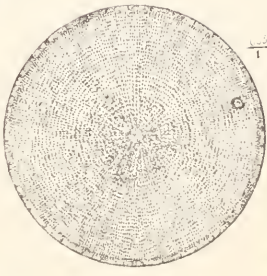
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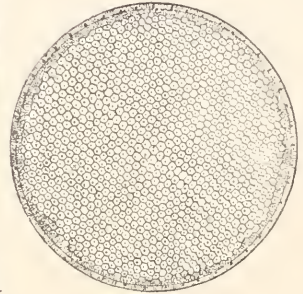
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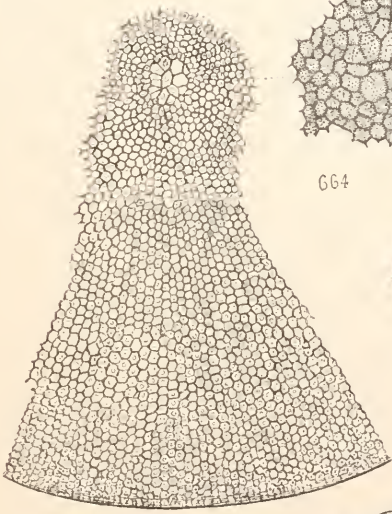
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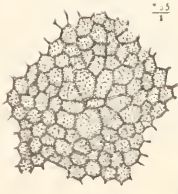
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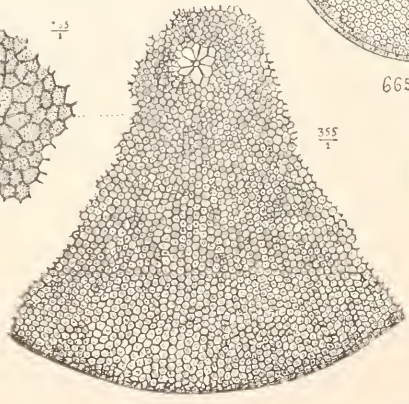
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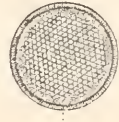
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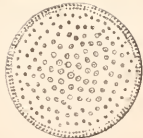
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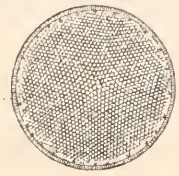
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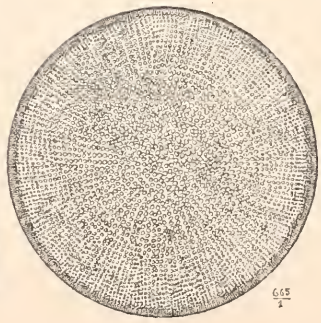
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PLATE XXIV.

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- Fig. 670. *Amphora robusta*, Greg., p. 129.  
Fig. 671. *Amphora Proteus*, Greg., p. 129.  
Fig. 672. *Amphora dubia* (Greg.), A.S., p. 128.  
Fig. 673. *Amphora arenaria*, Donk., p. 130.  
Fig. 674. *Amphora angusta*, Greg., p. 130.  
Fig. 675. *Amphora crassa*, Greg., p. 131.  
Fig. 676. *Amphora Grevilleana*, Greg., p. 131.  
Fig. 677. *Amphora alata*, Per., p. 131.  
Fig. 678. *Amphora cymbifera*, Greg., p. 133.  
Fig. 679. *Amphora rostrata*, Wm. Sm., p. 133.  
Fig. 680. *Amphora macilenta*, Greg., p. 133.  
Fig. 681. *Amphora coffeaeformis*, Kütz., p. 134.  
Fig. 682. *Amphora Sarniensis*, Grev., p. 135.  
Fig. 683. *Amphora Ergadensis*, Greg., p. 135.  
Fig. 684. *Amphora Eunotia*, Cleve, p. 136.  
Fig. 685. *Amphora turgida*, Greg., p. 136.  
Fig. 686. *Amphora binodis*, Greg., p. 136.  
Fig. 687. *Amphora spectabilis*, Greg., p. 137.  
Fig. 688. *Amphora obtusa*, Greg., p. 137.  
Fig. 689. *Amphora bacillaris*, Greg., p. 138.  
Fig. 690. *Amphora Arcus*, Greg., p. 138.  
Fig. 691. *Amphora hyalina*, Kütz., p. 138.  
Fig. 692. *Amphora acuta*, Greg., p. 139.  
Fig. 693. *Amphora lævis*, Greg., p. 139.  
Fig. 694. *Amphora lævissima*, Greg., p. 139.



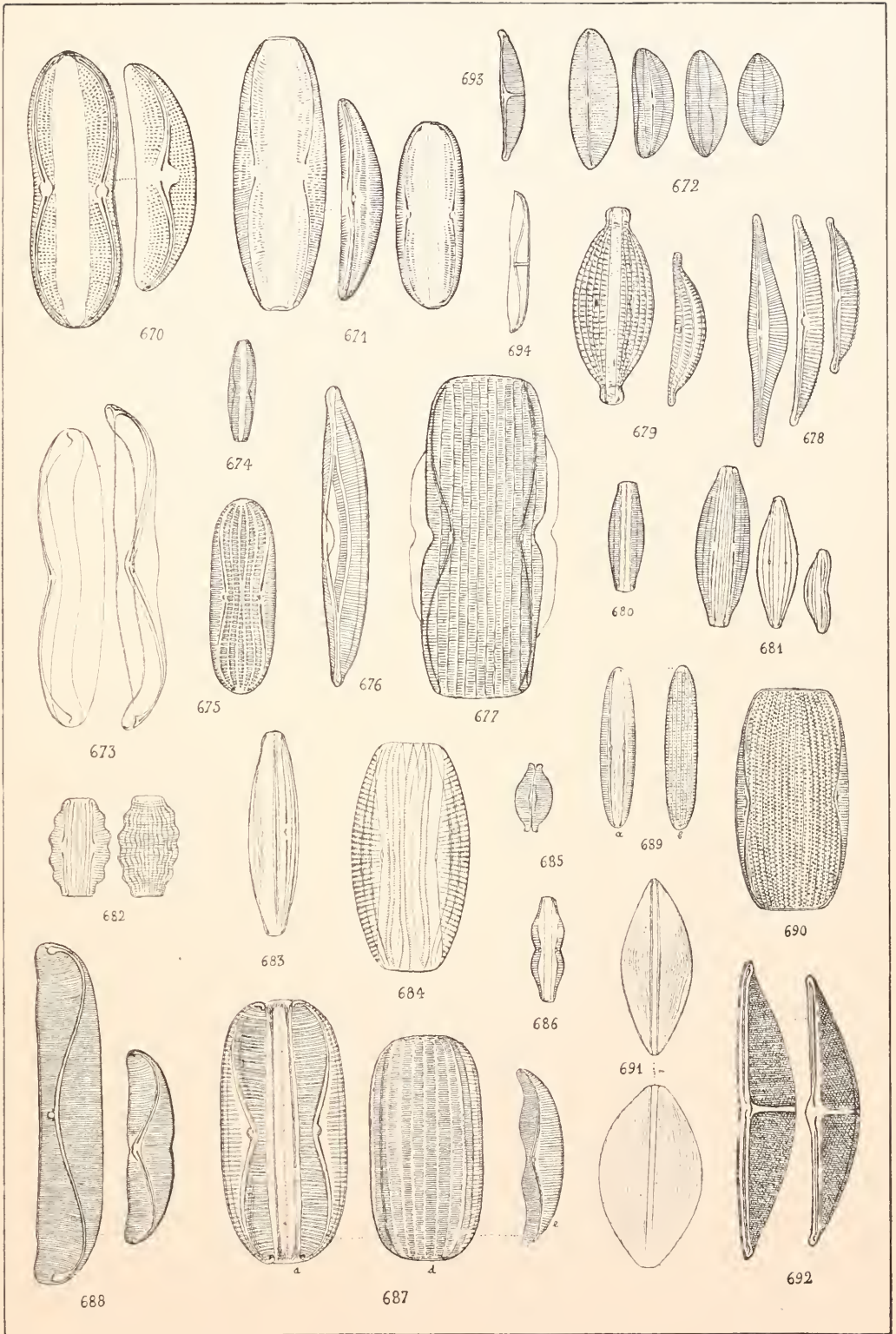




PLATE XXV.

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- Fig. 695. *Cymbella amphiocephala*, var. *Anglica*, p. 142.  
Fig. 696. *Cymbella laevis*, var. *rupicola*, p. 144.  
Fig. 697. *Cymbella tumidula*, Grun., p. 145.  
Fig. 698. *Cymbella aequalis*, Wm. Sm., p. 145.  
Fig. 699. *Cymbella abnormis*, Grun., p. 146.  
Fig. 700. *Mastogloia apiculata*, Wm. Sm., p. 154.  
Fig. 701. *Mastogloia Closeii*, O'Meara, p. 155.  
Fig. 702. *Stauroneis gracilis*, Ehr., p. 159.  
Fig. 703. *Stauroneis obliqua*, Greg., p. 161.  
Fig. 704. *Navicula quadratarea*, A.S., pp. 167, 207.  
Fig. 705. *Navicula Alpina*, Ralfs., p. 169.  
Fig. 706. *Navicula divergens*, Wm. Sm., p. 170.  
Fig. 707. *Navicula blanda*, A.S., p. 175.  
Fig. 708. *Navicula sejuncta*, A.S., p. 175.  
Fig. 709. *Navicula clavicularis*, Greg., p. 174.  
Fig. 710. *Navicula crucifera*, Grun., p. 183.  
Fig. 711. *Navicula nana*, Greg., p. 182.  
Fig. 712. *Navicula cancellata*, var. *ammophila*, p. 183.  
Fig. 713. *Navicula inflexa* (Greg.), Ralfs., p. 184.  
Fig. 714. *Navicula opima*, Grun., p. 184.  
Fig. 715. *Navicula fortis*, Greg., p. 184.  
Fig. 716. *Navicula longa*, Greg., p. 185.  
Fig. 717. *Navicula solaris*, Greg., p. 186.  
Fig. 718. *Navicula Semen*, Ehr., p. 187.  
Fig. 719. *Navicula capitata*, Ehr., p. 187.  
Fig. 720. *Navicula apiculata*, Bréb., p. 188.  
Fig. 721. *Navicula Kützingiana*, H.L.Sm., p. 188.  
Fig. 722. *Navicula directa*, Wm. Sm., p. 189.  
Fig. 723. *Navicula directa*, var. *subtilis*, p. 189.  
Fig. 724. *Navicula superimposita*, A.S., p. 189.  
Fig. 725. *Navicula compressicauda*, A.S., p. 190.  
Fig. 726. *Navicula Northumbriae*, Donk., p. 189.  
Fig. 727. *Navicula inaequilatera*, Lag., p. 190.  
Fig. 728. *Navicula Beyrichiana*, A.S., p. 192.



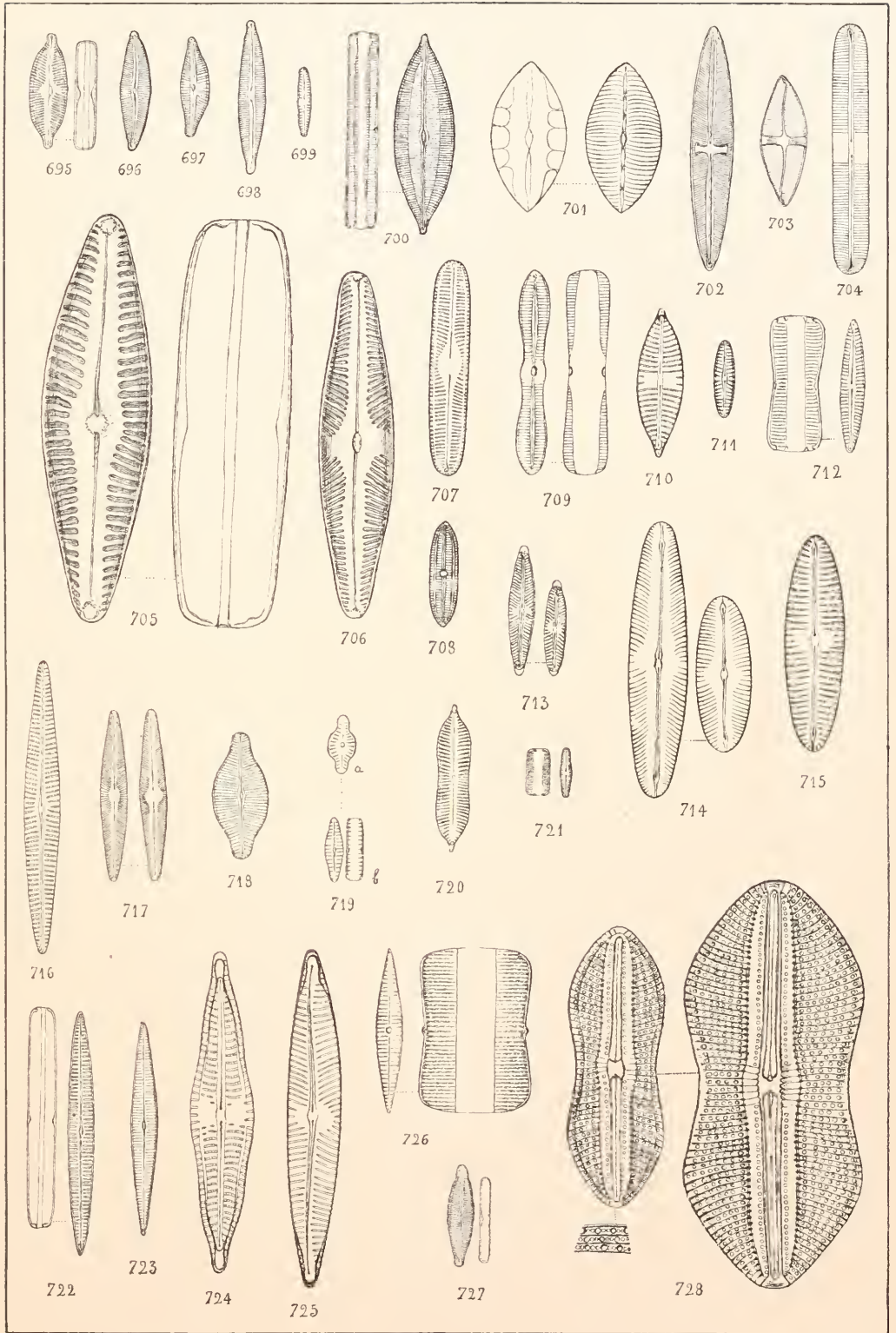






PLATE XXVI.

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- Fig. 729. *Navicula splendida*, Greg., p. 193.  
Fig. 730. *Navicula splendida*, var. *Puella*, p. 193.  
Fig. 731. *Navicula constricta*, Grun., p. 194.  
Fig. 732. *Navicula Entomon* (Ehr.), A.S., p. 195.  
Fig. 733. *Navicula incurvata*, Greg., p. 195.  
Fig. 734. *Navicula musca*, Greg., p. 196.  
Fig. 735. *Navicula musca*, Greg., p. 196.  
Fig. 736. *Navicula lineata*, Donk., p. 195.  
Fig. 737. *Navicula subcineta*, A.S., p. 195.  
Fig. 738. *Navicula Chersonensis*, Grun., p. 196.  
Fig. 739. *Navicula Eudoxia*, A.S., p. 196.  
Fig. 740. *Navicula Eugenia*, A.S., p. 196.  
Fig. 741. *Navicula fusca*, Greg., var. *Norvegica*, p. 199.  
Fig. 742. *Navicula fusca*, var. *subrectangularis*, p. 199.  
Fig. 743. *Navicula fusca*, var. *Gregorii*, p. 199.  
Fig. 744. *Navicula fusca*, var. *delicatula*, p. 199.  
Fig. 745. *Navicula fusca*, var. *hyperborea*, p. 199.  
Fig. 746. *Navicula fusca*, forma *excisa*, p. 199.  
Fig. 747. *Navicula nitescens*, Greg., p. 198.  
Fig. 748. *Navicula suborbicularis*, Greg., p. 199.  
Fig. 749. *Navicula suborbicularis*, var. *coffæformis*, p. 199.  
Fig. 750. *Navicula notabilis*, Grev., p. 200.  
Fig. 751. *Navicula notabilis*, var. *expleta*, p. 200.  
Fig. 752. *Navicula advena*, A.S., p. 200.  
Fig. 753. *Navicula advena*, var. *parca*, p. 200.  
Fig. 754. *Navicula hyalina*, Donk., p. 201.



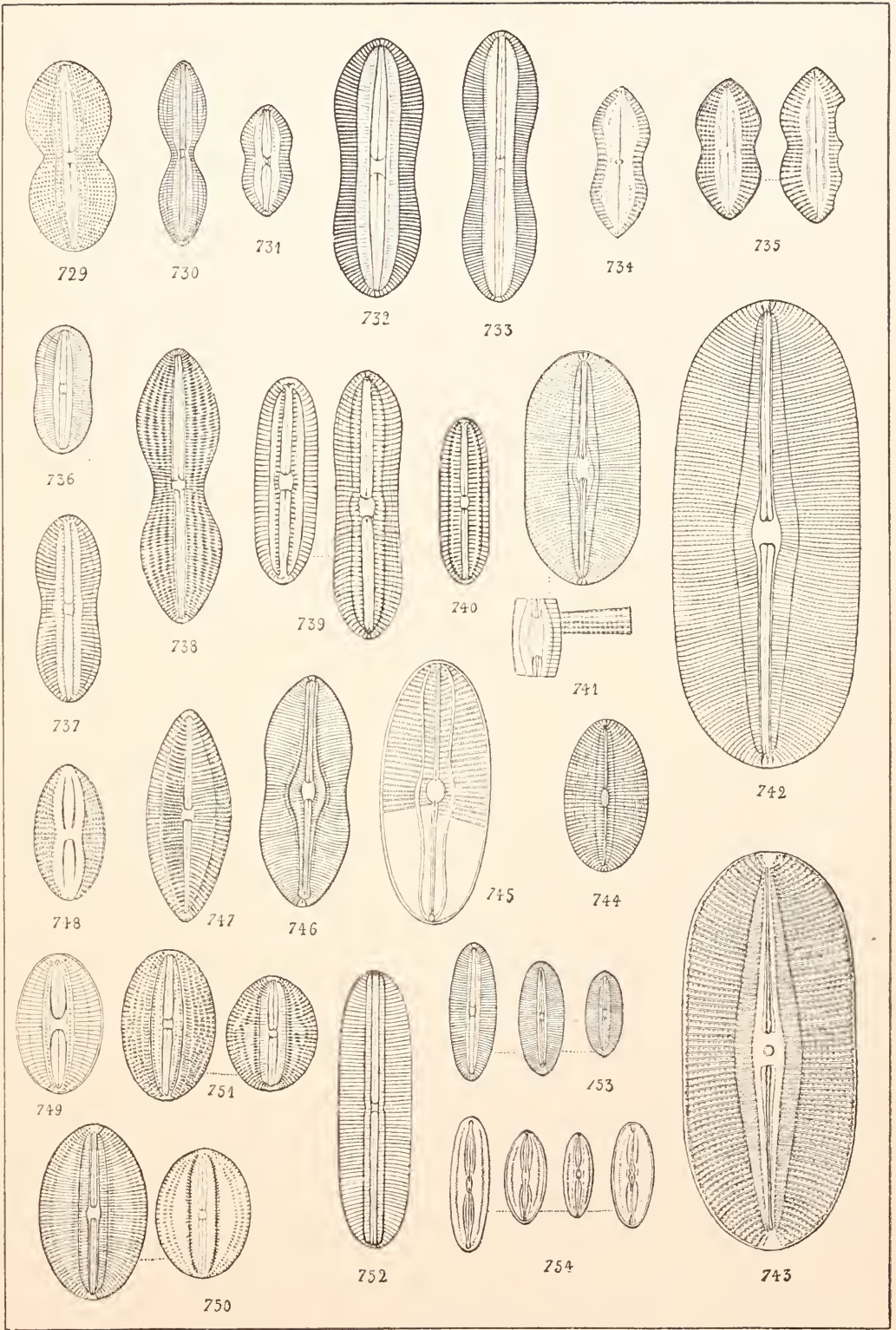




PLATE XXVII.

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- Fig. 755. *Navicula Hennedyi*, var. *nebulosa*, p. 204.  
 Fig. 756. *Navicula Sandriana*, Grun., p. 204.  
 Fig. 757. *Navicula spectabilis*, Greg., p. 202.  
 Fig. 758. *Navicula Pinnularia*, Cleve, pp. 167, 207.  
 Fig. 759. *Navicula Clepsydra*, Donk., p. 205.  
 Fig. 760. *Navicula subinflata*, Grun., p. 208.  
 Fig. 761. *Navicula elegans*, Wm. Sm., p. 210.  
 Fig. 762. *Navicula latissima*, Greg., p. 211.  
 Fig. 763. *Navicula scutelloides*, Wm. Sm., p. 211.  
 Fig. 764. *Navicula Scandinavica* (Lag.), A.S., p. 212.  
 Fig. 765. *Navicula Baileyana*, Grun., p. 212.  
 Fig. 766. *Navicula fraudulentata*, A.S., p. 212.  
 Fig. 767. *Navicula granulata*, var. *maculosa*, p. 211.  
 Fig. 768. *Navicula fusiformis*, Grun., p. 215.  
 Fig. 769. *Navicula fusiformis*, var. *Ostrearia*, p. 215.  
 Fig. 770. *Navicula inornata*, Grun., p. 215.  
 Fig. 771. *Navicula follis*, Ehr., p. 217.  
 Fig. 772. *Navicula æmula*, A.S., p. 223.  
 Fig. 773. *Navicula consimilis*, A.S., p. 222.  
 Fig. 774. *Navicula bacilliformis*, Grun., p. 224.  
 Fig. 775. *Navicula levissima* (Kütz?), Grun., p. 225.  
 Fig. 776. *Navicula Hobes*, Ralfs., p. 225.  
 Fig. 777. *Navicula cocconeiformis*, Greg., p. 228.  
 Fig. 778. *Navicula Bahusiensis*, Grun., p. 228.  
 Fig. 779. *Navicula cocconeiformis*, Greg., p. 228.  
 Fig. 780. *Navicula* (S.), *molle*, Wm. Sm., p. 231.  
 Fig. 780. *bis.* *Navicula* (S.), *corymbosum* Ag., p. 231.  
 Fig. 781. *Navicula ulvacea* (Berk.), H.V.H., p. 233.  
 Fig. 782. *Cymatoneis sulcata* (Grev.), Cleve, p. 238.  
 Fig. 783. *Navicula rhombica*, Greg., p. 235.  
 Fig. 784. *Navicula simulans*, Donk., p. 235.  
 Fig. 785. *Navicula complanata*, Grun., p. 235.  
 Fig. 786. *Navicula Hyalosira*, Cleve, p. 236.



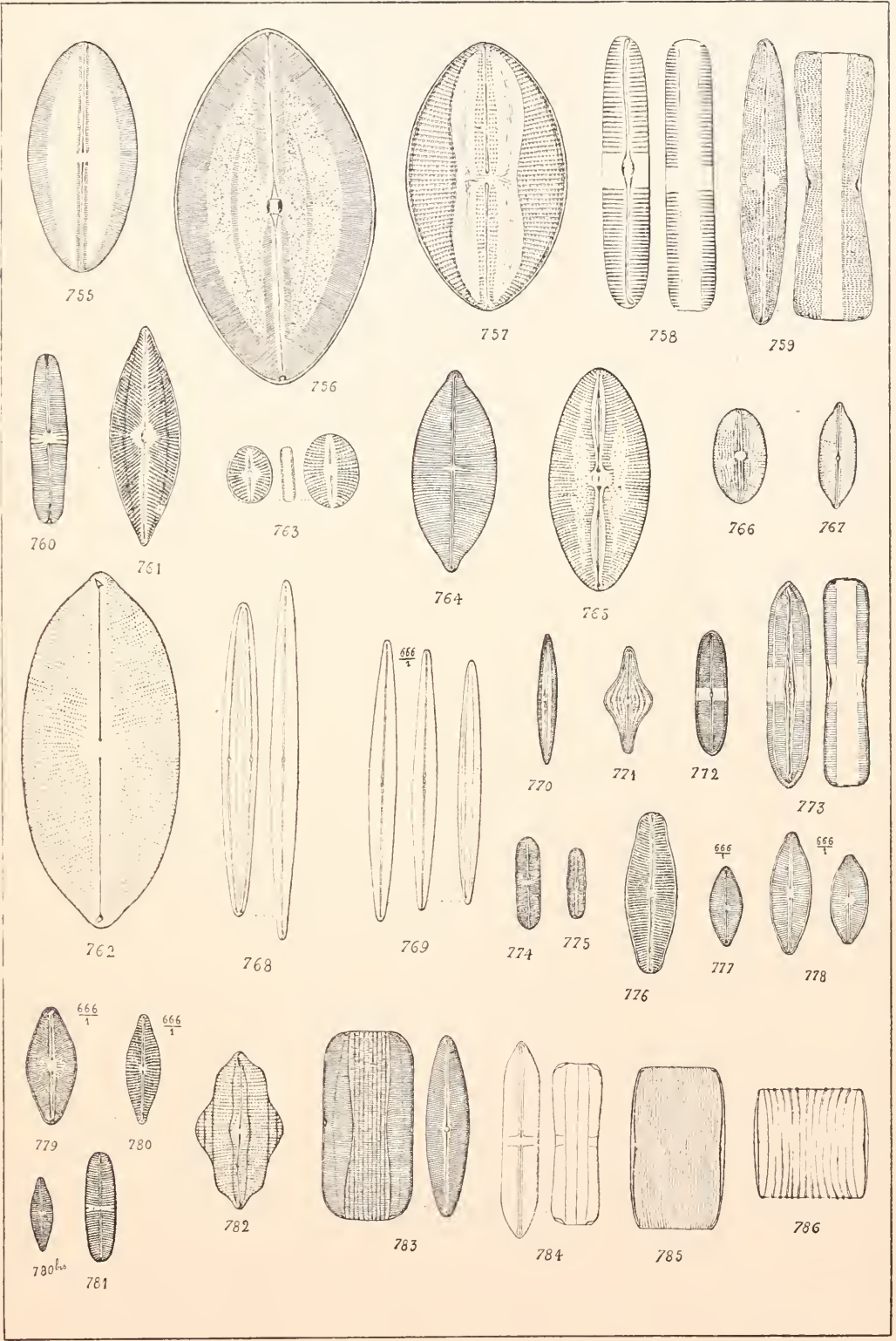






PLATE XXVIII.

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- Fig. 787. *Navicula plicata*, Donk., p. 235.  
Fig. 788. *Achnanthes trinodis* (Arnott), Grun., p. 282.  
Fig. 789. *Stenoneis inconspicua*, Greg., p. 241.  
Fig. 790. *Cistula Lorenziana*, Grun., p. 241.  
Fig. 791. *Scoliopleura Westii* (Wm. Sm.), Grun., p. 246.  
Fig. 791. *bis* (a) *Encyonema gracile*, var. *Scotica*, p. 151.  
Fig. 791. *bis* (b) *Encyonema gracile*, Rab., p. 151.  
Fig. 791. *bis* (c) *Encyonema lunatum* (Wm. Sm.), H.V.H., p. 150.  
Fig. 792. *Toxonidea Gregoriana*, Donk., p. 247.  
Fig. 793. *Pleurosigma speciosum*, Wm. Sm., p. 253.  
Fig. 794. *Pleurosigma marinum*, Donk., p. 254.  
Fig. 795. *Pleurosigma obscurum*, Wm. Sm., p. 254.  
Fig. 796. *Pleurosigma littorale*, Wm. Sm., p. 255.  
Fig. 797. *Pleurosigma reversum*, Greg., p. 256.  
Fig. 798. *Pleurosigma tenuissimum*, Wm. Sm., p. 258.  
Fig. 799. *Pleurosigma distortum*, Wm. Sm., p. 258.  
Fig. 800. *Pleurosigma inacrum*, Wm. Sm., p. 259.  
Fig. 801. *Rhicosigma falcatum* (Donk.), Grun., p. 260.  
Fig. 802. *Rhicosigma compactum* (Grev.), Grun., p. 260.



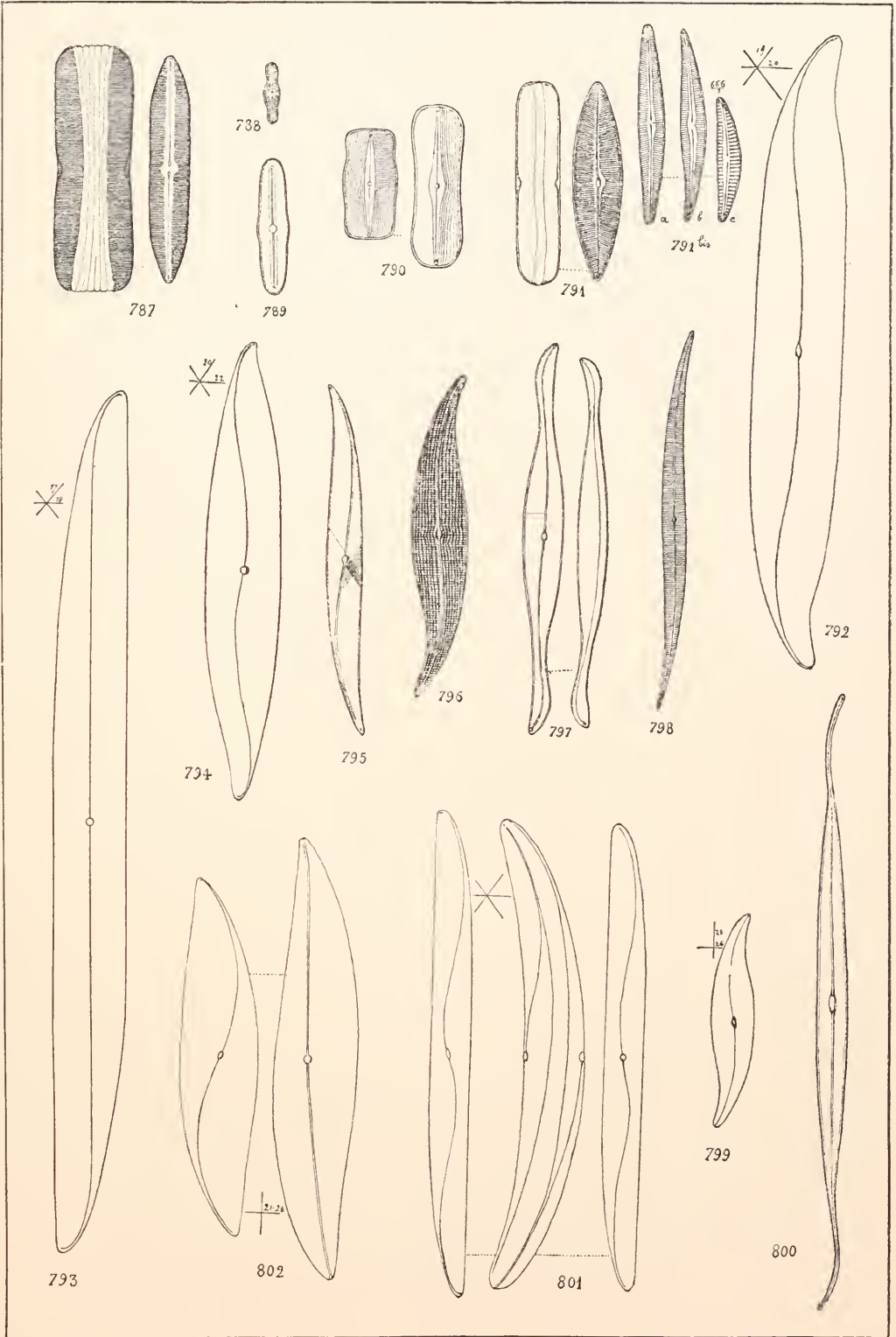




PLATE XXIX.

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- Fig. 803. *Amphiprora obtusa*, A.S., p. 264.  
Fig. 804. *Orthotropis lepidoptera*, var. *pusilla*, p. 264.  
Fig. 805. *Plagiotropis vitrea* (Wm. Sm.), Grun., p. 265.  
Fig. 806. *Plagiotropis gibberula*, Grun., p. 266.  
Fig. 807. *Auricula complexa* (Greg.), Cleve, p. 267.  
Fig. 808. *Auricula insecta*, Grun., p. 267.  
Fig. 809. *Auricula minuta*, Cleve, p. 268.  
Fig. 810. *Gomphonema geminatum* (Lyngb.), Ag., p. 269.  
Fig. 811. *Gomphonema subtile*, Ehr., p. 271.  
Fig. 812. *Gomphonema intricatum*, var. *vibrio*, p. 273.  
Fig. 813. *Gomphonema Sarcophagus*, Greg., p. 274.  
Fig. 814. *Orthoneis splendida* (Greg.), Grun., p. 284.  
Fig. 815. *Orthoneis binotata*, Grun., p. 284.  
Fig. 816. *Cocconeis costata* (Greg.), Cleve, p. 286.  
Fig. 817. *Cocconeis distans* (Greg.), Grun., p. 287.  
Fig. 818. *Cocconeis pinnata*, Greg., p. 288.  
Fig. 819. *Cocconeis Lyra*, A.S., p. 289.  
Fig. 820. *Cocconeis Danica*, Flög., p. 289.  
Fig. 821. *Cocconeis Quarnerensis* (Grun.), A.S., p. 289.  
Fig. 822. *Cocconeis Pelta*, A.S., p. 290.  
Fig. 823. *Cocconeis molesta*, Kütz, p. 290.  
Fig. 823. *bis* *Cocconeis molesta*, var. *Amygdalina*, p. 291.  
Fig. 824. *Cocconeis pseudomarginata*, Greg., p. 291.



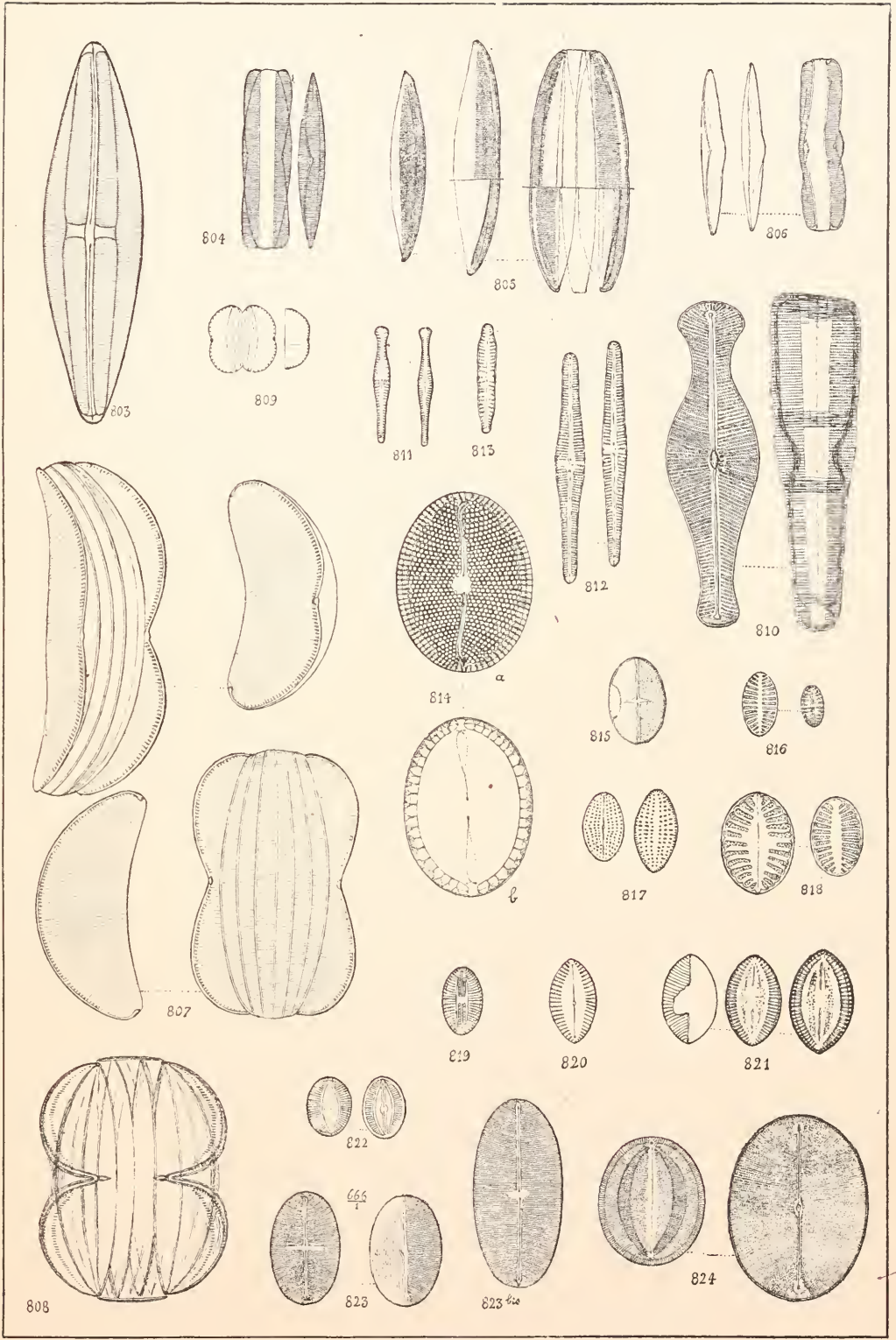






PLATE XXX.

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- Fig. 825. *Epithemia gibberula*, Kütz., p. 297.  
Fig. 826. *Eunotia Veneris*, Kütz., p. 301.  
Fig. 827. *Eunotia Veneris*, var. *obtusiuscula*, p. 301.  
Fig. 828. *Eunotia bidentula*, Wm. Sm., p. 302.  
Fig. 829. *Eunotia diodon*, Ehr., p. 303.  
Fig. 830. *Eunotia diodon*, Ehr., p. 303.  
Fig. 831. *Desmogonium Rabenhorstianum*, Grun., p. 305.  
Fig. 832. *Actirella punctata*, Lewis, p. 306.  
Fig. 833. *Synedra Vaucheriae*, var. *deformis*, p. 310.  
Fig. 834. *Synedra superba*, Kütz., p. 316.  
Fig. 835. *Synedra baculus*, Greg., p. 316.  
Fig. 836. *Synedra robusta*, Ralfs., p. 316.  
Fig. 837. *Synedra robusta*, Ralfs., p. 316.  
Fig. 838. *Asterionella formosa*, var. *Bleakelyi*, p. 321.  
Fig. 839. *Thalassiothrix Frauenfeldii*, Grun., p. 322.  
Fig. 840. *Thalassiothrix curvata*, Castr., p. 322.  
Fig. 841. *Fragilaria undata*, Wm. Sm., p. 324.  
Fig. 842. *Fragilaria striatula*, Lyngb., p. 324.  
Fig. 843. *Fragilaria tenuicornis*, Heib., p. 326.  
Fig. 843. *bis* *Fragilaria tenuicornis*, Heib., p. 326.  
Fig. 844. *Fragilaria tenuicornis*, var. *intermedia*, p. 326.  
Fig. 845. *Sceptroneis marina*, Grun., p. 332.  
Fig. 846. *Opephora* (*Fragilaria*), *pacifica*, Grun., p. 333.  
Fig. 847. *Glyphodesmis Williamsonii* (Greg.), Grun., p. 334.  
Fig. 848. *Glyphodesmis distans* (Greg.), Grun., p. 335.  
Fig. 849. *bis* *Dimeregramma marinum* (Greg.), Ralfs., p. 336.



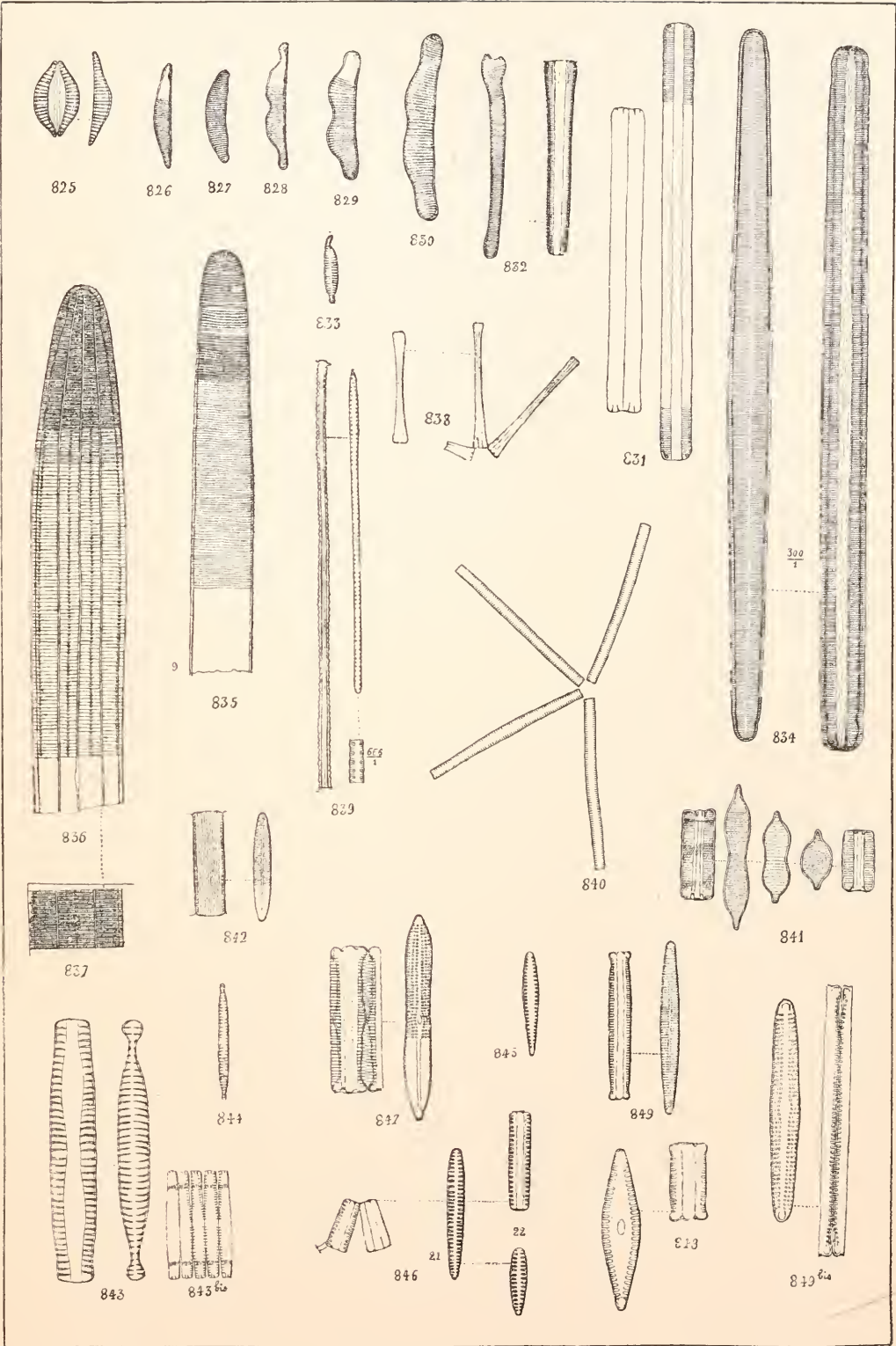




PLATE XXXI.

- Fig. 850. *Licnophora Juergensii*, Ag., p. 343.  
Fig. 851. *Licnophora gracilis* (Ehr.), Grun., p. 343.  
Fig. 852. *Licnophora flabellata* (Carm.), Ag., p. 342.  
Fig. 853. *Licnophora Ehrenbergii* (Kütz), Grun., p. 344.  
Fig. 854. *Licnophora Ehrenbergii*, var. *ovata*, p. 344.  
Fig. 855. *Licnophora paradoxa* (Lyng.), Ag., p. 344.  
Fig. 856. *Licnophora tincta* (Ag.), Grun., p. 344.  
Fig. 857. *Licnophora communis* (Heib.?), Grun., p. 345.  
Fig. 858. *Licnophora nebecula* (Kütz), Grun., p. 345.  
Fig. 859. *Licnophora tenuis* (Kütz), Grun., p. 345.  
Fig. 860. *Denticula elegans*, Kütz, p. 351.  
Fig. 861. *Denticula elegans*, var. *thermalis*, p. 351.  
Fig. 862. *Grammatophora angulosa*, Ehr., p. 355.  
Fig. 863. *Cymatopleura elliptica*, var. *Hibernica*, p. 367.  
Fig. 864. *Surirella linearis*, Wm. Sm., p. 370.  
Fig. 865. *Surirella Smithii*, Ralfs., p. 370.  
Fig. 866. *Surirella subsalsa*, Wm. Sm., p. 370.  
Fig. 867. *Surirella turgida*, Wm. Sm., p. 372.



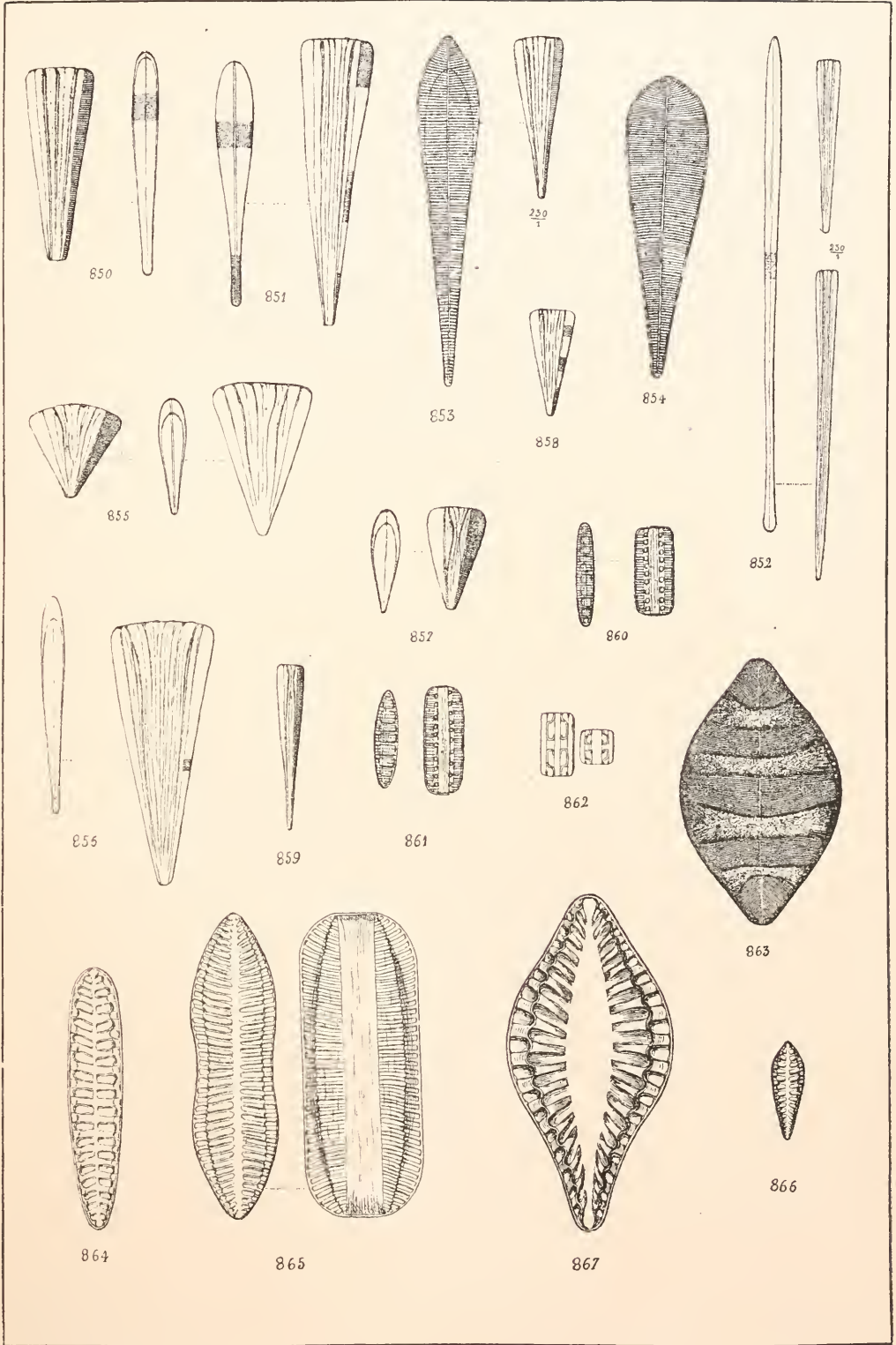






PLATE XXXII.

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- Fig. 868. *Campylodiscus Hodgsonii*, Wm. Sm., p. 376.  
Fig. 869. *Campylodiscus Ralfsii*, Wm. Sm., p. 376.  
Fig. 870. *Campylodiscus Horologium*, Williams, p. 377.  
Fig. 871. *Campylodiscus latus*, Shadb., p. 378.  
Fig. 872. *Campylodiscus eximius*, Greg., p. 379.  
Fig. 873. *Campylodiscus limbatus*, Breb., p. 380.  
Fig. 874. *Nitzschia scalaris*, Wm. Sm., p. 391.  
Fig. 875. *Nitzschia insignis*, Greg., p. 391.  
Fig. 876. *Nitzschia insignis*, var. *Smithii*, p. 391.



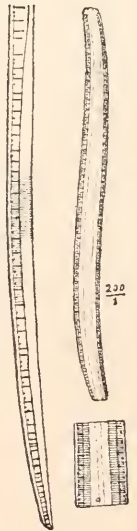
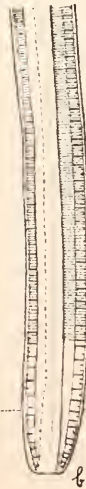
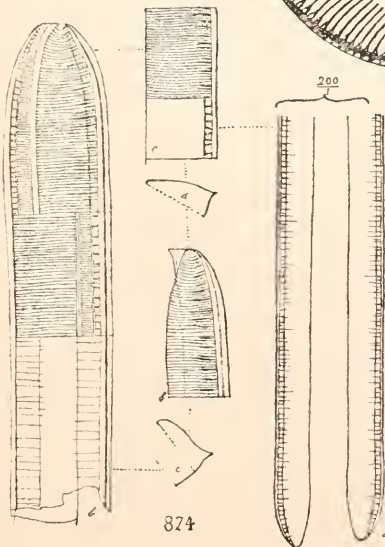
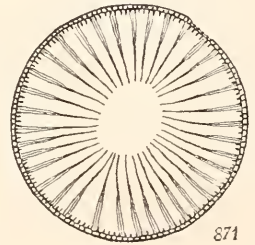
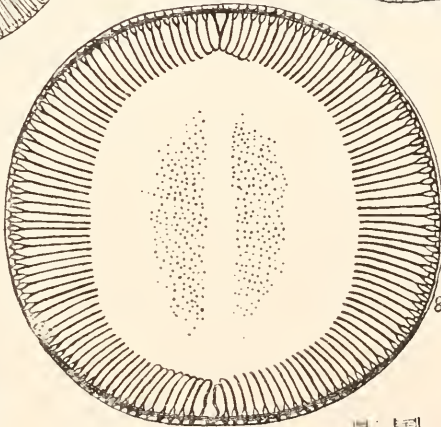
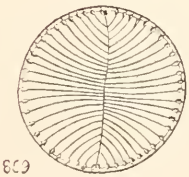
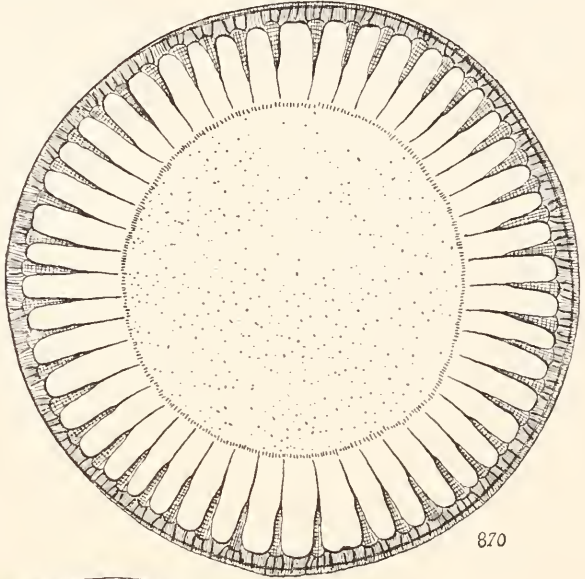
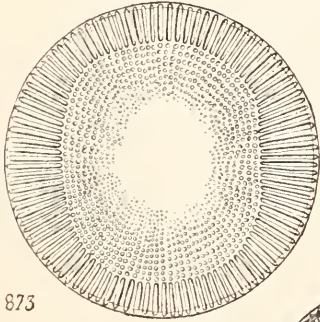
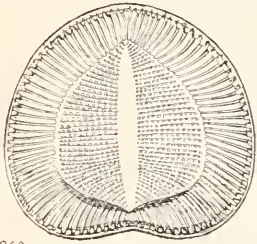




PLATE XXXIII.

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- Fig. 877. *Nitzschia vivax*, Wm. Sm., p. 392.  
Fig. 878. *Nitzschia distans*, Greg., p. 394.  
Fig. 879. *Nitzschia cursoria* (Donk), Grun., p. 394.  
Fig. 880. *Nitzschia ovalis*, Arnott, p. 403.  
Fig. 881. *Homœocladia Martiana*, Ag., p. 406.  
Fig. 882. *Homœocladia filiformis*, Wm. Sm., p. 406.  
Fig. 883. *Rhizosolenia robusta*, Norm., p. 414.  
Fig. 884. *Rhizosolenia calcar-avis*, Schultze, p. 415.  
Fig. 885. *Rhizosolenia imbricata*, Bright., p. 415.  
Fig. 886. *Rhizosolenia imbricata*, var. *Shrubsolii*, p. 415.  
Fig. 887. *Rhizosolenia alata*, Bright., p. 416.  
Fig. 888. *Rhizosolenia alata*, Bright., p. 416.  
Fig. 889. *Skeletonema costatum* (Grev.), Cl., p. 437.  
Fig. 890. *Skeletonema costatum* (Grev.), Cl., p. 437.



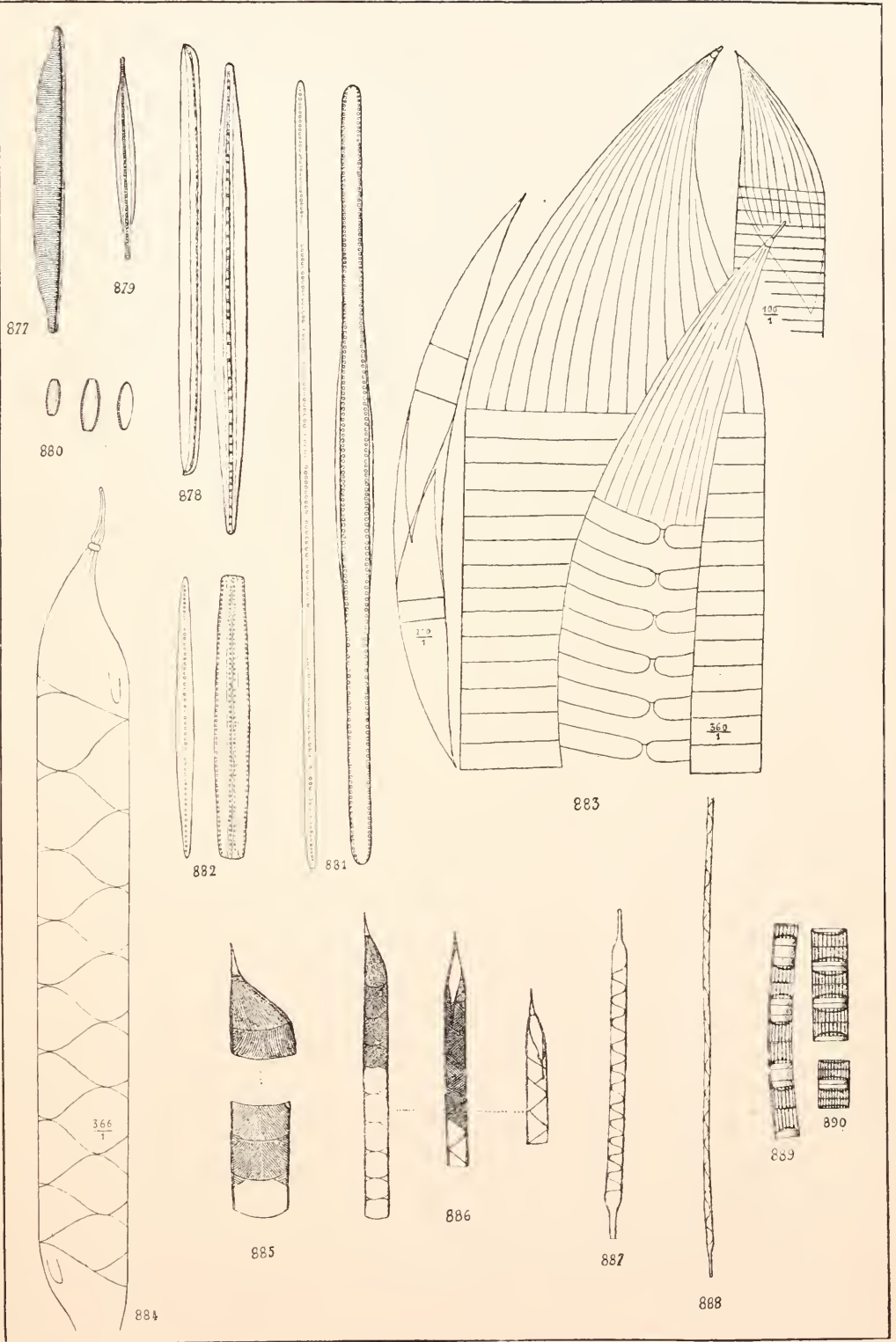




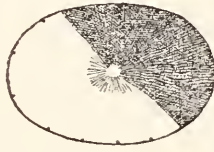
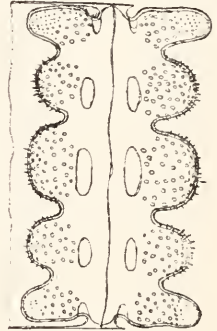
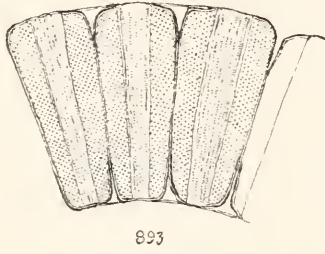


PLATE XXXIV.

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- Fig. 891. *Isthmia nervosa*, Kütz., p. 452.  
Fig. 892. *Anaulus debilis* (Grun.), H.V.H., p. 454.  
Fig. 893. *Eucampia Britannica*, Wm. Sm., p. 461.  
Fig. 894. *Biddulphia Regina*, Wm. Sm., p. 471.  
Fig. 895. *Biddulphia Tuomeyi*, Bail., p. 471.  
Fig. 896. *Biddulphia Tuomeyi*, Bail., p. 471.  
Fig. 897. *Actinocyclus crassus* (Wm. Sm.), Ralfs., p. 524.  
Fig. 898. *Actinocyclus Roperii* (Bréb.), Kitton, p. 524.  
Fig. 899. *Coscinodiscus perforatus*, Ehr., p. 529.  
Fig. 900. *Coscinodiscus nobilis*, Grun., p. 530.  
Fig. 901. *Coscinodiscus subtilis* (Ehr.?), Grun., p. 532.  
Fig. 902. *Coscinodiscus Gazellæ* Janisch, p. 534.  
Fig. 903. *Coscinodiscus Kützingii*, A.S., p. 532.  
Fig. 904. *Coscinodiscus punctulatus*, Greg., p. 533.  
Fig. 905. *Coscinodiscus decipiens*, Grun., p. 532.





66.6  
μm

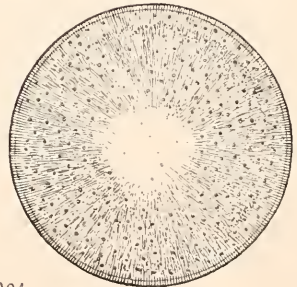
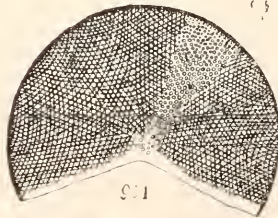
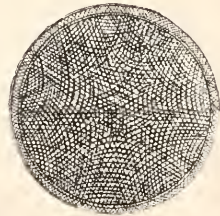
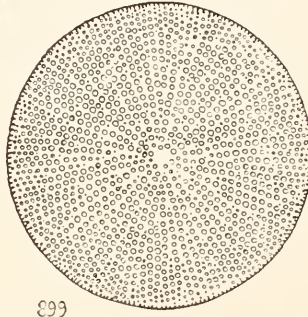
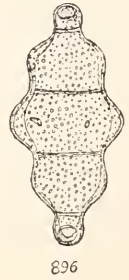


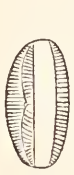


PLATE XXXV.

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- Fig. 906. *Amphora Pusio*, Cleve, p. 128.  
Fig. 907. *Amphora arenicola* Grun., p. 128.  
Fig. 908. *Amphora limbata*, Cleve and Grun., p. 136.  
Fig. 909. *Campylodiscus angularis*, Greg., p. 378.  
Fig. 910. *Navicula Liber*, Wm. Sm., var. *bicuneata*, Grun., p. 222.  
Fig. 911. *Navicula perpusilla*, Grun., p. 229. (x 1,000).  
Fig. 912. *Donkinia carinata* (Donk.), Ralfs., p. 248.  
Fig. 913a. *Raphidodiscus* (vel *Melonavicula*), *Marylandica*, Th., Christian,  
p. 236. (x 480).  
Fig. 913b. *Raphidodiscus* (vel *Melonavicula*), *Christiani* Gascoyne, p. 236.  
(x 1,000).  
Fig. 914. *Pleurosigma acutum*, Norman, p. 254.  
Fig. 915. *Nitzschia* (*Homæocladia*), *subcolicærens*, Grun., var. *Scotica*, Grun.  
p. 406.  
Fig. 916. *Chaetoceros paradoxum*, Cl., var. *Eibenii*, Grun., p. 422.  
Fig. 917. *Hyalodiscus subtilis*, Bail., forma minor, H.V.H., H. *Scoticus*  
(Kütz), Grun., p. 449.

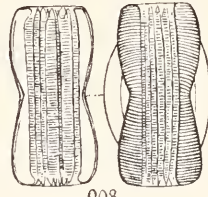




906



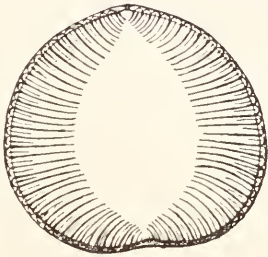
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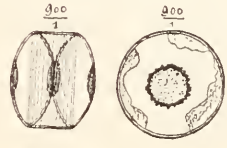
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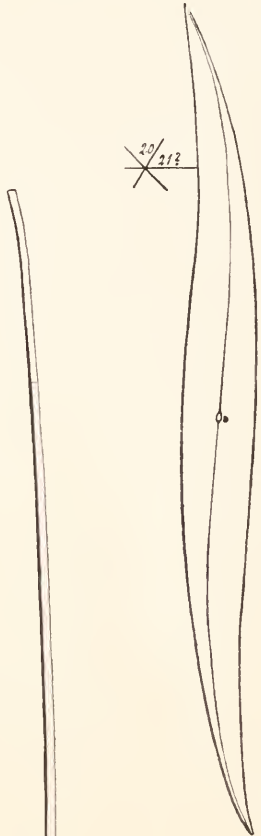
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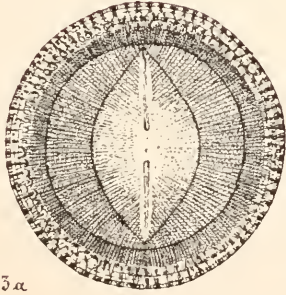
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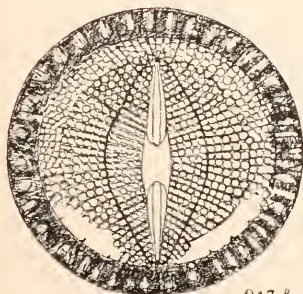
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913a



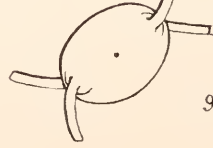
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913b



915



916

